

Лабораторная работа № 12

Синхронизация времени

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2025-11-29

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2. Вводная часть

3. Выполнение заданий

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Раздел 1

1. Информация

1.1 Докладчик

- ▶ Митрофанов Тимур Александрович

1.1 Докладчик

- ▶ Митрофанов Тимур Александрович
- ▶ Российский университет дружбы народов им. П. Лумумбы

Раздел 2

2. Вводная часть

2.1 Цели и задачи

Цель - получение навыков по управлению системным временем и настройке синхронизации времени.

1. Изучите команды по настройке параметров времени

2.1 Цели и задачи

Цель - получение навыков по управлению системным временем и настройке синхронизации времени.

1. Изучите команды по настройке параметров времени
2. Настройте сервер в качестве сервера синхронизации времени для локальной сети

2.1 Цели и задачи

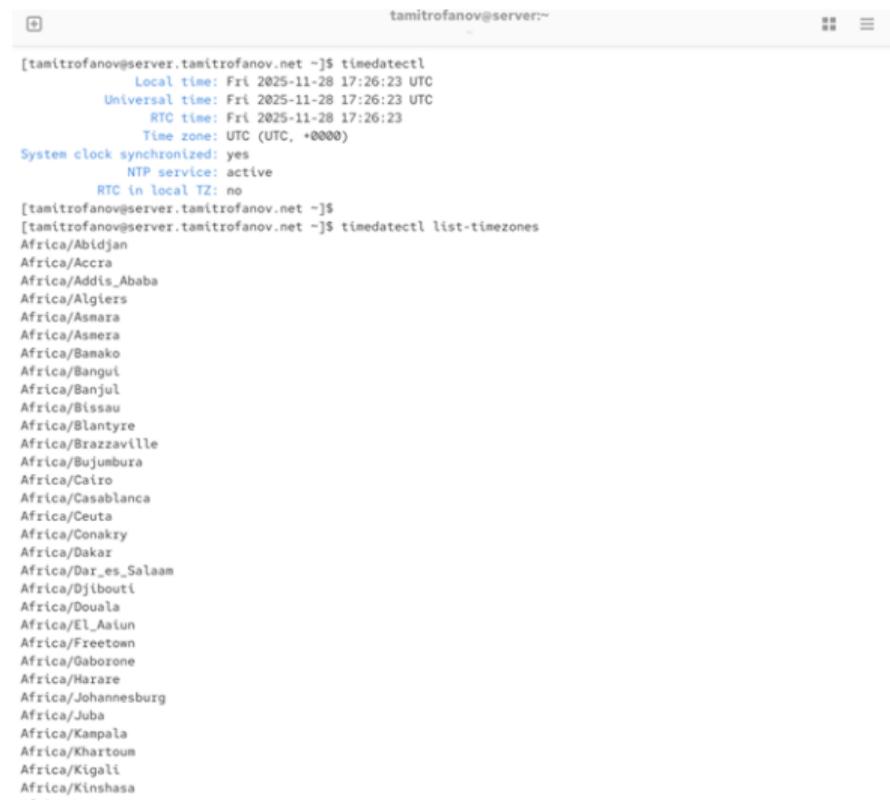
Цель - получение навыков по управлению системным временем и настройке синхронизации времени.

1. Изучите команды по настройке параметров времени
2. Настройте сервер в качестве сервера синхронизации времени для локальной сети
3. Напишите скрипты для Vagrant, фиксирующие действия по установке и настройке NTP-сервера и клиента

