ФЕДЕРАЛЬНОЕ ГОСУДАРСТВЕННОЕ АВТОНОМНОЕ ОБРАЗОВАТЕЛЬНОЕ УЧРЕЖДЕНИЕ ВЫСШЕГО ОБРАЗОВАНИЯ

«САНКТ-ПЕТЕРБУРГСКИЙ НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ УНИВЕРСИТЕТ ИНФОРМАЦИОННЫХ ТЕХНОЛОГИЙ, МЕХАНИКИ И ОПТИКИ»

Факультет безопасности информационных технологий

Дисциплина:

«Операционные системы»

ОТЧЕТ ПО ЛАБОРАТОРНОЙ РАБОТЕ №5

«Файловые системы»

Выполнила:

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Проверил:

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Санкт-Петербург

2023г.

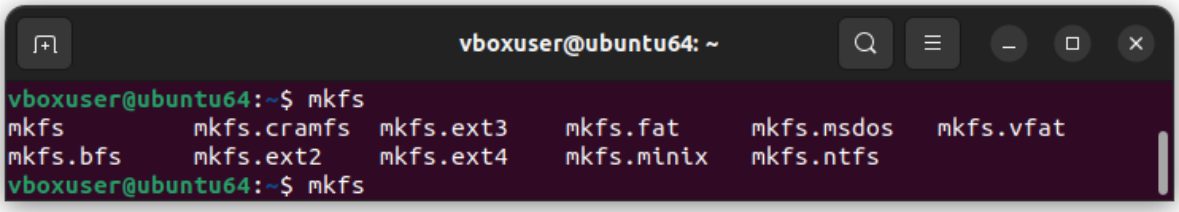
Задание:

Выбрать 3 (или больше) файловых систем, выбрать методику проверки и найти лучшую из них.

Усложненный вариант

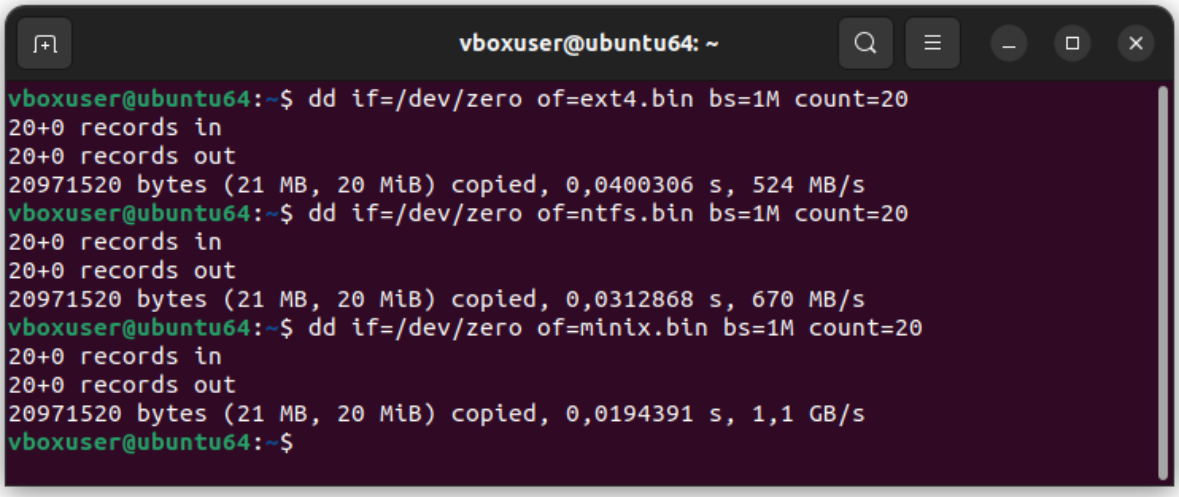
Экзотические фс или экзотические методики проверки

