

МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ РОССИЙСКОЙ
ФЕДЕРАЦИИ

Федеральное государственное автономное образовательное учреждение

высшего образования

«КРЫМСКИЙ ФЕДЕРАЛЬНЫЙ УНИВЕРСИТЕТ им. В. И. ВЕРНАДСКОГО»

ФИЗИКО-ТЕХНИЧЕСКИЙ ИНСТИТУТ

Кафедра компьютерной инженерии и моделирования

Использование сетевых файловых систем в среде Linux

Отчет по лабораторной работе 14

по дисциплине «**Системное программное обеспечение**»

студента 3 курса группы ИВТ-б-о-202

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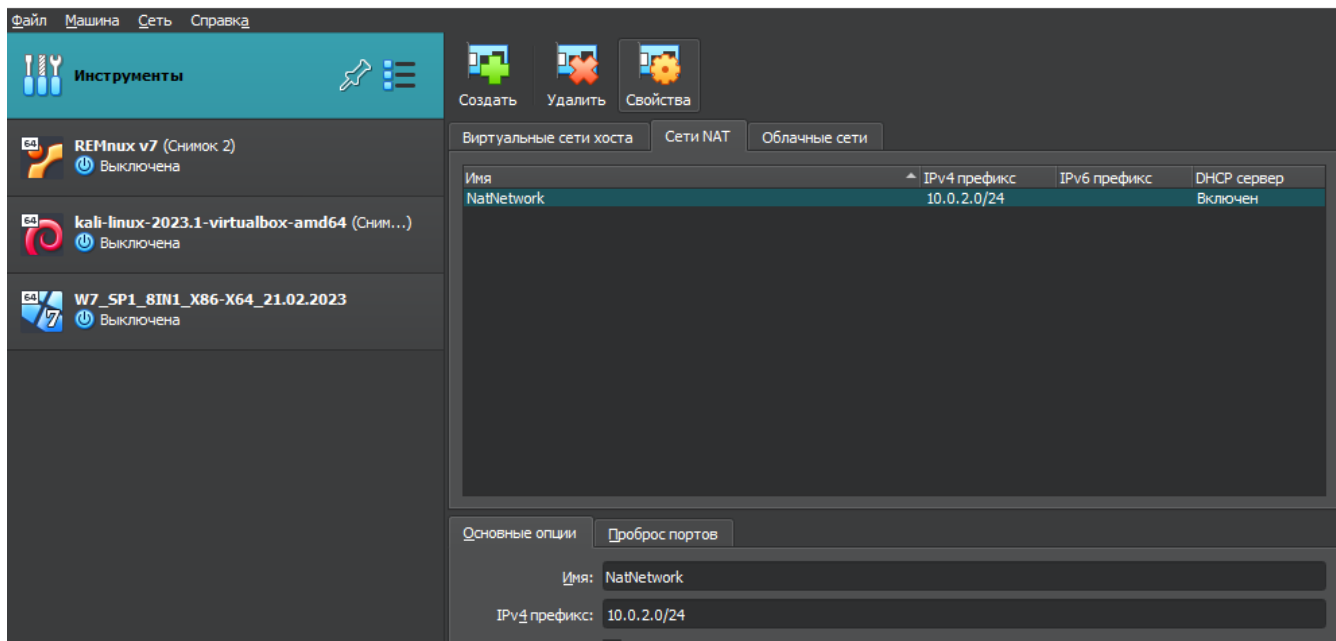
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Симферополь, 2023

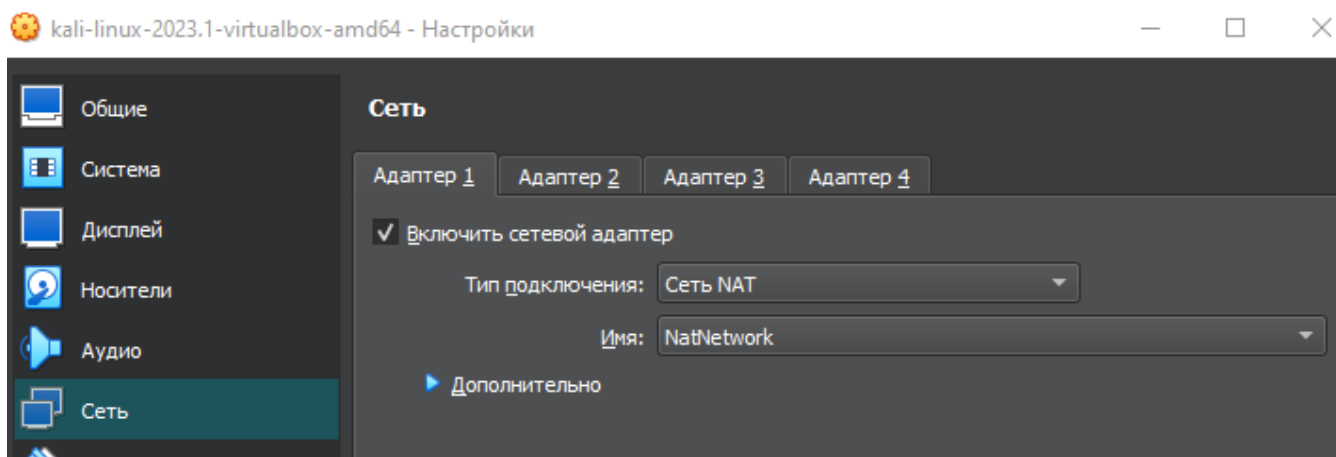
Лабораторная работа №14. Использование сетевых файловых систем в среде Linux