Раздел 3

3. Выполнение заданий

3.1 слайд 1



tamitrofanov@server:~\$ timedatectl
Local time: Fri 2025-11-28 17:26:23 UTC
Universal time: Fri 2025-11-28 17:26:23 UTC
RTC time: Fri 2025-11-28 17:26:23
Time zone: UTC (UTC, +0000)
System clock synchronized: yes
NTP service: active
RTC in local TZ: no
[tamitrofanov@server.tamitrofanov.net ~]\$
[tamitrofanov@server.tamitrofanov.net ~]\$ timedatectl list-timezones
Africa/Abidjan
Africa/Accra
Africa/Addis_Ababa
Africa/Algiers
Africa/Asmara
Africa/Asmeria
Africa/Bamako
Africa/Bangui
Africa/Banjul
Africa/Bissau
Africa/Blantyre
Africa/Brazzaville
Africa/Bujumbura
Africa/Cairo
Africa/Casablanca
Africa/Ceuta
Africa/Conakry
Africa/Dakar
Africa/Dar_es_Salaam
Africa/Djibouti
Africa/Douala
Africa/El_Aaiun
Africa/Freetown
Africa/Gaborone
Africa/Harare
Africa/Johannesburg
Africa/Juba
Africa/Kampala
Africa/Khartoum
Africa/Kigali
Africa/Kinshasa
Africa/Lagos

3.2 слайд 2

```
[tmitrofanov@server.tmitrofanov.net ~]$ timedatectl set-timezone Europe/Moscow
[tmitrofanov@server.tmitrofanov.net ~]$ timedatectl
    Local time: Fri 2025-11-28 20:29:16 MSK
    Universal time: Fri 2025-11-28 17:29:16 UTC
        RTC time: Fri 2025-11-28 17:29:16
       Time zone: Europe/Moscow (MSK, +0300)
System clock synchronized: yes
          NTP service: active
    RTC in local TZ: no
[tmitrofanov@server.tmitrofanov.net ~]$ timedatectl -?
timedatectl: invalid option -- '?'
[tmitrofanov@server.tmitrofanov.net ~]$ timedatectl help
timedatectl [OPTIONS...] COMMAND ...

Query or change system time and date settings.

Commands:
  status           Show current time settings
  show            Show properties of systemd-timedated
  set-time TIME   Set system time
  set-timezone ZONE Set system time zone
  list-timezones   Show known time zones
  set-local-rtc BOOL Control whether RTC is in local time
  set-ntp BOOL     Enable or disable network time synchronization

systemd-timesyncd Commands:
  timesync-status   Show status of systemd-timesyncd
  show-timesync     Show properties of systemd-timesyncd
  ntp-servers INTERFACE SERVER...
                                Set the interface specific NTP servers
  revert INTERFACE     Revert the interface specific NTP servers

Options:
  -h --help          Show this help message
  --version         Show package version
  --no-pager        Do not pipe output into a pager
  --no-ask-password Do not prompt for password
  -H --host=[USER@]HOST Operate on remote host
  -M --machine=CONTAINER Operate on local container
  --adjust-system-clock Adjust system clock when changing local RTC mode
  --monitor         Monitor status of systemd-timesyncd
```

3.3 слайд 3

The screenshot shows a terminal window titled "vagrant_client_1758395812371_75390 (Перед лайбай 12) [Работает] - Oracle VirtualBox". The window title bar includes "Файл", "Машина", "Вид", "Ввод", "Устройства", "Справка". The terminal prompt is "Nov 28 8:38 PM tamitrofanov@client:~". The terminal content displays the following command outputs:

```
[tamitrofanov@client.tamitrofanov.net ~]$ timedatectl
    Local time: Fri 2025-11-28 17:33:00 UTC
    Universal time: Fri 2025-11-28 17:33:00 UTC
        RTC time: Fri 2025-11-28 17:33:00
      Time zone: UTC (UTC, +0000)
System clock synchronized: yes
          NTP service: active
      RTC in local TZ: no
[tamitrofanov@client.tamitrofanov.net ~]$ time set-timezone Europe/Moscow
bash: set-timezone: command not found...
real    0m1.141s
user    0m0.006s
sys     0m0.010s
[tamitrofanov@client.tamitrofanov.net ~]$ time set-timezone Europe/Moscow
bash: set-timezone: command not found...
real    0m0.129s
user    0m0.007s
sys     0m0.009s
[tamitrofanov@client.tamitrofanov.net ~]$ timedatectl set-timezone Europe/Moscow
[tamitrofanov@client.tamitrofanov.net ~]$ timedatectl show
Timezone=Europe/Moscow
LocalRTC=no
LocalNTP=yes
CanNTP=yes
NTP=yes
NTPSyncronized=yes
Timeusec=Fri 2025-11-28 20:34:53 MSK
RTCTimeusec=Fri 2025-11-28 20:34:53 MSK
[tamitrofanov@client.tamitrofanov.net ~]$ timedatectl help
timedatectl [OPTIONS...] COMMAND ...
Query or change system time and date settings.

Commands:
status           Show current time settings
show            Show properties of systemd-timedated
set-time TIME   Set system time
set-timezone ZONE Set system time zone
list-timezones  Show known time zones
set-local-rtc BOOL Control whether RTC is in local time
```