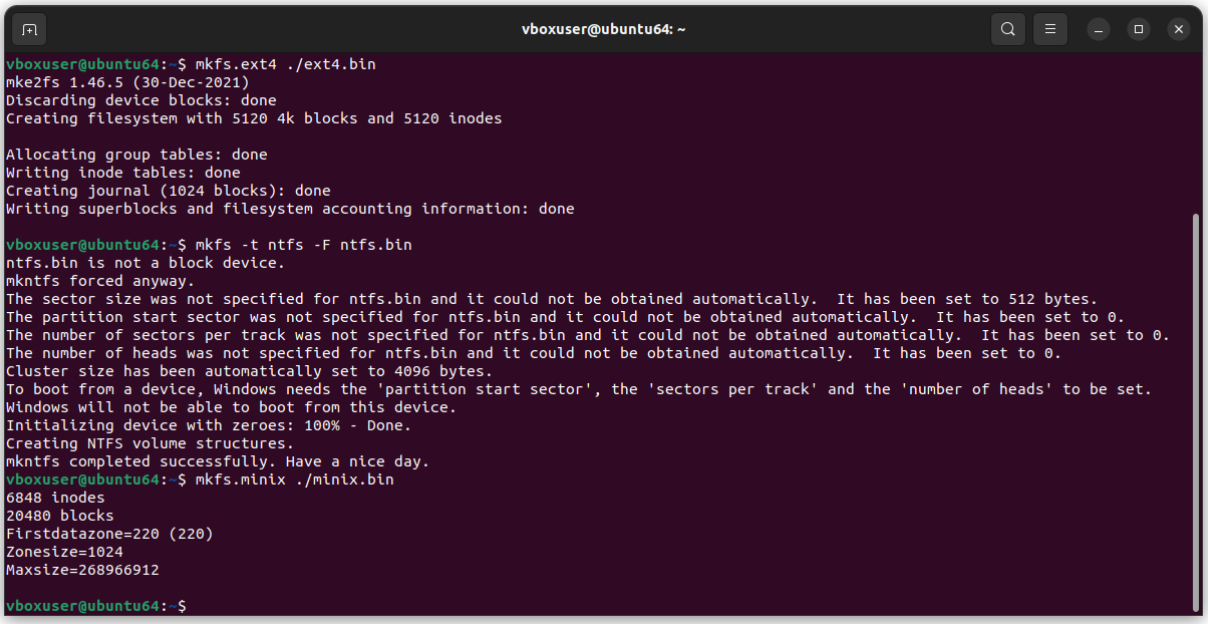
Ход работы

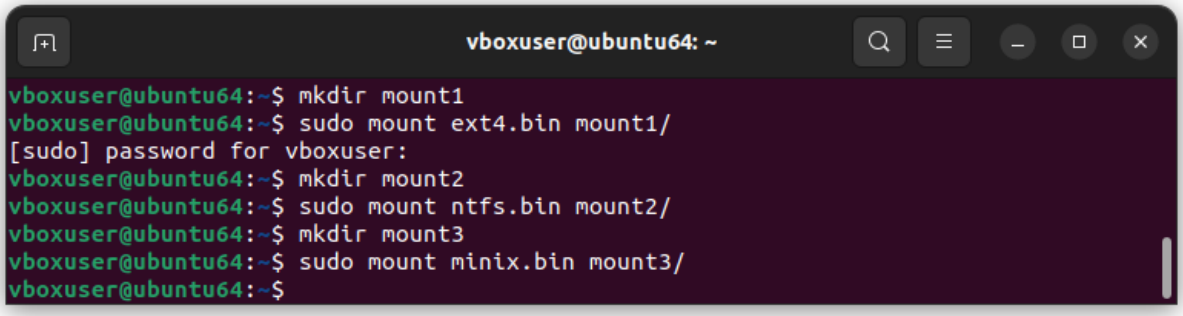


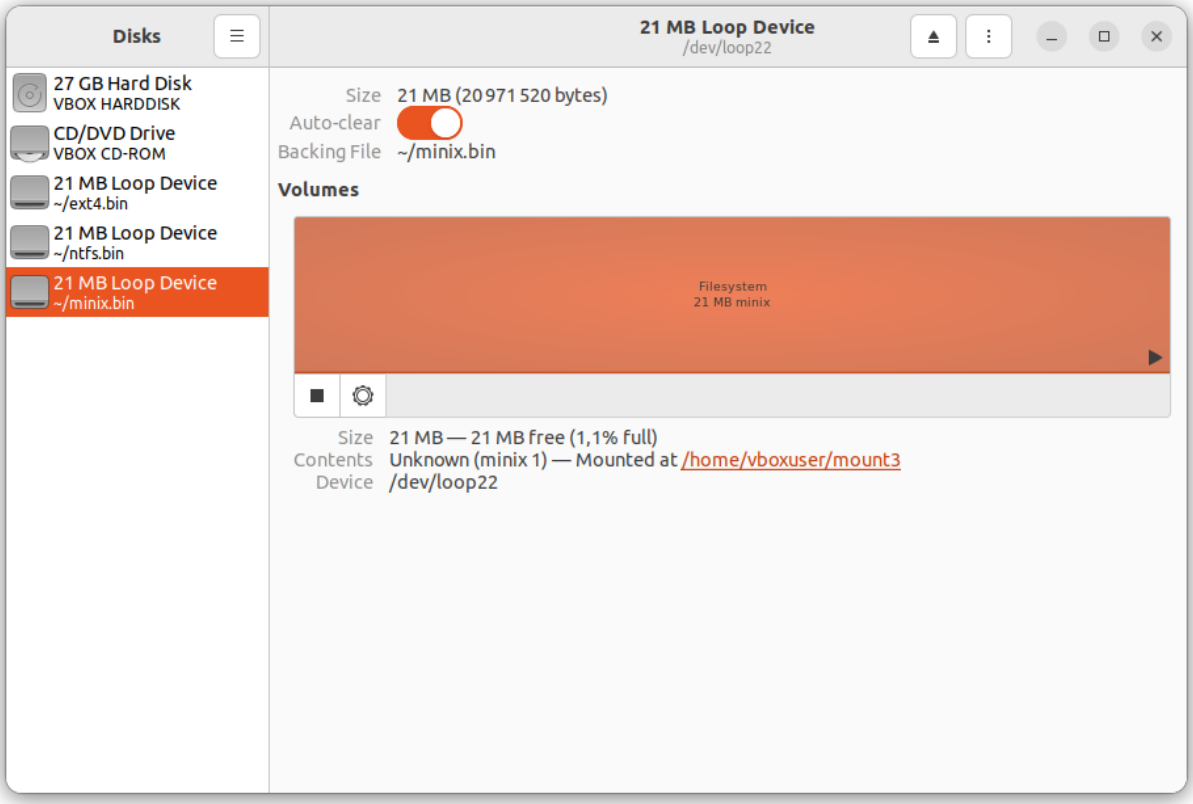
Для выполнения лабораторной работы были выбраны следующие файловые системы:

- **Ext4** — журналируемая файловая система, используемая преимущественно в операционных системах с ядром Linux
- **NTFS** — основная файловая система для последних версий Windows
- **Minix** — первая файловая система, которая использовалась в операционной системе Minix, ставшей прообразом ядра ОС Linux
- Экзотическая: **ZFS** — copy-on-write файловая система с деревом Меркла, созданная Sun Microsystems в 2004–2005 годах для операционной системы Solaris.

