Final task presentation

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Goals

- Build test infrastructure (Web, Router, Database)

- Configure each vm according to specified requirements

- Demonstrate how this chain works

Tools for virtualization

- Vagrant – command line utility for configuring and managing of virtual machines

- Virtualbox as virtualization environment provider

How Vms are configured?

- The whole infrastructure is configured with Vagrantfile and almost fully automated. Only small part of it is configured manually.

- Virtual machines share common configurations : set of packages, timezone, kernel

- Bash/shell is used as an instrument of provisioning

- After common configuration comes specific one for each node

- Vms share directory with a host via NFS mount

Choice of Software

- Debian 11

- PosgreSQL

- Nginx

- Unbound (dns resolver with split-horizon functionality)

- Flask

- Prometheus/Grafana

Preparation

Before we run our virtual machines via vagrant up we must complete two prerequisites:

- Create network interface for management network we will use to access virtual machines. Just type make iface and VboxManage will create one for you.

```
iface:
        @echo "Create $(HOST_IFACE)"
        @if [ "x$$(ip -4 -br addr | grep -o $(HOST_IFACE))" != "x$(HOST_IFACE)" ]; then \
                VBoxManage hostonlyif create; \
        else true; fi
        touch $@
```

Preparation

- Second prerequisite is installing dependencies that are required for enabling NFS access to shared folder that is located on host machine. Type make deps to install it.

```
deps:
        @echo "Install dependencies: $(DEPS)"
        @for pkg in $(DEPS); do
           sudo apt-get -y install $$pkg
        done
```

Installation of mainline kernel

The process of downloading and installation of the latest linux kernel is time consuming and takes about two hours. We use configuration file from kernel already installed to virtual machines with little modifications:

- Preemption model is set to No Forced Preemption

- Signature verification is disabled

To download and compile the latest kernel type make kernel command.

Installation of mainline kernel

Provision target inside Vagrantfile that executes kernel installation is never executed automatically and should be executed manually.

Manual configuration

As already mentioned most part of the configuration is automated. The only small parts have been left for manual configuration.

Manual configuration for PostgreSQL

I have put tips for configuration settings to README file in /vagrant/db/ directory. In short we are just putting everything in the right place:

- Set the mapping for users in pg_ident.conf

- Add authentication directives to pg_hba.conf

- Put postgresql to listening on all interfaces

- Exec SQL instructions via psql utility

- Restart postgresql service

Manual configuration for Grafana

The same tactics as in the former case is applied to grafana settings. The file with settings is called /vagrant/monitoring/README.grafana.settings. The following steps are required:

- Choose the data source (prometheus in our case, located on the same host)

- Load pre-configured dashboard with metrics

Results: mainline kernel

```
root@router:~# uname -a
Linux router 5.15.0+ #1 SMP PREEMPT Thu Nov 4 15:49:05 MSK 2021 x86_64 GNU/Linux
root@router:~#
```

```
vagrant@db:~$ uname -a
Linux db 5.15.0+ #1 SMP PREEMPT Thu Nov 4 15:49:05 MSK 2021 x86_64 GNU/Linux
vagrant@db:~$
```

```
vagrant@web:~$ uname -a
Linux web 5.15.0+ #1 SMP PREEMPT Thu Nov 4 15:49:05 MSK 2021 x86_64 GNU/Linux
vagrant@web:~$
```

