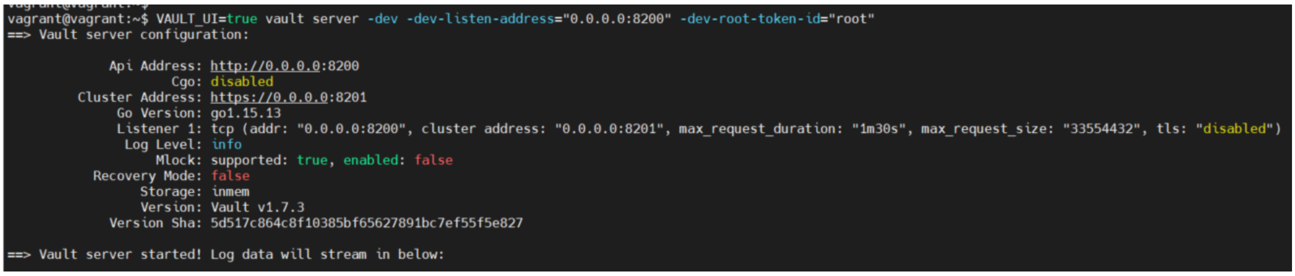
Тема: "Элементы безопасности информационных систем"

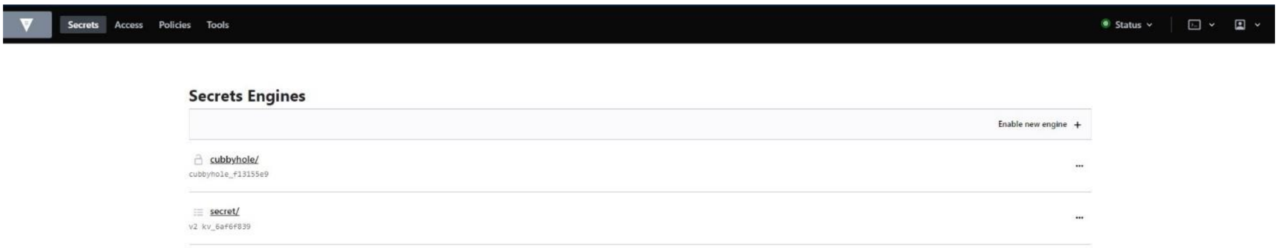
1. Установил Hashicorp Vault на виртуальной машине Vagrant/VirtualBox (Ubuntu 20.04.1 LTS).

Для получения и хранения сертификатов и ключей для web-сервера Nginx.

2. Запустил vault в dev- режиме, (т.е. только для разработки или экспериментов).



```
vagrant@vagrant:~$ VAULT_UI=true vault server -dev -dev-listen-address="0.0.0.0:8200" -dev-root-token-id="root"
==> Vault server configuration:

             Api Address: http://0.0.0.0:8200
                     Cgo: disabled
         Cluster Address: https://0.0.0.0:8201
              Go Version: go1.15.13
              Listener 1: tcp (addr: "0.0.0.0:8200", cluster address: "0.0.0.0:8201", max_request_duration: "1m30s", max_request_size: "33554432", tls: "disabled")
               Log Level: info
                   Mlock: supported: true, enabled: false
           Recovery Mode: false
                 Storage: inmem
                 Version: Vault v1.7.3
             Version Sha: 5d517c864c8f10385bf65627891bc7ef55f5e827

==> Vault server started! Log data will stream in below:
```