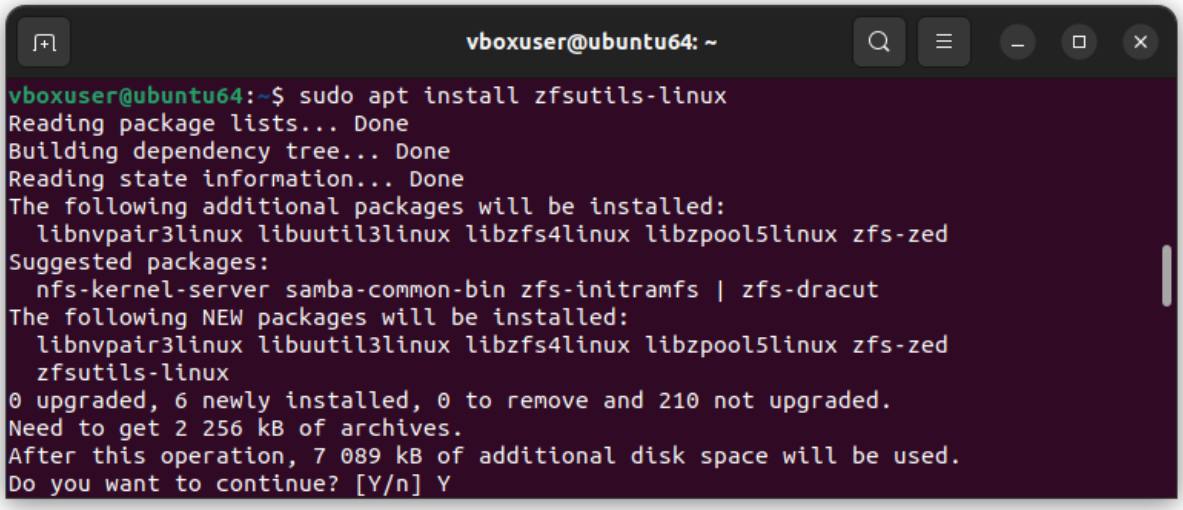


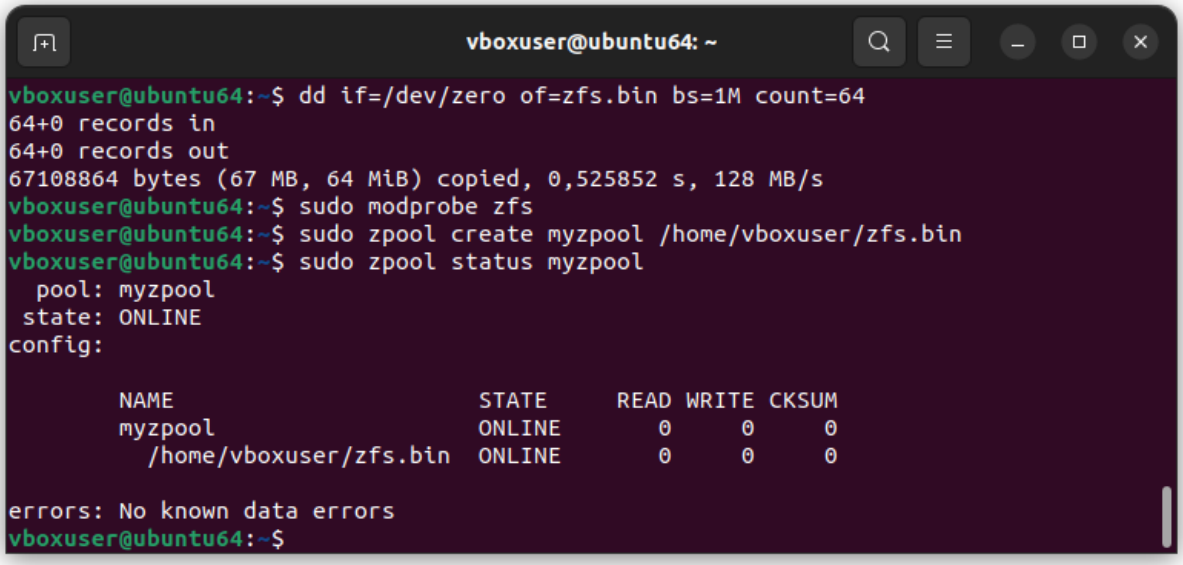

vboxuser@ubuntu64: ~
vboxuser@ubuntu64:~$ mkfs.ext4 ./ext4.bin
mke2fs 1.46.5 (30-Dec-2021)
Discarding device blocks: done
Creating filesystem with 5120 4k blocks and 5120 inodes
Allocating group tables: done
Writing inode tables: done
Creating journal (1024 blocks): done
Writing superblocks and filesystem accounting information: done
vboxuser@ubuntu64:~$ mkfs -t ntfs -F ntfs.bin
ntfs.bin is not a block device.
mkntfs forced anyway.
The sector size was not specified for ntfs.bin and it could not be obtained automatically. It has been set to 512 bytes.
The partition start sector was not specified for ntfs.bin and it could not be obtained automatically. It has been set to 0.
The number of sectors per track was not specified for ntfs.bin and it could not be obtained automatically. It has been set to 0.
The number of heads was not specified for ntfs.bin and it could not be obtained automatically. It has been set to 0.
Cluster size has been automatically set to 4096 bytes.
To boot from a device, Windows needs the 'partition start sector', the 'sectors per track' and the 'number of heads' to be set.