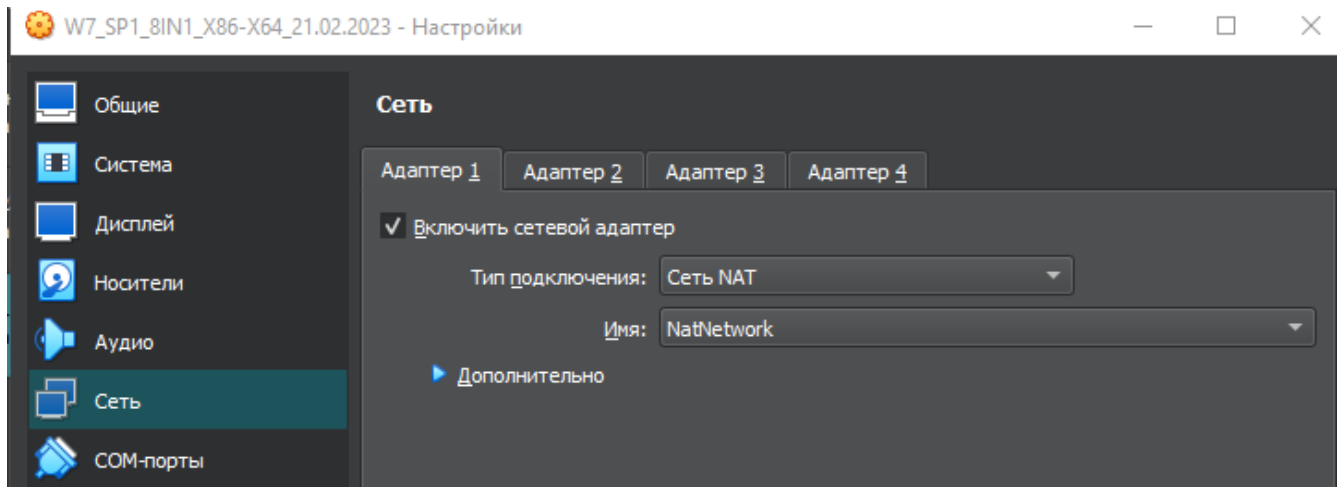
Цель работы: Получение навыков настройке и обслуживанию распределённых файловых систем, функционирующих по протоколу NFS и CIFS

Создание сети Nat

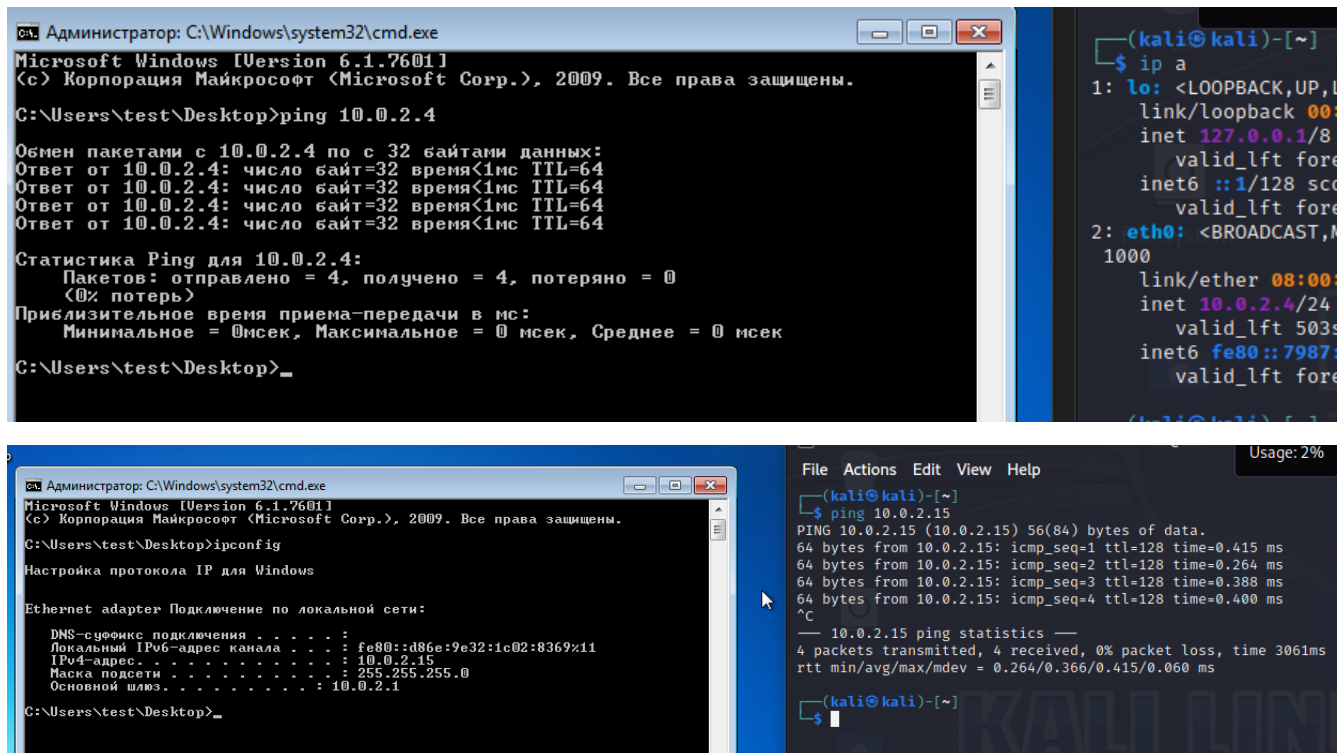


Подключение к сети NAT двух машин





Проверка работы сети



1. Настроить экспортирование директории для выполнения операций чтения и записи по протоколу NFS для определённого узла