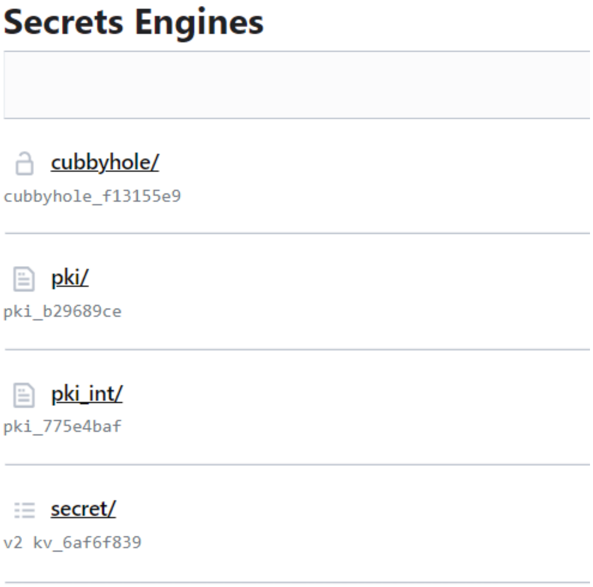


Secrets Engines

cubbyhole/
cubbyhole_f13155e9

secret/
v2 kv_6af6f839

3. Создал корневой (Root CA) и промежуточный (Intermediate CA) сертификаты



Secrets Engines

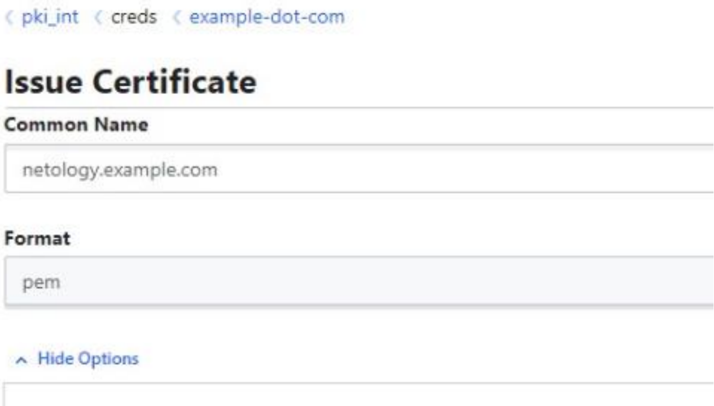
cubbyhole/
cubbyhole_f13155e9

pki/
pki_b29689ce

pki_int/
pki_775e4baf

secret/
v2 kv_6af6f839

4. Подписал Intermediate CA csr на сертификат для тестового домена (netology.example.com)

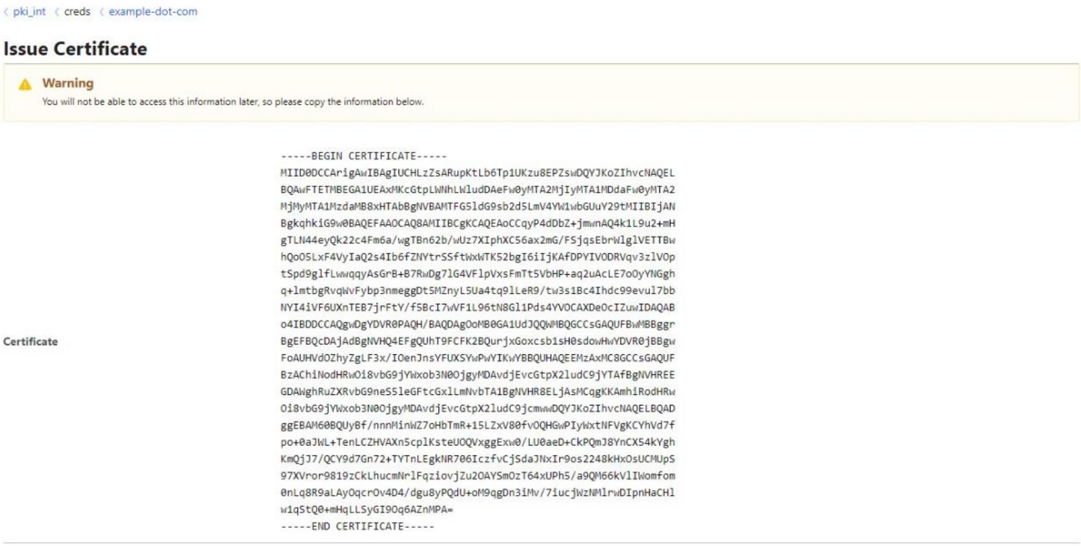


‹ pki_int ‹ creds ‹ example-dot-com

Issue Certificate

Common Name: netology.example.com

Format: pem



‹ pki_int ‹ creds ‹ example-dot-com

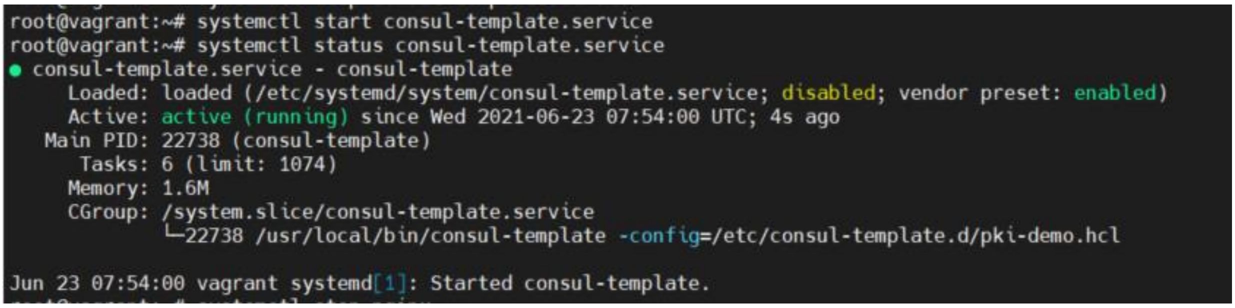
Issue Certificate

Warning
You will not be able to access this information later, so please copy the information below.