The terminal window has a standard Linux-style interface with tabs, a status bar at the bottom, and a scroll bar on the right.

3.4 слайд 4

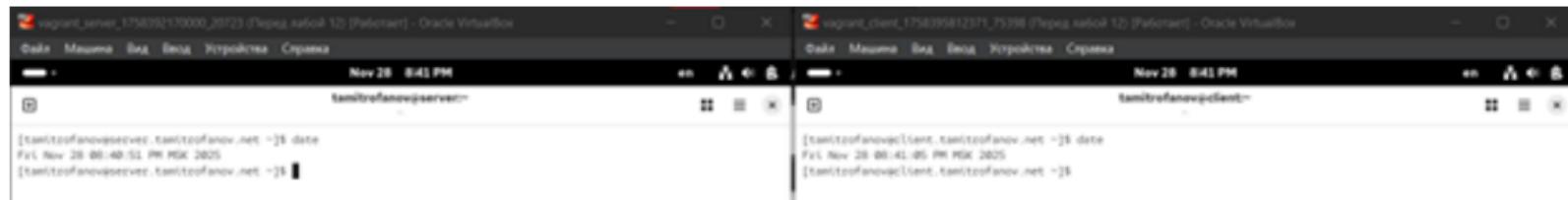


Рисунок 4: Время командой date на сервере и клиенте

3.5 слайд 5

```
[tamitrofanov@server.tamitrofanov.net ~]$ date -R
Fri, 28 Nov 2025 20:43:05 +0300
[tamitrofanov@server.tamitrofanov.net ~]$ date
Fri Nov 28 08:43:09 PM MSK 2025
[tamitrofanov@server.tamitrofanov.net ~]$ date -R
Fri, 28 Nov 2025 20:43:13 +0300
[tamitrofanov@server.tamitrofanov.net ~]$ date +"%Y-%m-%d %H:%M:%S"
2025-11-28 20:44:00:
[tamitrofanov@server.tamitrofanov.net ~]$
```

Рисунок 5: эксперименты с командой date

3.6 слайд 6

The screenshot shows two terminal windows side-by-side, both titled "vagrant_server_17583958170000_20723 (Перед лабой 12) [Работает] - Oracle VirtualBox" and "vagrant_client_1758395812371_75398 (Перед лабой 12) [Работает] - Oracle VirtualBox". Both windows have the title bar "root@server:~ - sudo -i" and the status bar "Nov 28 20:46 PM".

Terminal on the left (Server):

```
[tmitzofanov@server tmitzofanov.net ~]$ hwclock
hwclock: Cannot access the Hardware Clock via any known method.
hwclock: Use the --verbose option to see the details of our search for an access method.
[tmitzofanov@server tmitzofanov.net ~]$ hwclock
hwclock: Cannot access the Hardware Clock via any known method.
hwclock: Use the --verbose option to see the details of our search for an access method.
[tmitzofanov@server tmitzofanov.net ~]$ sudo -i
bash: sudo: command not found...
[tmitzofanov@server tmitzofanov.net ~]$ sudo -i
[sudo] password for tmitzofanov:
[root@server tmitzofanov.net ~]# hwclock
2025-11-28 20:46:50.419689-03:00
[root@server tmitzofanov.net ~]#
```