Установка NFS Сервера

```
(root@kali)-[/var/log]
# apt install nfs-kernel-server
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following NEW packages will be installed:
  nfs-kernel-server
0 upgraded, 1 newly installed, 0 to remove and 558 not upgraded.
Need to get 151 kB of archives.
After this operation, 626 kB of additional disk space will be used.
0% [Working]
```

Статус NFS сервера

```
(root@kali)-[/var/log]
# systemctl enable --now nfs-server
Created symlink /etc/systemd/system/multi-user.target.wants/nfs-server.service → /lib/systemd/system/nfs-server.service.

(root@kali)-[/var/log]
# systemctl status nfs-server
● nfs-server.service - NFS server and services
   Loaded: loaded (/lib/systemd/system/nfs-server.service; enabled; preset: disabled)
   Active: active (exited) since Fri 2023-06-09 11:25:39 EDT; 3min 7s ago
     Main PID: 20311 (code=exited, status=0/SUCCESS)
    CPU: 5ms

Jun 09 11:25:39 kali systemd[1]: Starting nfs-server.service - NFS server and services...
Jun 09 11:25:39 kali systemd[1]: Finished nfs-server.service - NFS server and services.

(root@kali)-[/var/log]
#
```

Проверка работоспособности пора NFS(2049)

```
(root@kali)-[/var/log]
# ss -ltn
State      Recv-Q    Send-Q    Local Address:Port    Peer Address:Port    Process
LISTEN     0         4096      0.0.0.0:60887          0.0.0.0:*
LISTEN     0         4096      0.0.0.0:111           0.0.0.0:*
LISTEN     0         64       0.0.0.0:2049          0.0.0.0:*
LISTEN     0         64       0.0.0.0:42201         0.0.0.0:*
LISTEN     0         4096      0.0.0.0:51335         0.0.0.0:*
LISTEN     0         4096      0.0.0.0:38767         0.0.0.0:*
LISTEN     0         4096      0.0.0.0:45573         0.0.0.0:*
LISTEN     0         25       0.0.0.0:514           0.0.0.0:*
LISTEN     0         244      127.0.0.1:5432        0.0.0.0:*
```

Создание директории под сервер

```
(kali@kali)-[/home/user_test/data]
$ ll
total 0
-rw-r--r-- 1 root root 0 Jun 11 08:09 test_file1
-rw-r--r-- 1 root root 0 Jun 11 08:09 test_file2
-rw-r--r-- 1 root root 0 Jun 11 08:09 test_file3
```

Настройка доступа к серверу

```
File Actions Edit View Help
GNU nano 7.2 /etc/exports
# /etc/exports: the access control list for filesystems which may be exported
#               to NFS clients.  See exports(5).
#
# Example for NFSv2 and NFSv3:
# /srv/homes hostname1(rw,sync,no_subtree_check) hostname2(ro,sync,no_subtree_check)
#
# Example for NFSv4:
# /srv/nfs4 gss/krb5i(rw,sync,fsid=0,crossmnt,no_subtree_check)
# /srv/nfs4/homes gss/krb5i(rw,sync,no_subtree_check)
#
/home/user_test/data/ 10.0.2.15(rw)
/home/user_test/data/ 10.0.2.5(rw)
```

Список раздаваемых файлов

```
(kali㉿kali)-[/home/user_test/data]
$ sudo exportfs -av
exportfs: /etc/exports [1]: Neither 'subtree_check' or 'no_subtree_check' specified for export "10.0.2.15:/home/user_test/data/".
    Assuming default behaviour ('no_subtree_check').
    NOTE: this default has changed since nfs-utils version 1.0.x

exportfs: /etc/exports [2]: Neither 'subtree_check' or 'no_subtree_check' specified for export "10.0.2.5:/home/user_test/data/".
    Assuming default behaviour ('no_subtree_check').
    NOTE: this default has changed since nfs-utils version 1.0.x

exporting 10.0.2.15:/home/user_test/data
exporting 10.0.2.5:/home/user_test/data

(kali㉿kali)-[/home/user_test/data]
$ sudo exportfs -s
/home/user_test/data 10.0.2.15(sync,wdelay,hide,no_subtree_check,sec=sys,rw,secure,root_squash,no_all_squash)
/home/user_test/data 10.0.2.5(sync,wdelay,hide,no_subtree_check,sec=sys,rw,secure,root_squash,no_all_squash)
/home/user/test/data/ 10.0.2.15(sync,wdelay,hide,no_subtree_check,sec=sys,rw,secure,root_squash,no_all_squash)

(kali㉿kali)-[/home/user_test/data]
$ sudo exportfs
/home/user_test/data
10.0.2.15
/home/user_test/data
10.0.2.5
/home/user/test/data/
10.0.2.15
```

2. Подключить удалённую файловую систему по протоколу NFS и проверить возможность записи и чтения