Certificate

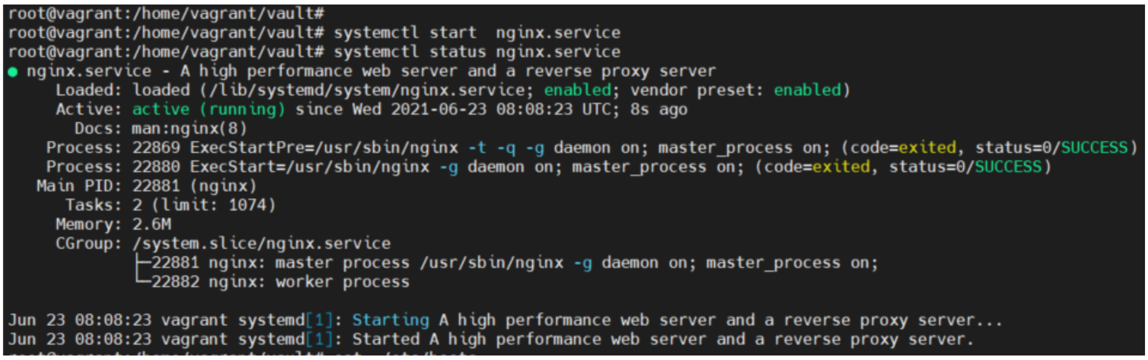
```
-----BEGIN CERTIFICATE-----
MIID0DCCArigAwIBAgIUCHLzZsARupKtLb6Tp1UKzu8EPZswDQYJKoZIhvcNAQEL
BQAwFTETMBEGA1UEAxMKcGtpLWNhLWludDAeFw0yMTA2MjIyMTA1MDdaFw0yMTA2
MjMyMTA1MzdaMB8xHTAbBgNVBAMTFG5ldG9sb2d5LmV4YW1wbGUuY29tMIIBIjAN
BgkqhkiG9w0BAQEFAAOCAQ8AMIIBCgKCAQEAoCCqyP4dDbZ+jmwnAQ4k1L9u2+mH
gTLN44eyQk22c4Fm6a/wgTBn62b/wUz7XIphXC56ax2mG/FSjqsEbrWlglVETTBw
hQoO5LxF4VyIaQ2s4Ib6fZNYtrSSftWxWTK52bgI6iIjKAfDPYIVODRVqv3zlVOp
tSpd9glfLwwqqyAsGrB+B7RwDg7lG4VFlpVxsFmTt5VbHP+aq2uAcLE7oOyYNGgh
q+lmtbgRvqWvFybp3nmeggDt5MZnyL5Ua4tq9lLeR9/tw3s1Bc4Ihdc99evul7bb
NYI4iVF6UXnTEB7jrFtY/f5BcI7wVF1L96tN8Gl1Pds4YVOCAXDeOcIZuwIDAQAB
o4IBDDCCAQgwDgYDVR0PAQH/BAQDAgOoMB0GA1UdJQQWMBQGCCsGAQUFBwMBBggr
BgEFBQcDAjAdBgNVHQ4EFgQUhT9FCFK2BQurjxGoxcsb1sH0sdowHwYDVR0jBBgw
FoAUHVdOZhyZgLF3x/IOenJnsYFUXSYwPwYIKwYBBQUHAQEEMzAxMC8GCCsGAQUF
BzAChiNodHRwOi8vbG9jYWxob3N0OjgyMDAvdjEvcGtpX2ludC9jYTAfBgNVHREE
GDAWghRuZXRvbG9neS5leGFtcGxlLmNvbTA1BgNVHR8ELjAsMCqgKKAmhiRodHRw
Oi8vbG9jYWxob3N0OjgyMDAvdjEvcGtpX2ludC9jcmwwDQYJKoZIhvcNAQELBQAD
ggEBAM60BQUyBf/nnnMinWZ7oHbTmR+15LZxV80fvOQHGwPIyWxtNFVgKCYhVd7f
po+0aJWL+TenLCZHVAXn5cplKsteUOQVxggExw0/LU0aeD+CkPQmJ8YnCX54kYgh
KmQjJ7/QCY9d7Gn72+TYTnLEgkNR706IczfvCjSdaJNxIr9os2248kHxOsUCMUpS
97XVror9819zCkLhucmNrlFqziovjZu2OAYSmOzT64xUPh5/a9QM66kVlIWomfom
0nLq8R9aLAyOqcrOv4D4/dgu8yPQdU+oM9qgDn3iMv/7iucjWzNMlrwDIpnHaCHl
w1qStQ0+mHqLLSyGI9Oq6AZnMPA=
-----END CERTIFICATE-----
```

5. Установил и настроил consul-template для автоматического подтягивания сертификата из Vault.