Terminal on the right (Client):

```
[tmitzofanov@client tmitzofanov.net ~]$ date
Fri Nov 28 20:41:05 PM MSK 2025
[tmitzofanov@client tmitzofanov.net ~]$ sudo -i
[sudo] password for tmitzofanov:
[root@client tmitzofanov.net ~]# hwclock
2025-11-28 20:46:20.723110-03:00
[root@client tmitzofanov.net ~]#
```

Рисунок 6: Просмотр аппаратного времени через hwclock

3.7 слайд 7

vagrant_server_1750398170000_20723 (Перед лабой 12) [Parrotet] - Oracle VirtualBox

```
root@server:~# sudo -i
Package          Architecture Version      Repository   Size
Upgrading:
chromy           x86_64      4.6.1-2.el18     baseos       351 kB
Transaction Summary
Upgrade 1 Package
Total download size: 351 kB
Downloading Packages:
chromy-4.6.1-2.el18.x86_64.rpm
Total
Running transaction check
Transaction check succeeded.
Running transaction test
Transaction test succeeded.
Running transaction
Preparing : 1/1
Running scriptlet: chromy-4.6.1-2.el18.x86_64
Upgrading : chromy-4.6.1-2.el18.x86_64
Running scriptlet: chromy-4.6.1-2.el18.x86_64
Running scriptlet: chromy-4.6.1-1.el18.x86_64
Running scriptlet: chromy-4.6.1-1.el18.x86_64
Cleanup : chromy-4.6.1-1.el18.x86_64
Running scriptlet: chromy-4.6.1-1.el18.x86_64
Upgraded:
chromy-4.6.1-2.el18.x86_64
Completed!
[vzroot@server:~#]# chromy sources
bash: chromy: command not found...
[vzroot@server:~#]# chromyc sources
Unrecognized command
[vzroot@server:~#]# chromy sources
bash: chromy: command not found...
[vzroot@server:~#]# chromyc sources
PS Name/IP address      Status Poll Reach LastRx Last sample
```

vagrant_client_175039812311_25398 (Перед лабой 12) [Parrotet] - Oracle VirtualBox

```
root@client:~# sudo -i
[root@client:~#]# def -y install chromy
Last metadata expiration check: 0:13:37 ago on Fri, 28 Nov 2025 08:34:56 PM MSK.
Package chromy-4.6.1-2.el18.x86_64 is already installed.
Dependencies resolved.
Package          Architecture Version      Repository   Size
Upgrading:
chromy           x86_64      4.6.1-2.el18     baseos       351 kB
Transaction Summary
Upgrade 1 Package
Total download size: 351 kB
Downloading Packages:
chromy-4.6.1-2.el18.x86_64.rpm
Total
Running transaction check
Transaction check succeeded.
Running transaction test
Transaction test succeeded.
Running transaction
Preparing : 1/1
Running scriptlet: chromy-4.6.1-2.el18.x86_64
Upgrading : chromy-4.6.1-2.el18.x86_64
Running scriptlet: chromy-4.6.1-2.el18.x86_64
Running scriptlet: chromy-4.6.1-1.el18.x86_64
Running scriptlet: chromy-4.6.1-1.el18.x86_64
Cleanup : chromy-4.6.1-1.el18.x86_64
Running scriptlet: chromy-4.6.1-1.el18.x86_64
Upgraded:
chromy-4.6.1-2.el18.x86_64
Completed!
[root@client:~#]# chromy sources
bash: chromy: command not found...
[root@client:~#]# chromyc sources
Status Poll Reach LastRx Last sample
```