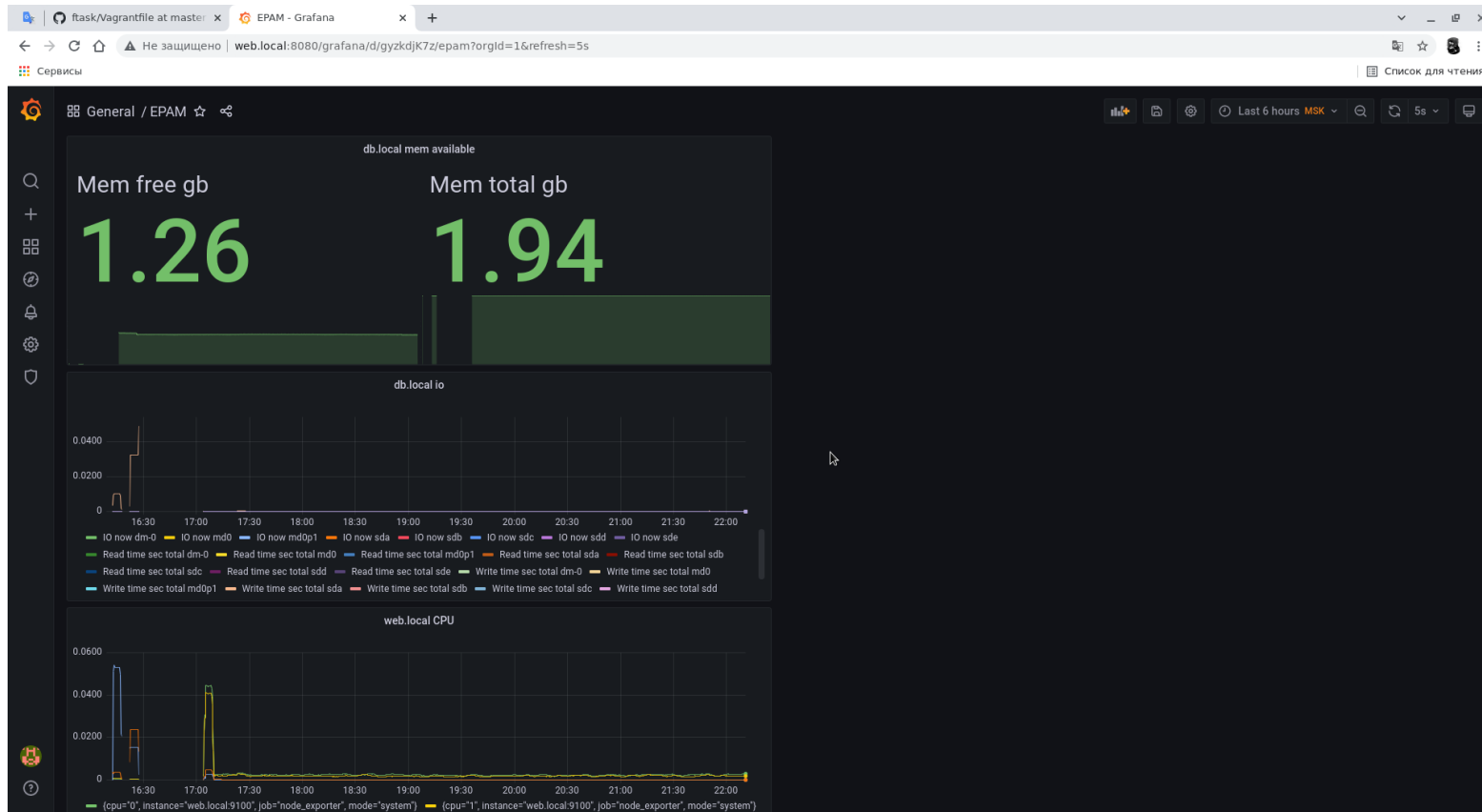# Results: http request from db.local to web.local

```
192.168.58.4.80 > 192.168.57.3.42554: Flags [P.], cksum 0xb0a3 (correct), seq 1:278, ack 74, win 509, options [nop,nop,TS val 21664
        HTTP/1.1 200 OK
        Server: nginx/1.18.0
        Date: Sun, 07 Nov 2021 18:55:10 GMT
        Content-Type: text/html; charset=utf-8
        Content-Length: 114
        Connection: keep-alive

        <a href='/authors'>Authors</a><br><a href='/magazines'>Magazines</a><br><a href='/article_types'>Article types</a> [|http]
        0x0000:  4500 0149 44c7 4000 3f06 0190 c0a8 3a04   E..ID.@.?.....:.
        0x0010:  c0a8 3903 0050 a63a 0c92 0a72 c020 580e   ..9..P.:...r..X.
        0x0020:  8018 01fd b0a3 0000 0101 080a 8121 9012   .............!..
        0x0030:  d104 e53e 4854 5450 2f31 2e31 2032 3030   ...>HTTP/1.1.200
        0x0040:  204f 4b0d 0a53 6572 7665 723a 206e 6769   .OK..Server:.ngi
        0x0050:  6e78 2f31 2e31 382e 300d 0a44 6174 653a   nx/1.18.0..Date:
        0x0060:  2053 756e 2c20 3037 204e 6f76 2032 3032   .Sun,.07.Nov.202
        0x0070:  3120 3138 3a35 353a 3130 2047 4d54 0d0a   1.18:55:10.GMT..
        0x0080:  436f 6e74 656e 742d 5479 7065 3a20 7465   Content-Type:.te
        0x0090:  7874 2f68 746d 6c3b 2063 6861 7273 6574   xt/html;.charset
        0x00a0:  3d75 7466 2d38 0d0a 436f 6e74 656e 742d   =utf-8..Content-
        0x00b0:  4c65 6e67 7468 3a20 3131 340d 0a43 6f6e   Length:.114..Con
        0x00c0:  6e65 6374 696f 6e3a 206b 6565 702d 616c   nection:.keep-al
        0x00d0:  6976 650d 0a0d 0a3c 6120 6872 6566 3d27   ive....<a.href='