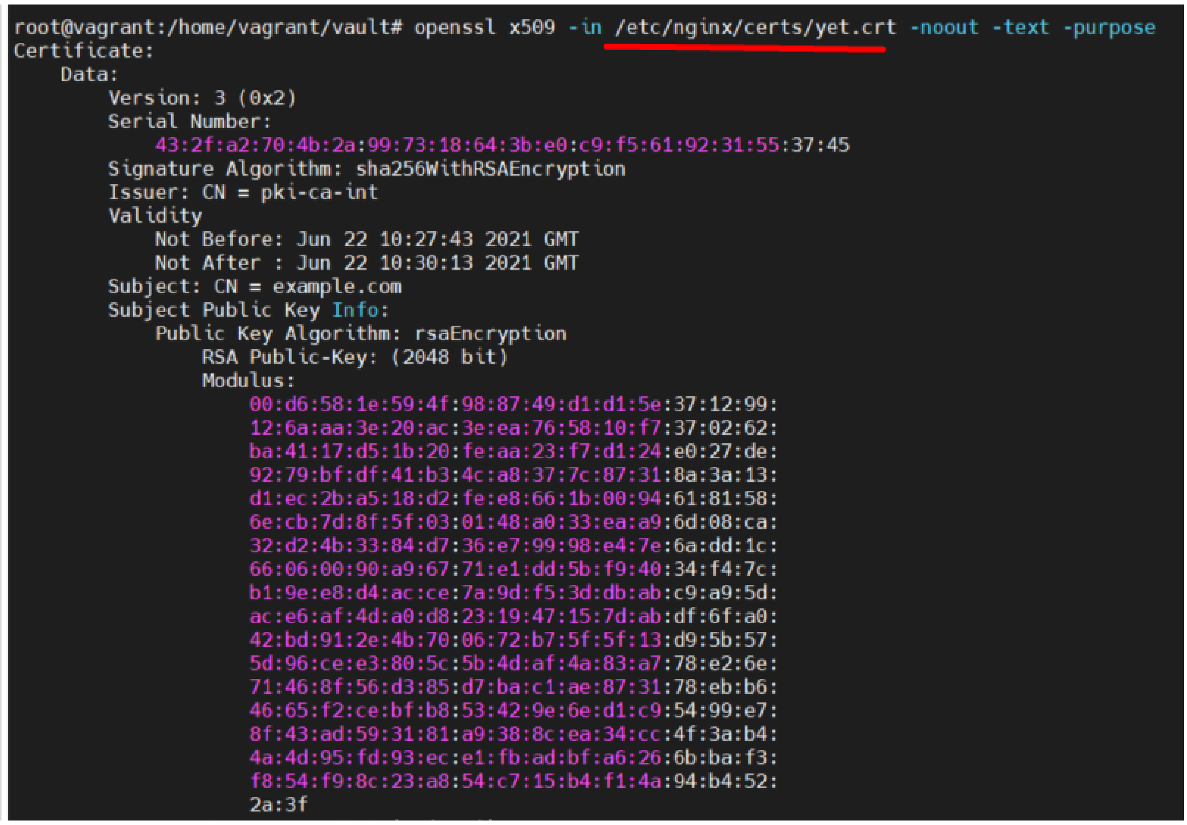


```
root@vagrant:~# systemctl start consul-template.service
root@vagrant:~# systemctl status consul-template.service
● consul-template.service - consul-template
     Loaded: loaded (/etc/systemd/system/consul-template.service; disabled; vendor preset: enabled)
     Active: active (running) since Wed 2021-06-23 07:54:00 UTC; 4s ago
   Main PID: 22738 (consul-template)
      Tasks: 6 (limit: 1074)
     Memory: 1.6M
     CGroup: /system.slice/consul-template.service
             └─22738 /usr/local/bin/consul-template -config=/etc/consul-template.d/pki-demo.hcl

Jun 23 07:54:00 vagrant systemd[1]: Started consul-template.
```

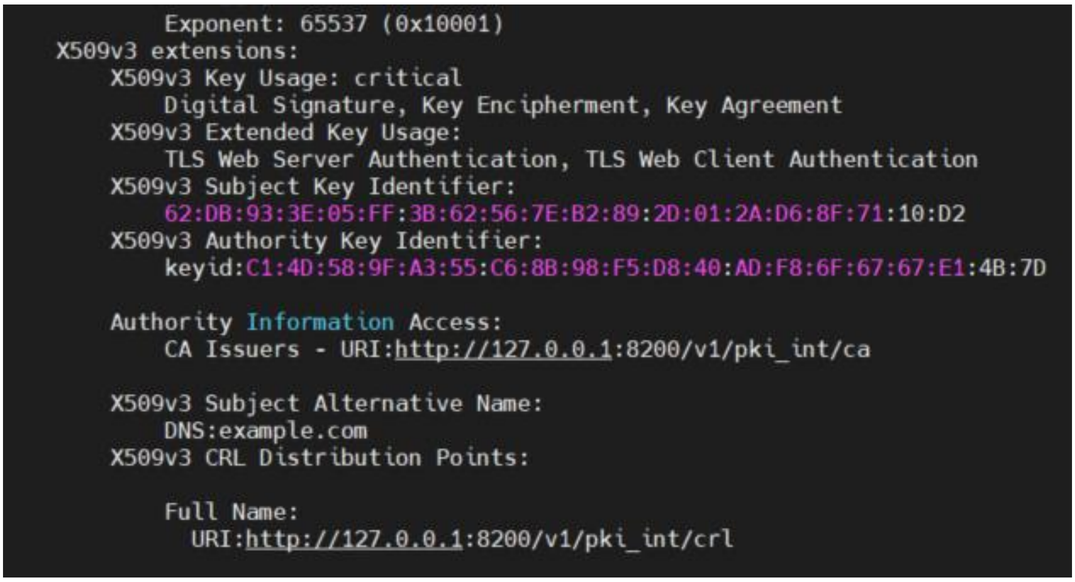
6. Сервер nginx получил подписанный сертификат Vault Intermediate CA и успешно запустился.