3.8 слайд 8

The screenshot shows a terminal window titled "root@server:~ – sudo -i". The window has a red header bar and a black status bar at the bottom right. The main area displays the contents of the /etc/chrony.conf file. The file contains configuration for NTP synchronization, including server definitions, drift file settings, and kernel synchronization options. The status bar indicates the file is "Modified".

```
root@server:~ – sudo -i
+
GNU nano 8.1          /etc/chrony.conf          Modified
-
# Use public servers from the pool.ntp.org project.
# Please consider joining the pool (https://www.pool.ntp.org/join.html).
pool 2.rocky.pool.ntp.org iburst

# Use NTP servers from DHCP.
sourcedir /run/chrony-dhcp

# Record the rate at which the system clock gains/losses time.
driftfile /var/lib/chrony/drift

# Allow the system clock to be stepped in the first three updates
# if its offset is larger than 1 second.
makestep 1.0 3

# Enable kernel synchronization of the real-time clock (RTC).
rtcsync

# Enable hardware timestamping on all interfaces that support it.
#hwtimestamp *

# Increase the minimum number of selectable sources required to adjust
# the system clock.
#minsources 2

# Allow NTP client access from local network.
```

3.9 слайд 9



The screenshot shows a terminal window with a red header bar. The header bar contains a square icon with a plus sign, the text "root@server:~ - sudo -i", and three icons for maximizing, minimizing, and closing the window.

```
[root@server.tamitrofanov.net ~]# systemctl restart chronyd
[root@server.tamitrofanov.net ~]# firewall-cmd --add-service=ntp --permanent
firewall-cmd --reload
success
success
[root@server.tamitrofanov.net ~]#
[root@server.tamitrofanov.net ~]#
[root@server.tamitrofanov.net ~]#
```

Рисунок 9: перезагрузка служб и безопасности

3.10 слайд 10

```
root@client:~ - sudo -i
GNU nano 8.1          /etc/chrony.conf      Modified

# Enable kernel synchronization of the real-time clock (RTC).
rtcsync

# Enable hardware timestamping on all interfaces that support it.
#hwtimestamp *

# Increase the minimum number of selectable sources required to adjust
# the system clock.
#minsources 2

# Allow NTP client access from local network.
#allow 192.168.0.0/16

# Serve time even if not synchronized to a time source.
#local stratum 10

# Require authentication (nts or key option) for all NTP sources.
#authselectmode require

# Specify file containing keys for NTP authentication.
#keyfile /etc/chrony.keys

# Save NTS keys and cookies.
#ntsdumpdir /var/lib/chrony

# Insert/delete leap seconds by slewing instead of stepping.
#leapsecmode slew

# Set the TAI-UTC offset of the system clock.
#leapseclist /usr/share/zoneinfo/leap-seconds.list

# Specify directory for log files.
#logdir /var/log/chrony

# Select which information is logged.
#log measurements statistics tracking
```

3.11 слайд 11

```
[root@client.tamitrofanov.net ~]# systemctl restart chronyd  
[root@client.tamitrofanov.net ~]#
```

Рисунок 11: Перезагрузка службы

3.12 слайд 12

```
[root@server.tamitrofanov.net ~]# chronyc sources
MS Name/IP address      Stratum Poll Reach LastRx Last sample
=====
^-- vpn-1f.ubnt          3   6   377   53  +8831us[+9042us] +/-    72ms
^* ntp1.mail.ru          2   6   377   52  +258us[ +470us] +/-  4217us
^- 90.188.6.85           3   6   333   52  -5124us[-5124us] +/-   101ms
^- vigil.intelfx.name     2   6   377   54  +5829us[+6040us] +/-   36ms

[root@server.tamitrofanov.net ~]#
[root@server.tamitrofanov.net ~]#
[root@server.tamitrofanov.net ~]# chronyc reacking
Unrecognized command
[root@server.tamitrofanov.net ~]# chronyc tracking
Reference ID      : 5E64B485 (ntp1.mail.ru)
Stratum          : 3
Ref time (UTC)   : Fri Nov 28 18:01:00 2025
System time       : 0.000067075 seconds fast of NTP time
Last offset       : -0.000064430 seconds
RMS offset        : 0.000891226 seconds
Frequency         : 6.276 ppm slow
Residual freq    : -0.022 ppm
Skew              : 7.708 ppm
Root delay        : 0.008308926 seconds
Root dispersion   : 0.000996939 seconds
Update interval   : 65.0 seconds
Leap status       : Normal
[root@server.tamitrofanov.net ~]# chronyc tracking
Reference ID      : 5E64B485 (ntp1.mail.ru)
Stratum          : 3
Ref time (UTC)   : Fri Nov 28 18:01:00 2025
System time       : 0.000064688 seconds fast of NTP time
Last offset       : -0.000064430 seconds
RMS offset        : 0.000891226 seconds
Frequency         : 6.276 ppm slow
Residual freq    : -0.022 ppm
Skew              : 7.708 ppm
```