        0x00e0:  2f61 7574 686f 7273 273e 4175 7468 6f72   /authors'>Author
        0x00f0:  733c 2f61 3e3c 6272 3e3c 6120 6872 6566   s</a><br><a.href
        0x0100:  3d27 2f6d 6167 617a 696e 6573 273e 4d61   ='/magazines'>Ma
        0x0110:  6761 7a69 6e65 733c 2f61 3e3c 6272 3e3c   gazines</a><br><
        0x0120:  6120 6872 6566 3d27 2f61 7274 6963 6c65   a.href='/article
        0x0130:  5f74 7970 6573 273e 4172 7469 636c 6520   _types'>Article.
        0x0140:  7479 7065 733c 2f61 3e                    types</a>
```
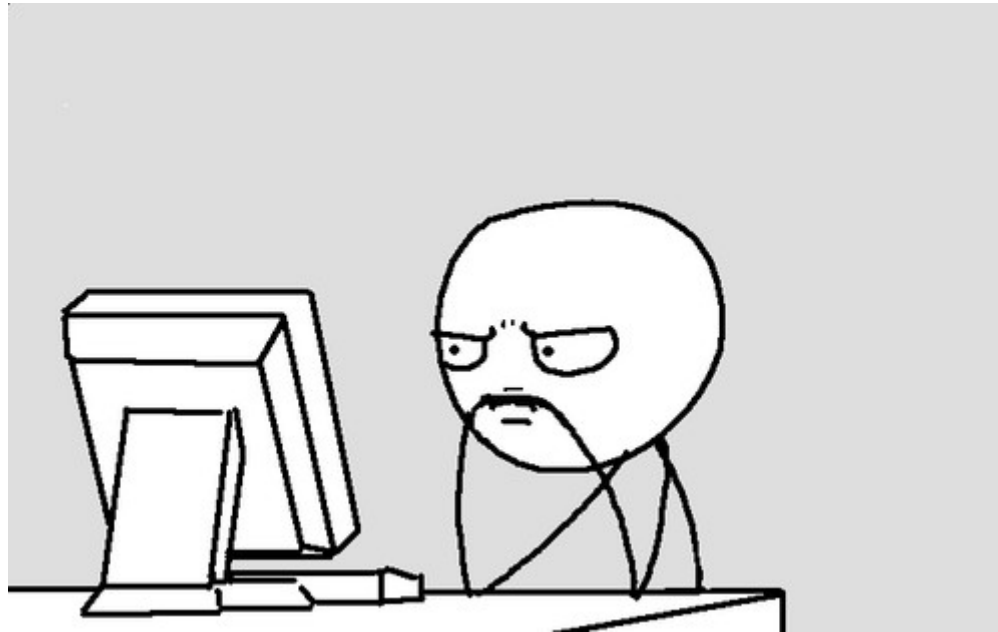
Results: https request from db.local to web.local

```
192.168.58.4.443 > 192.168.57.3.52832: Flags [P.], cksum 0xfd4a (incorrect -> 0x5119
    0x0000:  4500 0900 8716 4000 3f06 b789 c0a8 3a04  E.....@.?.....:.
    0x0010:  c0a8 3903 01bb ce60 19ab a81d ccbc 8630  ..9....`.......0
    0x0020:  8018 01fa fd4a 0000 0101 080a 8122 7949  .....J......."yI
    0x0030:  d105 ce63 1603 0300 7a02 0000 7603 034d  ...c....z...v..M
    0x0040:  2cdc 17be 0f57 4451 d9b4 5180 d4e2 ba42  ,....WDQ..Q....B
    0x0050:  5562 fe99 b928 cd6a b550 b1bf 939a 2d20  Ub...(.j.P....-.
    0x0060:  88a1 7ece e056 3454 2348 a110 a738 838a  ..~..V4T#H...8..
    0x0070:  cf93 7769 e99f e364 d7ff eb71 bf6b ab5e  ..wi...d...q.k.^
    0x0080:  1302 0000 2e00 2b00 0203 0400 3300 2400  ......+.....3.$.
    0x0090:  1d00 20d6 6aa5 3e18 2038 14f9 0242 de21  ....j.>..8...B.!
    0x00a0:  b5f2 f717 465d eb19 8850 421f 30fb 0969  ....F]...PB.0..i
    0x00b0:  dca3 0c14 0303 0001 0117 0303 0024 3316  .............$3.
    0x00c0:  7025 5acb 88ac 4e43 15ea d46a 1783 ecd0  p%Z...NC...j....