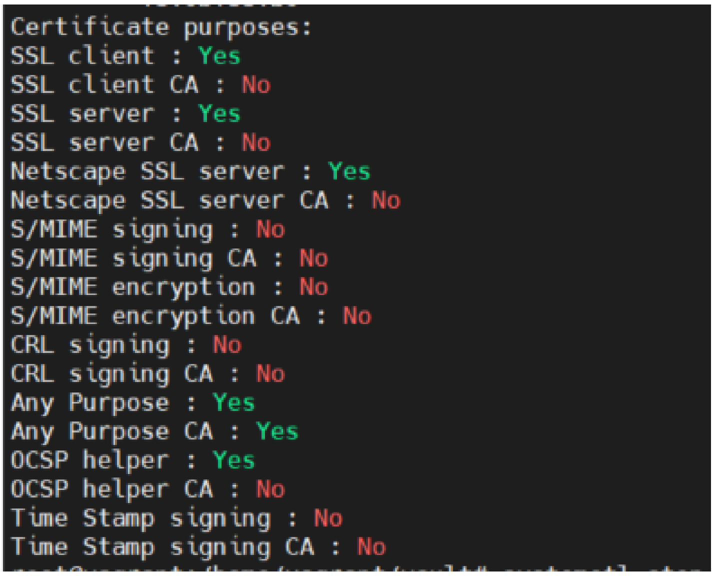
```
root@vagrant:/home/vagrant/vault#
root@vagrant:/home/vagrant/vault# systemctl start  nginx.service
root@vagrant:/home/vagrant/vault# systemctl status nginx.service
● nginx.service - A high performance web server and a reverse proxy server
     Loaded: loaded (/lib/systemd/system/nginx.service; enabled; vendor preset: enabled)
     Active: active (running) since Wed 2021-06-23 08:08:23 UTC; 8s ago
       Docs: man:nginx(8)
    Process: 22869 ExecStartPre=/usr/sbin/nginx -t -q -g daemon on; master_process on; (code=exited, status=0/SUCCESS)
    Process: 22880 ExecStart=/usr/sbin/nginx -g daemon on; master_process on; (code=exited, status=0/SUCCESS)
   Main PID: 22881 (nginx)
      Tasks: 2 (limit: 1074)
     Memory: 2.6M
     CGroup: /system.slice/nginx.service
             ├─22881 nginx: master process /usr/sbin/nginx -g daemon on; master_process on;
             └─22882 nginx: worker process

Jun 23 08:08:23 vagrant systemd[1]: Starting A high performance web server and a reverse proxy server...
Jun 23 08:08:23 vagrant systemd[1]: Started A high performance web server and a reverse proxy server.
```



```
root@vagrant:/home/vagrant/vault# openssl x509 -in /etc/nginx/certs/yet.crt -noout -text -purpose
Certificate:
    Data:
        Version: 3 (0x2)
        Serial Number:
            43:2f:a2:70:4b:2a:99:73:18:64:3b:e0:c9:f5:61:92:31:55:37:45
        Signature Algorithm: sha256WithRSAEncryption
        Issuer: CN = pki-ca-int
        Validity
            Not Before: Jun 22 10:27:43 2021 GMT
            Not After : Jun 22 10:30:13 2021 GMT
        Subject: CN = example.com
        Subject Public Key Info:
            Public Key Algorithm: rsaEncryption
                RSA Public-Key: (2048 bit)
                Modulus:
                    00:d6:58:1e:59:4f:98:87:49:d1:d1:5e:37:12:99:
                    12:6a:aa:3e:20:ac:3e:ea:76:58:10:f7:37:02:62:
                    ba:41:17:d5:1b:20:fe:aa:23:f7:d1:24:e0:27:de:
                    92:79:bf:df:41:b3:4c:a8:37:7c:87:31:8a:3a:13:
                    d1:ec:2b:a5:18:d2:fe:e8:66:1b:00:94:61:81:58:
                    6e:cb:7d:8f:5f:03:01:48:a0:33:ea:a9:6d:08:ca:
                    32:d2:4b:33:84:d7:36:e7:99:98:e4:7e:6a:dd:1c:
                    66:06:00:90:a9:67:71:e1:dd:5b:f9:40:34:f4:7c:
                    b1:9e:e8:d4:ac:ce:7a:9d:f5:3d:db:ab:c9:a9:5d:
                    ac:e6:af:4d:a0:d8:23:19:47:15:7d:ab:df:6f:a0:
                    42:bd:91:2e:4b:70:06:72:b7:5f:5f:13:d9:5b:57:
                    5d:96:ce:e3:80:5c:5b:4d:af:4a:83:a7:78:e2:6e:
                    71:46:8f:56:d3:85:d7:ba:c1:ae:87:31:78:eb:b6:
                    46:65:f2:ce:bf:b8:53:42:9e:6e:d1:c9:54:99:e7:
                    8f:43:ad:59:31:81:a9:38:8c:ea:34:cc:4f:3a:b4:
                    4a:4d:95:fd:93:ec:e1:fb:ad:bf:a6:26:6b:ba:f3:
                    f8:54:f9:8c:23:a8:54:c7:15:b4:f1:4a:94:b4:52:
                    2a:3f
```