3.13 слайд 13



root@client:~ – sudo -i

```
[root@client.tamitrofanov.net ~]# chronyc sources
MS Name/IP address      Stratum Poll Reach LastRx Last sample
=====
^+ 83.167.27.4           1   6    177    34    +268us[ +268us] +/-   15ms
^+ time.cloudflare.com  3   6    177    36   -3612us[-3622us] +/-   11ms
^+ lemonbro.ru           1   6    177    42    +2924us[+2915us] +/-   13ms
^+ spb-ntp02c.ntppool.yande> 2   6    177    45    +238us[ +228us] +/-   12ms
^* www.tamitrofanov.net  3   6    177    49   -280us[ -289us] +/- 5974us
```

```
[root@client.tamitrofanov.net ~]#
```

```
[root@client.tamitrofanov.net ~]#
```

```
[root@client.tamitrofanov.net ~]# chronyc tracking
```

```
Reference ID      : C0A80101 (ns.tamitrofanov.net)
Stratum          : 4
Ref time (UTC)   : Fri Nov 28 18:03:50 2025
System time       : 0.000018641 seconds slow of NTP time
Last offset       : +0.000237760 seconds
RMS offset        : 0.000517579 seconds
Frequency         : 3.824 ppm slow
Residual freq    : +0.519 ppm
Skew              : 4.312 ppm
Root delay        : 0.008618812 seconds
Root dispersion   : 0.001834268 seconds
Update interval   : 64.4 seconds
```

3.14 слайд 14



The screenshot shows a terminal window with a red header bar. The header bar contains the text "root@server:/vagrant/provision/server – sudo -i". On the left side of the header is a small square icon with a white plus sign. On the right side are three icons: a grid, a horizontal ellipsis, and a close button.

```
[root@server.tamitrofanov.net ~]# cd /vagrant/provision/server
mkdir -p /vagrant/provision/server/ntp/etc
cp -R /etc/chrony.conf /vagrant/provision/server/ntp/etc/
[root@server.tamitrofanov.net server]#
[root@server.tamitrofanov.net server]#
[root@server.tamitrofanov.net server]# cd /vagrant/provision/server
touch ntp.sh
chmod +x ntp.sh
[root@server.tamitrofanov.net server]# █
```