    0x00d0:  dcea 56dc ef55 7ea7 3eab 75ae 0dd2 6844  ..V..U~.>.u...hD
    0x00e0:  9874 1703 0305 b15d 2933 061a 1aa1 0627  .t.....])3.....'
    0x00f0:  7809 2d1c 73ab a31b 608b 73ee 943c 5889  x.-.s...`.s..<X.
    0x0100:  2af8 d339 5d22 0f1e c920 74ec 829f 007c  *..9]"....t....|
    0x0110:  587d 4987 c047 87a1 2fae 9a9e b7d6 6b3a  X}I..G../.....k:
    0x0120:  9568 2190 a0af 71ed 37cf 6e62 a9d5 9d17  .h!...q.7.nb....
    0x0130:  8dba 1e9c 3297 2c70 b6f9 7b24 0f12 0eff  ....2.,p..{$....
    0x0140:  9716 9563 2f1e d899 85d7 5c1b fc2f d965  ...c/.....\../.e
    0x0150:  8c53 8ed9 c3fc 4ce6 0d41 0dab 5bbc 4f2b  .S....L..A..[.O+
    0x0160:  4b5d 71cb d340 97ee a510 09c8 ce99 06a7  K]q..@..........
    0x0170:  7cbb fe63 d592 95f9 7e38 0338 28b5 f20d  |..c....~8.8(...
    0x0180:  8809 144b ddaf 7b18 719b 69a7 ff00 a916  ...K..{.q.i.....
    0x0190:  7e13 d3b4 6d24 ef74 424b 74e6 a9ae aef6  ~...m$.tBKt.....
    0x01a0:  2a9b 4518 33bc 8fbf 97f3 1991 f00f 49ec  *.E.3.........I.
    0x01b0:  b155 dfe4 c4dd 434b c7a4 cb27 d2e6 3156  .U....CK...'..1V
    0x01c0:  20a3 fd21 5ce8 fa8f ccd0 7c91 488c 9502  ...!\.....|.H...
    0x01d0:  e100 9850 4778 4fbf 5409 9fce b74a 7297  ...PGxO.T....Jr.
    0x01e0:  6646 cd75 0c31 86c1 bd3e 59fb 35dd 65d4  fF.u.1...>Y.5.e.
    0x01f0:  b622 880d 6059 785b eace 7558 ef27 206c  ."..`Yx[..uX.'.l
    0x0200:  1794 8d3a 802f 4512 f66b 3a27 adab bc22  ...:./E..k:'..."
    0x0210:  f154 c0d8 471d 8abe 33c3 82e1 fc48 749c  .T..G...3....Ht.
```

Results: Grafana

Thank you for your attention!

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