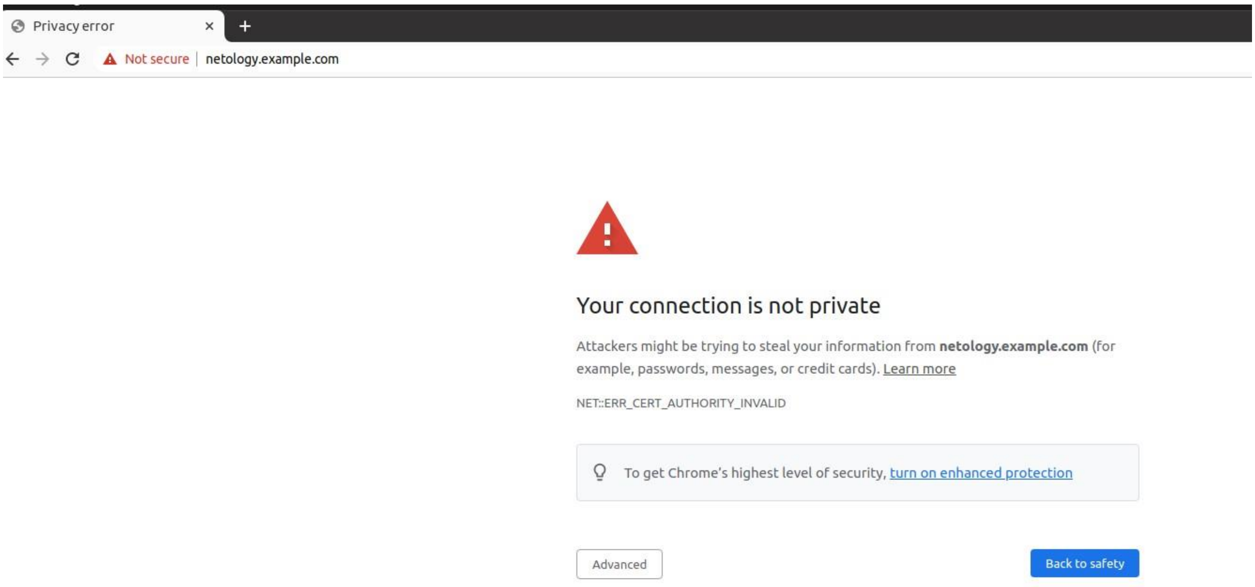


```
            Exponent: 65537 (0x10001)
    X509v3 extensions:
        X509v3 Key Usage: critical
            Digital Signature, Key Encipherment, Key Agreement
        X509v3 Extended Key Usage:
            TLS Web Server Authentication, TLS Web Client Authentication
        X509v3 Subject Key Identifier:
            62:DB:93:3E:05:FF:3B:62:56:7E:B2:89:2D:01:2A:D6:8F:71:10:D2
        X509v3 Authority Key Identifier:
            keyid:C1:4D:58:9F:A3:55:C6:8B:98:F5:D8:40:AD:F8:6F:67:67:E1:4B:7D

        Authority Information Access:
            CA Issuers - URI:http://127.0.0.1:8200/v1/pki_int/ca

        X509v3 Subject Alternative Name:
            DNS:example.com
        X509v3 CRL Distribution Points:

            Full Name:
              URI:http://127.0.0.1:8200/v1/pki_int/crl
```



```
Certificate purposes:
SSL client : Yes
SSL client CA : No
SSL server : Yes
SSL server CA : No
Netscape SSL server : Yes
Netscape SSL server CA : No
S/MIME signing : No
S/MIME signing CA : No
S/MIME encryption : No
S/MIME encryption CA : No
CRL signing : No
CRL signing CA : No
Any Purpose : Yes
Any Purpose CA : Yes
OCSP helper : Yes
OCSP helper CA : No
Time Stamp signing : No
Time Stamp signing CA : No
```