Windows will not be able to boot from this device.
Initializing device with zeroes: 100% - Done.
Creating NTFS volume structures.
mkntfs completed successfully. Have a nice day.
vboxuser@ubuntu64:~$ mkfs.minix ./minix.bin
6848 inodes
20480 blocks
Firstdatazone=220 (220)
Zonesize=1024
Maxsize=268966912
vboxuser@ubuntu64:~$

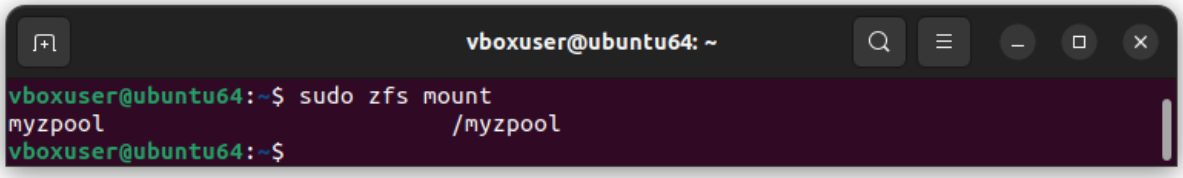

vboxuser@ubuntu64: ~
vboxuser@ubuntu64:~$ mkdir mount1
vboxuser@ubuntu64:~$ sudo mount ext4.bin mount1/
[sudo] password for vboxuser:
vboxuser@ubuntu64:~$ mkdir mount2
vboxuser@ubuntu64:~$ sudo mount ntfs.bin mount2/
vboxuser@ubuntu64:~$ mkdir mount3
vboxuser@ubuntu64:~$ sudo mount minix.bin mount3/
vboxuser@ubuntu64:~$


Disks
21 MB Loop Device
/dev/loop22
27 GB Hard Disk
VBOX HARDDISK
CD/DVD Drive
VBOX CD-ROM
21 MB Loop Device
~/ext4.bin
21 MB Loop Device
~/ntfs.bin
21 MB Loop Device
~/minix.bin
Size 21 MB (20 971 520 bytes)
Auto-clear
Backing File ~/minix.bin
Volumes
Filesystem
21 MB minix
Size 21 MB — 21 MB free (1,1% full)
Contents Unknown (minix 1) — Mounted at /home/vboxuser/mount3
Device /dev/loop22