Установка на вторую систему инструментов подключения к серверу

```
remnux@remnux:~$ apt install nfs-common
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  keyutils libnfsidmap2 libtirpc1 rpcbind
Suggested packages:
  open-iscsi watchdog
The following NEW packages will be installed:
  keyutils libnfsidmap2 libtirpc1 nfs-common rpcbind
0 upgraded, 5 newly installed, 0 to remove and 725 not upgraded.
Need to get 399 kB of archives.
After this operation, 1,364 kB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://us.archive.ubuntu.com/ubuntu bionic-updates/main amd64
```

Результат монтирования

```
remnux@remnux:~$ sudo mount 10.0.2.4:/home/user_test/data /mnt
remnux@remnux:~$ df -h /mnt/
Filesystem                Size      Used Avail Use% Mounted on
10.0.2.4:/home/user_test/data 79G      14G   62G  18% /mnt
remnux@remnux:~$ mount |grep /mnt
10.0.2.4:/home/user_test/data on /mnt type nfs4 (rw,relatime,vers=4.2,rsiz=262144,wsiz=262144,namlen=255,hard,proto=tcp,timeo=600,retrans=2,sec=sys,clientaddr=10.0.2.5,local_lock=none,addr=10.0.2.4)
remnux@remnux:~$
```

Проверка чтения и записи

```
remnux@remnux:~$ ls /mnt
test_file1 test_file2 test_file3
remnux@remnux:~$ cat /mnt/test_file1
remnux@remnux:~$ sudo touch /mnt/test_file4
touch: cannot touch '/mnt/test_file4': Permission denied
remnux@remnux:~$
```

Настройка прав доступа (смена пользователя)

```
(kali㉿kali)-[~user_test/data]
└─$ ll
total 0
-rw-r--r-- 1 user_test root 0 Jun 11 08:09 test_file1
-rw-r--r-- 1 root      root 0 Jun 11 08:09 test_file2
-rw-r--r-- 1 root      root 0 Jun 11 08:09 test_file3

(kali㉿kali)-[~user_test/data]
└─$ sudo chown kali test_file1

(kali㉿kali)-[~user_test/data]
└─$ ll
total 0
-rw-r--r-- 1 kali root 0 Jun 11 08:09 test_file1
-rw-r--r-- 1 root root 0 Jun 11 08:09 test_file2
-rw-r--r-- 1 root root 0 Jun 11 08:09 test_file3
```

Создал нового пользователя на сервере и не получилось(1001)

```
remnux@remnux:~$ stat /mnt/test_file1
  File: /mnt/test_file1
  Size: 0                Blocks: 0          IO Block: 262144 regular empty file
Device: 32h/50d Inode: 524491    Links: 1
Access: (0644/-rw-r--r--)  Uid: (  0/   root)   Gid: (  0/   root)
Access: 2023-06-11 08:09:51.529502166 -0400
Modify: 2023-06-11 08:09:51.529502166 -0400
Change: 2023-06-11 08:09:51.529502166 -0400
 Birth: -

remnux@remnux:~$ stat /mnt/test_file1
  File: /mnt/test_file1
  Size: 0                Blocks: 0          IO Block: 262144 regular empty file
Device: 32h/50d Inode: 524491    Links: 1
Access: (0644/-rw-r--r--)  Uid: (1001/ UNKNOWN)  Gid: (  0/   root)
Access: 2023-06-11 08:09:51.529502166 -0400
Modify: 2023-06-11 08:09:51.529502166 -0400
Change: 2023-06-11 08:33:04.405518236 -0400
 Birth: -

remnux@remnux:~$
```


Поменял на уже существующего пользователя(1000)

```
remnux@remnux:~$ id
uid=1000(remnux) gid=1000(remnux) groups=1000(remnux),4(adm),24(cdrom),27(sudo),30(dip),46(plug
dev),111(lpadmin),112(sambashare),129(wireshark)
remnux@remnux:~$ stat /mnt/test_file1
  File: /mnt/test_file1
  Size: 0                Blocks: 0          IO Block: 262144 regular empty file
Device: 32h/50d Inode: 524491      Links: 1
Access: (0644/-rw-r--r--)  Uid: ( 1000/  remnux)   Gid: (   0/   root)
Access: 2023-06-11 08:09:51.529502166 -0400
Modify: 2023-06-11 08:09:51.529502166 -0400
Change: 2023-06-11 08:36:17.057520459 -0400
 Birth: -
remnux@remnux:~$
```

Запись на сервер

```
remnux@remnux:~$ sudo mount 10.0.2.4:/home/user_test/data /mnt
remnux@remnux:~$ echo test > /mnt/test_file1
remnux@remnux:~$ cat /mnt/file1
cat: /mnt/file1: No such file or directory
remnux@remnux:~$ cat /mnt/test_file1
test
remnux@remnux:~$
```

```
(kali㉿kali)-[~user_test/data]
$ ll
total 0
-rw-r--r-- 1 kali root 0 Jun 11 08:09 test_file1
-rw-r--r-- 1 root root 0 Jun 11 08:09 test_file2
-rw-r--r-- 1 root root 0 Jun 11 08:09 test_file3
Home
(kali㉿kali)-[~user_test/data]
$ cat test_file1
test
```