7. На рабочем компьютере (Ubuntu 21.04) в Google Chrome перешел на сайт: https://netology.example.com

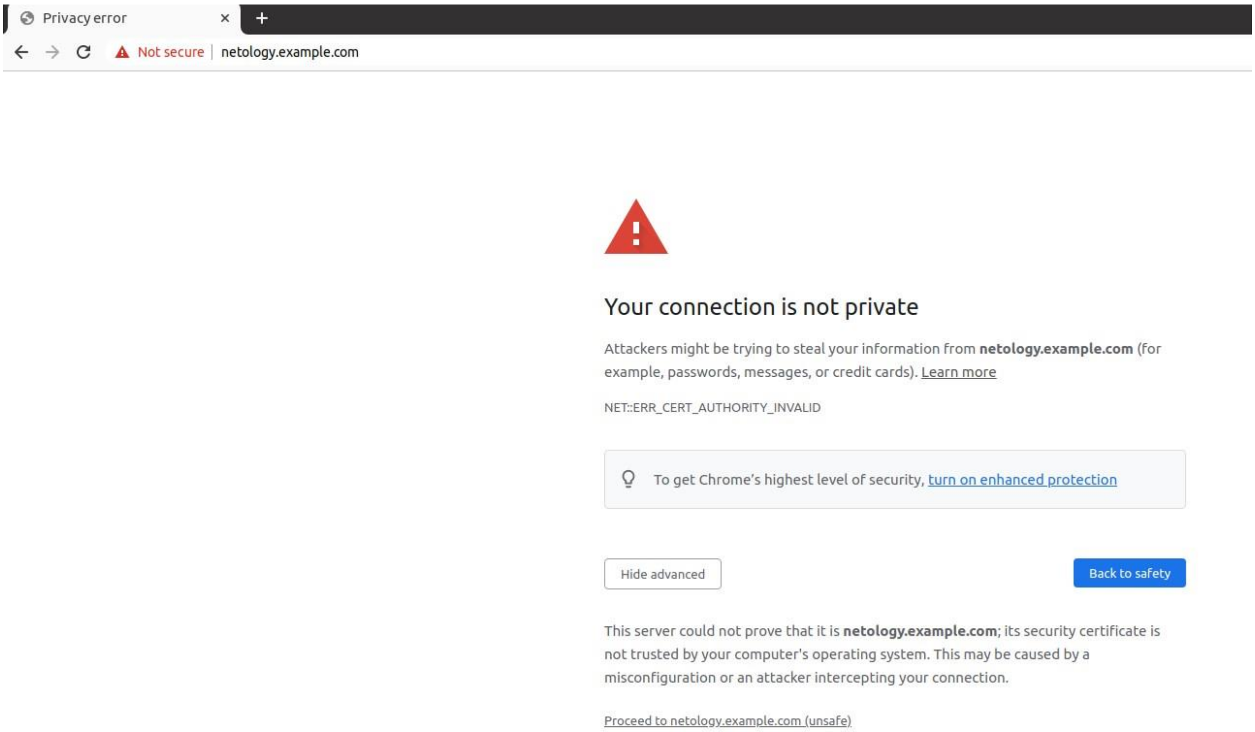


Your connection is not private

Attackers might be trying to steal your information from **netology.example.com** (for example, passwords, messages, or credit cards). Learn more

NET::ERR_CERT_AUTHORITY_INVALID

To get Chrome's highest level of security, turn on enhanced protection



Your connection is not private

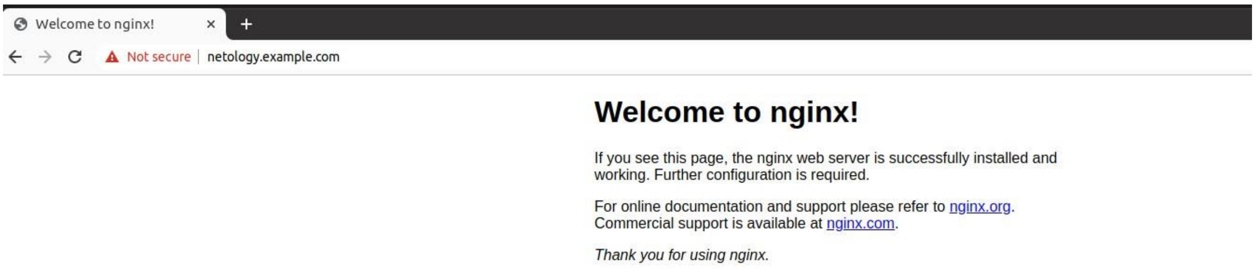
Attackers might be trying to steal your information from **netology.example.com** (for example, passwords, messages, or credit cards). Learn more

NET::ERR_CERT_AUTHORITY_INVALID

To get Chrome's highest level of security, turn on enhanced protection

This server could not prove that it is **netology.example.com**; its security certificate is not trusted by your computer's operating system. This may be caused by a misconfiguration or an attacker intercepting your connection.