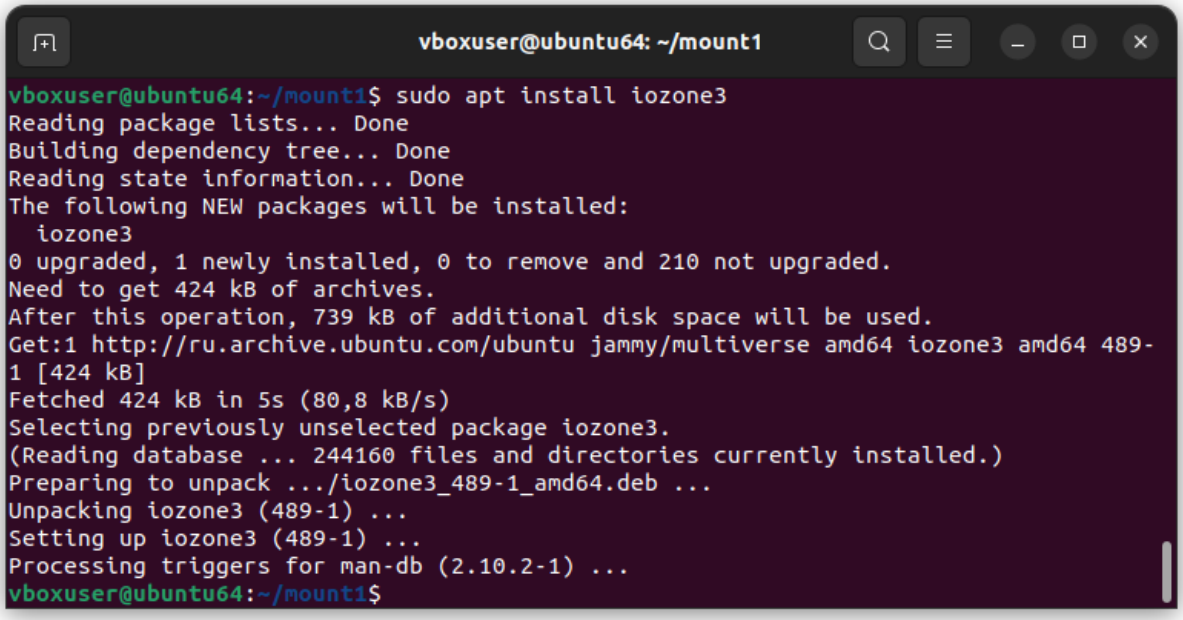
ZFS:


vboxuser@ubuntu64: ~
vboxuser@ubuntu64:~$ sudo apt install zfsutils-linux
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
libnvpair3linux libuutil3linux libzfs4linux libzpool5linux zfs-zed
Suggested packages:
nfs-kernel-server samba-common-bin zfs-initramfs | zfs-dracut
The following NEW packages will be installed:
libnvpair3linux libuutil3linux libzfs4linux libzpool5linux zfs-zed
zfsutils-linux
0 upgraded, 6 newly installed, 0 to remove and 210 not upgraded.
Need to get 2 256 kB of archives.
After this operation, 7 089 kB of additional disk space will be used.
Do you want to continue? [Y/n] Y