3. Проанализировать статистику работы сервера

```
(kali㉿kali)-[~user_test/data]
$ nfsstat -s
Server rpc stats:
calls      badcalls   badfmt     badauth    badclnt
183        0          0          0          0

Server nfs v4:
null      compound
1         0%        182        99%

Server nfs v4 operations:
op0-unused    op1-unused    op2-future    access      close
0             0             0             13          5
0%            0%            0%            2%          0%
commit        create         delegpurge     delegreturn  getattr
0             0             0             3           146
0%            0%            0%            0%          26%
getfh         link          lock           lockt        locku
14            0             0             0           0
2%            0%            0%            0%          0%
lookup        lookup_root   nverify       open         openattr
13            0             0             8           0
2%            0%            0%            1%          0%
open_conf     open_dgrd     putfh         putpubfh     putrootfh
0             0             155           0           4
0%            0%            28%           0%          0%
read          readdir       readlink      remove       rename
1             3             0             0           0
0%            0%            0%            0%          0%
renew         restorefh     savefh        secinfo      setattr
0             0             0             0           1
0%            0%            0%            0%          0%
setcltid      setcltidconf verify         write        rellockowner
0             0             0             2           0
0%            0%            0%            0%          0%
bc_ctl        bind_conn     exchange_id   create_ses   destroy_ses
0             0             2             1           0
0%            0%            0%            0%          0%
free_stateid  getdirdeleg  getdevinfo    getdevlist   layoutcommit
0             0             0             0           0
0%            0%            0%            0%          0%
layoutget     layoutreturn  secinfononam  sequence     set_ssv
0             0             2             179          0
0%            0%            0%            32%         0%
test_stateid  want_deleg   destroy_clid  reclaim_comp  allocate
0             0             0             1           0
0%            0%            0%            0%          0%
copy          copy_notify  deallocate     ioadvise     layouterror
0             0             0             0           0
0%            0%            0%            0%          0%
layoutstats   offloadcancel offloadstatus  readplus     seek
0             0             0             0           0
0%            0%            0%            0%          0%
write_same
0             0%
0%            0%
```

4. Настроить сервер для предоставления доступа по протоколу SMB, применяя опцию аутентификации user

Установка

```
(kali@kali)-[~user_test/data]
$ sudo apt install samba
[sudo] password for kali:
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  libldb2 libsmbclient libwbclient0 python3-ldb python3-samba samba-ad-prov
  samba-dsdb-modules samba-libs samba-vfs-modules smbclient winexe
Suggested packages:
  bind9 bind9utils ctdb ldb-tools ntp | chrony ufw winbind heimdal-clients
The following packages will be upgraded:
  libldb2 libsmbclient libwbclient0 python3-ldb python3-samba samba samba-a
  samba-common-bin samba-dsdb-modules samba-libs samba-vfs-modules smbclient
14 upgraded, 0 newly installed, 0 to remove and 544 not upgraded.
Need to get 12.7 MB of archives.
After this operation, 41.0 kB of additional disk space will be used.
Do you want to continue? [Y/n]
```

Конфигурация

```
GNU nano 7.2 /etc/samba/smb.conf
[global]
##### Kali configuration (use kali-tweaks to change it) #####

# By default a Kali system should be configured for wide compatibility,
# to easily interact with servers using old vulnerable protocols.
  client min protocol = LANMAN1

## Browsing/Identification ##
# Change this to the workgroup/NT-domain name your Samba server will part of
  workgroup = WORKGROUP

#### Networking ####
# The specific set of interfaces / networks to bind to
# This can be either the interface name or an IP address/netmask;
# interface names are normally preferred
; interfaces = 127.0.0.0/8 eth0

# Only bind to the named interfaces and/or networks; you must use the
# 'interfaces' option above to use this.
# It is recommended that you enable this feature if your Samba machine is
# not protected by a firewall or is a firewall itself. However, this
# option cannot handle dynamic or non-broadcast interfaces correctly.
; bind interfaces only = yes

security = user
```

5. Произвести доступ к удалённому доступу Windows

Table 6.1: Share-level Access Options

Option	Parameters	Function	Default	Scope
admin users	string (list of usernames)	Specifies a list of users who can perform operations as root.	None	Share
valid users	string (list of usernames)	Specifies a list of users that can connect to a share.	None	Share
invalid users	string (list of usernames)	Specifies a list of users that will be denied access to a share.	None	Share
read list	string (list of usernames)	Specifies a list of users that have read-only access to a writable share.	None	Share
write list	string (list of usernames)	Specifies a list of users that have read-write access to a read-only share.	None	Share
max connections	numerical	Indicates the maximum number of connections for a share at a given time.	0	Share
guest only (only guest)	boolean	Specifies that this share allows only guest access.	no	Share
guest account	string (name of account)	Names the Unix account that will be used for guest access.	nobody	Share

```
GNU nano 7.2 /etc/samba/smb.conf
# Windows clients look for this share name as a source of downloadable
# printer drivers
[print$]
    comment = Printer Drivers
    path = /var/lib/samba/printers
    browseable = yes
    read only = yes
    guest ok = no
# Uncomment to allow remote administration of Windows print drivers.
# You may need to replace 'lpadmin' with the name of the group your
# admin users are members of.
# Please note that you also need to set appropriate Unix permissions
# to the drivers directory for these users to have write rights in it
; write list = root, @lpadmin

[share]
    comment = Samba
    path = /home/samba_user
    browseable = Yes
    read list = @samba_user
    write list = samba_user
```