Рисунок 14: копирование конфигурации и задание её на сервере

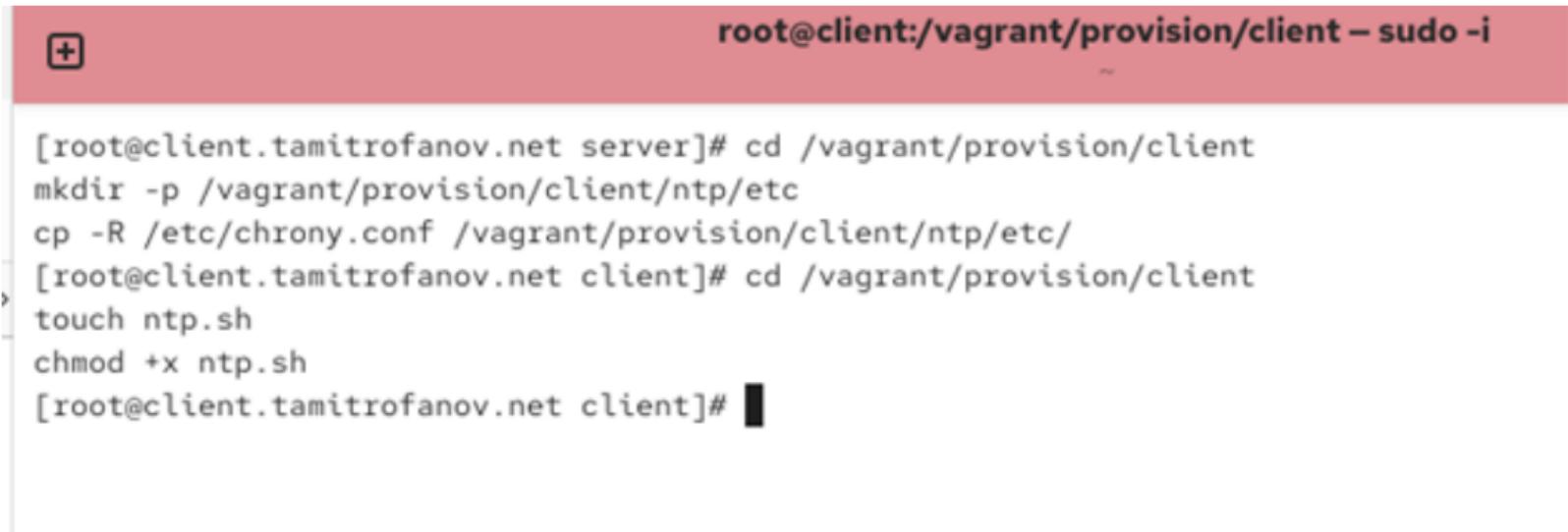
3.15 слайд 15



```
GNU nano 8.1          ntp.sh          Modified
#!/bin/bash
echo "Provisioning script $0"
echo "Install needed packages"
dnf -y install chrony
echo "Copy configuration files"
cp -R /vagrant/provision/server/ntp/etc/* /etc
restorecon -vR /etc
echo "Configure firewall"
firewall-cmd --add-service=ntp
firewall-cmd --add-service=ntp --permanent
echo "Restart chronyd service"
systemctl restart chronyd
```

Рисунок 15: внесение скрипта на сервер

3.16 слайд 16



The screenshot shows a terminal window with a red header bar. The header bar contains a small square icon with a plus sign and the text "root@client:/vagrant/provision/client – sudo -i". Below the header, the terminal displays the following command sequence:

```
[root@client.tamitrofanov.net server]# cd /vagrant/provision/client  
mkdir -p /vagrant/provision/client/ntp/etc  
cp -R /etc/chrony.conf /vagrant/provision/client/ntp/etc/  
[root@client.tamitrofanov.net client]# cd /vagrant/provision/client  
touch ntp.sh  
chmod +x ntp.sh  
[root@client.tamitrofanov.net client]#
```

Рисунок 16: копирование конфигурации и задание её на клиенте

3.17 слайд 17

The screenshot shows a terminal window with a red header bar. The header bar contains a small icon with a plus sign and the text "root@client:/vagrant/provision/client – sudo -i". Below the header is a black status bar with the text "GNU nano 8.1" on the left and "ntp.sh" on the right. The main terminal area displays a shell script named "ntp.sh". The script content is as follows:

```
#!/bin/bash
echo "Provisioning script $0"
echo "Copy configuration files"
cp -R /vagrant/provision/client/ntp/etc/* /etc
restorecon -vR /etc
echo "Restart chronyd service"
systemctl restart chronyd
```

Рисунок 17: внесение скрипта на клиент

3.18 слайд 18

```
116  
117     server.vm.provision "server ntp",  
118         type: "shell",  
119         preserve_order: true,  
120         path: "provision/server/ntp.sh"  
121
```

Рисунок 18: настройка бутконфига для сервера

3.19 слайд 19

```
160
161     client.vm.provision "client_ntp",
162         type: "shell",
163         preserve_order: true,
164         path: "provision/client/ntp.sh"
165
```

Рисунок 19: настройка бутконфига для сервера

Раздел 4

4. Выводы

4.1 слайд 1

Сегодня я получил навыки по управлению системным временем и настройке синхронизации времени.