Proceed to netology.example.com (unsafe)



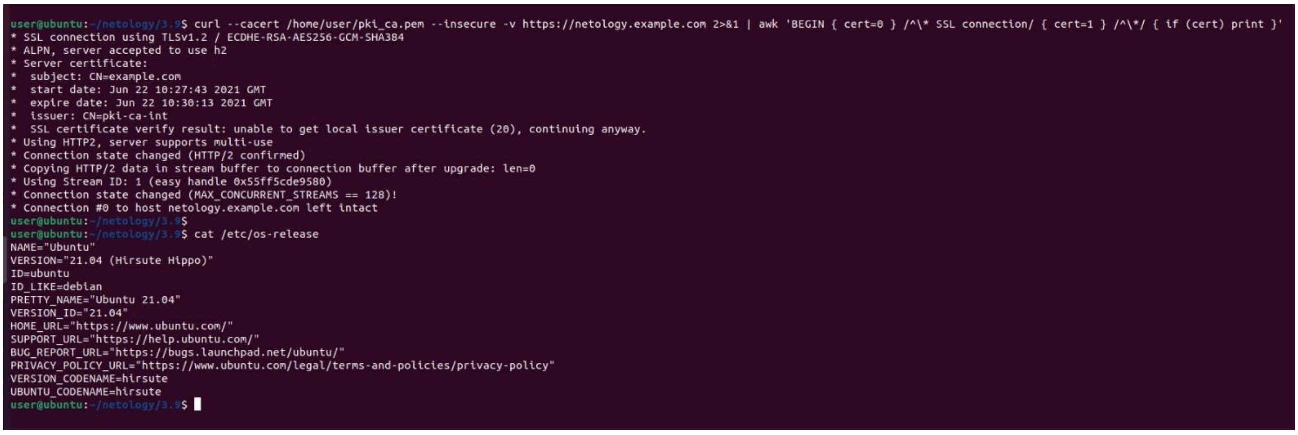
Welcome to nginx!

If you see this page, the nginx web server is successfully installed and working. Further configuration is required.

For online documentation and support please refer to nginx.org.
Commercial support is available at nginx.com.

Thank you for using nginx.

С помощью команды `curl` со своего рабочего компьютера проверил статус сертификата NGINX:



```
user@ubuntu:~/netology/3.9$ curl --cacert /home/user/pki_ca.pem --insecure -v https://netology.example.com 2>&1 | awk 'BEGIN { cert=0 } /^\* SSL connection/ { cert=1 } /^\*/ { if (cert) print }'
* SSL connection using TLSv1.2 / ECDHE-RSA-AES256-GCM-SHA384
* ALPN, server accepted to use h2
* Server certificate:
*  subject: CN=example.com
*  start date: Jun 22 10:27:43 2021 GMT
*  expire date: Jun 22 10:30:13 2021 GMT
*  issuer: CN=pki-ca-int
*  SSL certificate verify result: unable to get local issuer certificate (20), continuing anyway.
* Using HTTP2, server supports multi-use
* Connection state changed (HTTP/2 confirmed)
* Copying HTTP/2 data in stream buffer to connection buffer after upgrade: len=0
* Using Stream ID: 1 (easy handle 0x55ff5cde9580)
* Connection state changed (MAX_CONCURRENT_STREAMS == 128)!
* Connection #0 to host netology.example.com left intact
user@ubuntu:~/netology/3.9$
user@ubuntu:~/netology/3.9$ cat /etc/os-release
NAME="Ubuntu"
VERSION="21.04 (Hirsute Hippo)"
ID=ubuntu
ID_LIKE=debian
PRETTY_NAME="Ubuntu 21.04"
VERSION_ID="21.04"
HOME_URL="https://www.ubuntu.com/"
SUPPORT_URL="https://help.ubuntu.com/"
BUG_REPORT_URL="https://bugs.launchpad.net/ubuntu/"
PRIVACY_POLICY_URL="https://www.ubuntu.com/legal/terms-and-policies/privacy-policy"
VERSION_CODENAME=hirsute
UBUNTU_CODENAME=hirsute
user@ubuntu:~/netology/3.9$ 
```

Выполненные команды в файле README.md,

Конфигурационные файлы (nginx, consul-template) и сертификаты от Valut в git-репозитории