Browseable – видимая

Проверка конфигурации

```
(kali㉿kali)-[~]
└─$ testparm /etc/samba/smb.conf
Load smb config files from /etc/samba/smb.conf
Loaded services file OK.
Weak crypto is allowed by GnuTLS (e.g. NTLM as a compatibility fallback)
File System
Server role: ROLE_STANDALONE

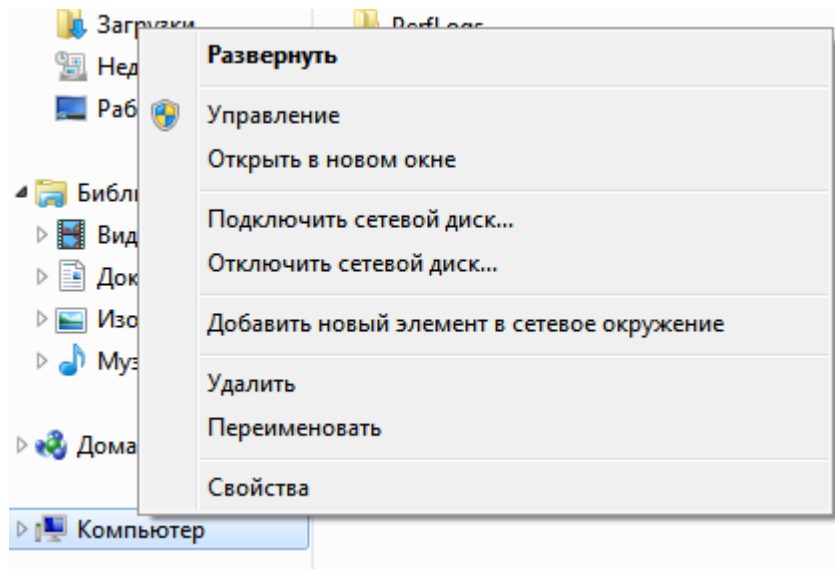
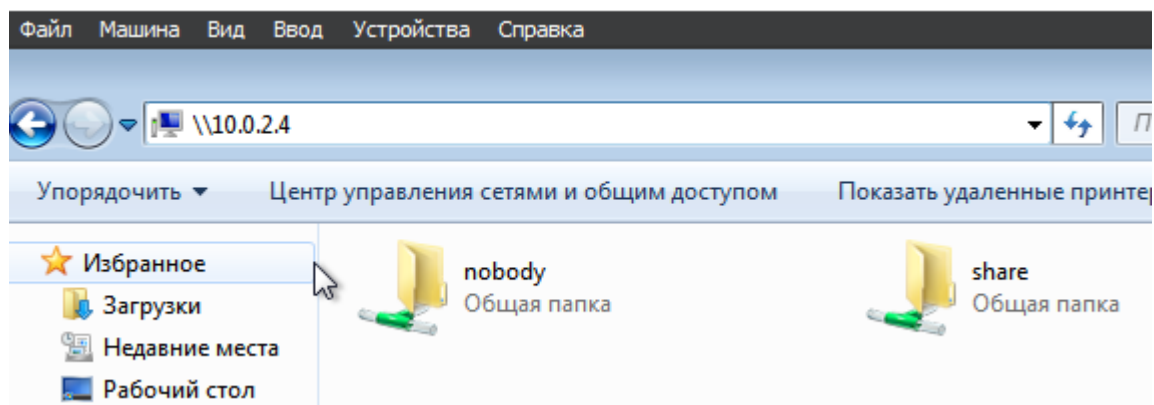
Press enter to see a dump of your service definitions
```

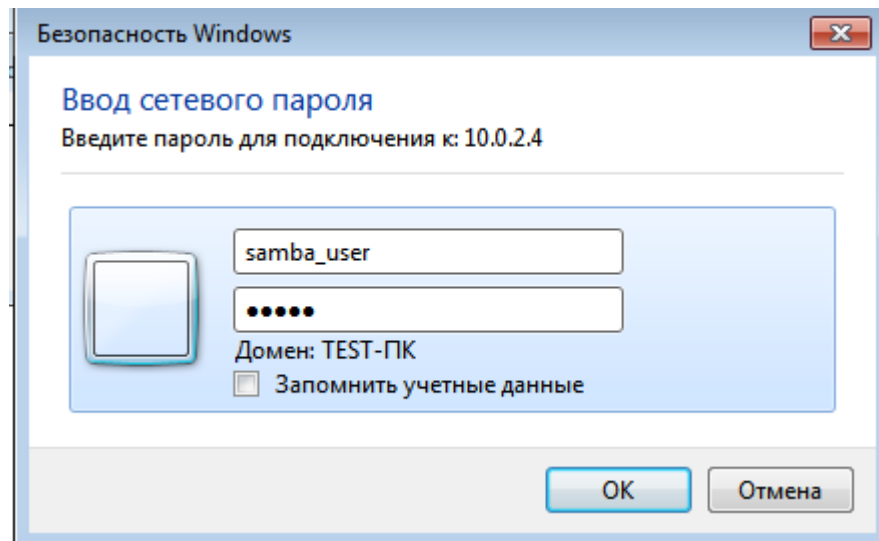
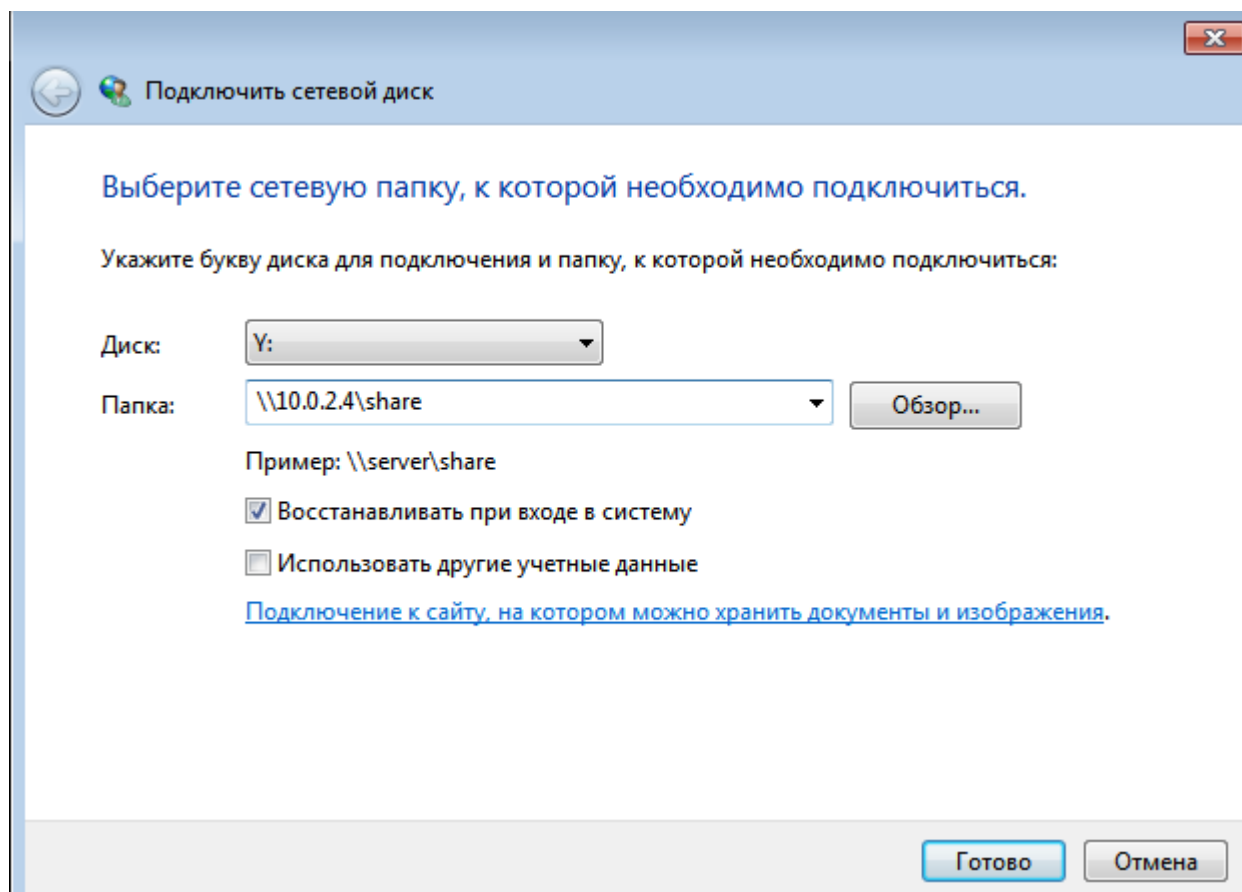
Установка пароля на пользователя samba

```
File Actions Edit View Help
(kali@kali)-[~]
$ sudo smbpasswd -a samba_user
New SMB password:
Retype new SMB password:
Added user samba_user.
```

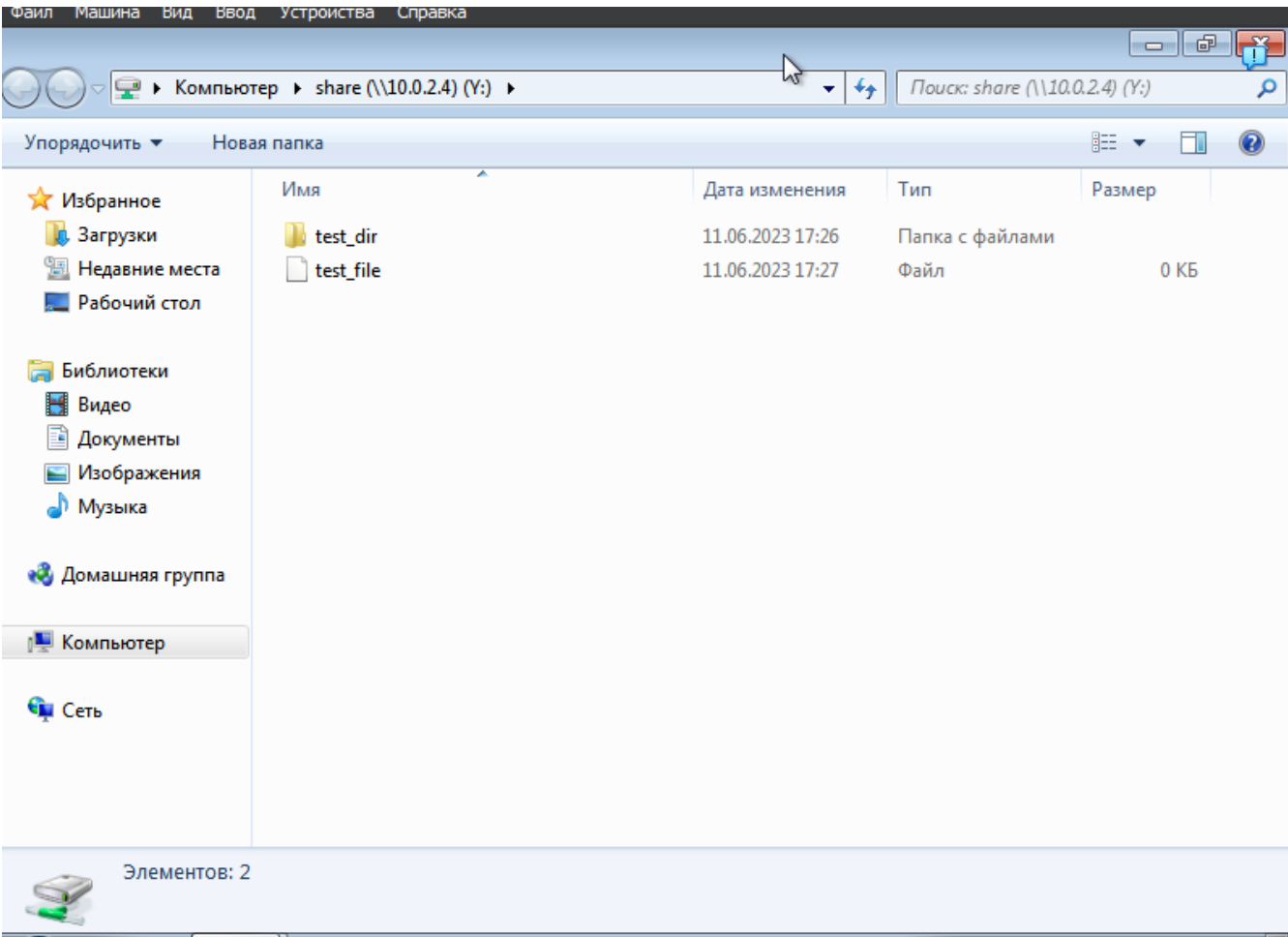
samba

Подключение к сетевому диску





Проверка работы сетевого диска



6. Произвести монтирование удалённого ресурса по протоколу SMB на Linux узле

Список доступных шар

```
remnux@remnux:~$ sudo apt install samba-client
Reading package lists... Done
Building dependency tree
Reading state information... Done
Note, selecting 'smbclient' instead of 'samba-client'
The following additional packages will be installed:
  libldb1 libsmbclient libwbclient0 python-ldb python-samba
  samba-common-bin samba/libs
Suggested packages:
```

```
remnux@remnux:~$ smbclient -L 10.0.2.4
WARNING: The "syslog" option is deprecated
Enter WORKGROUP\remnux's password:

      Sharename      Type      Comment
      -----      -
      print$         Disk      Printer Drivers
      share           Disk      Samba
      IPC$           IPC       IPC Service (Samba 4.17.5-Debian)
      nobody         Disk      Home Directories
Reconnecting with SMB1 for workgroup listing.
protocol negotiation failed: NT_STATUS_INVALID_NETWORK_RESPONSE
Failed to connect with SMB1 -- no workgroup available
```

Просмотр шар доступных пользователи samba_user

```
remnux@remnux:~$ smbclient -L 10.0.2.4 -U samba_user
WARNING: The "syslog" option is deprecated
Enter WORKGROUP\samba_user's password:

      Sharename      Type      Comment
      -----      -
      print$         Disk      Printer Drivers
      share           Disk      Samba
      IPC$           IPC       IPC Service (Samba 4.17.5-Debian)
      samba_user     Disk      Home Directories
Reconnecting with SMB1 for workgroup listing.
protocol negotiation failed: NT_STATUS_INVALID_NETWORK_RESPONSE
Failed to connect with SMB1 -- no workgroup available
remnux@remnux:~$
```


Подключение к шаре

```
[--pw-nt-hash] service <password>  
remnux@remnux:~$ smbclient //samba_user/share -U samba_user --pw-nt-hash samba  
WARNING: The "syslog" option is deprecated  
remnux@remnux:~$
```

Монтирование шары

```
remnux@remnux:~$ sudo apt install cifs-utils  
Reading package lists... Done  
Building dependency tree  
Reading state information... Done  
Suggested packages:  
  winbind  
The following NEW packages will be installed:  
  cifs-utils  
0 upgraded, 1 newly installed, 0 to remove and 721 not upgraded.  
Need to get 81.5 kB of archives.
```

Вход

```
remnux@remnux:~$ sudo mount //10.0.2.4/share /mnt -o username=samba_user  
Password for samba_user@//10.0.2.4/share: *****  
remnux@remnux:~$
```

Проверка работы

```
(root@kali)~[/home/samba_user]  
# ls  
test_dir test_file  
  
(root@kali)~[/home/samba_user]  
#
```

```
remnux@remnux:~$ sudo mount //10.0.2.4/share /mnt -o username=samba_user  
Password for samba_user@//10.0.2.4/share: *****  
remnux@remnux:~$ ls  
Desktop Documents Downloads Music Pictures Public Templates Videos  
remnux@remnux:~$ ls /mnt  
remnux@remnux:~$ ls  
Desktop Documents Downloads Music Pictures Public Templates Videos  
remnux@remnux:~$ cd /mnt  
remnux@remnux:/mnt$ ls  
test_dir test_file  
remnux@remnux:/mnt$
```

Вывод: в ходе данной лабораторной работы я настроил сеть между тремя виртуальными машинами. Установил и сконфигурировал NFS сервер. Подключился к удалённой файловой системе по протоколу NFS и проверил запись и чтения, настроил запись. Проанализировал статистику работы сервера. Настроить сервер для предоставления доступа по протоколу SMB, применяя опцию аутентификации user. Произвёл доступ к удалённому доступу Windows. Произвёл монтирование удалённого ресурса по протоколу SMB на Linux узле.