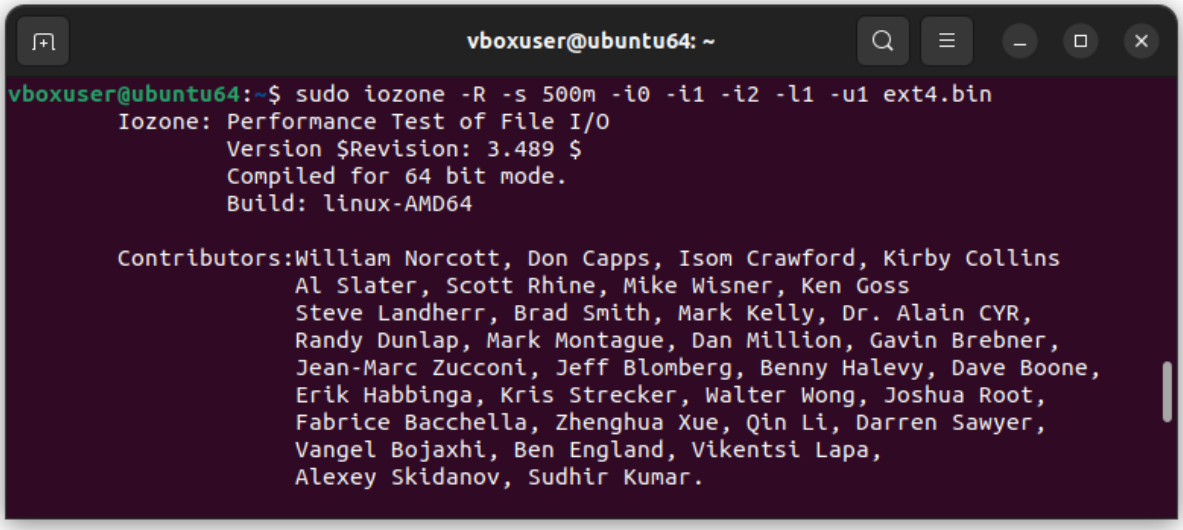

vboxuser@ubuntu64: ~
vboxuser@ubuntu64:~$ dd if=/dev/zero of=zfs.bin bs=1M count=64
64+0 records in
64+0 records out
67108864 bytes (67 MB, 64 MiB) copied, 0,525852 s, 128 MB/s
vboxuser@ubuntu64:~$ sudo modprobe zfs
vboxuser@ubuntu64:~$ sudo zpool create myzpool /home/vboxuser/zfs.bin
vboxuser@ubuntu64:~$ sudo zpool status myzpool
pool: myzpool
state: ONLINE
config:
NAME STATE READ WRITE CKSUM
myzpool ONLINE 0 0 0
/home/vboxuser/zfs.bin ONLINE 0 0 0
errors: No known data errors
vboxuser@ubuntu64:~$


vboxuser@ubuntu64: ~
vboxuser@ubuntu64:~$ sudo zfs mount
myzpool /myzpool
vboxuser@ubuntu64:~$

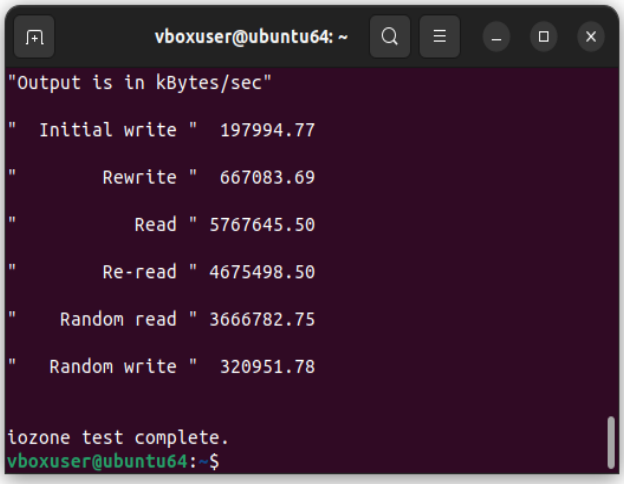
Тестирование:



sudo iozone -R -s 500m -i0 -i1 -i2 -l1 -u1



Ext4:



"Output is in kBytes/sec"

" Initial write " 197994.77

" Rewrite " 667083.69

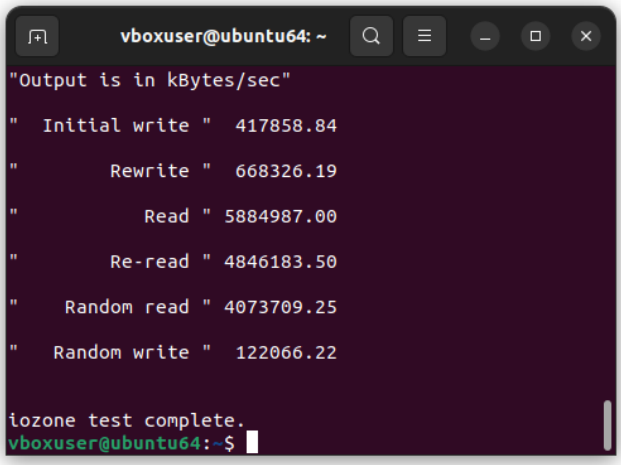
" Read " 5767645.50

" Re-read " 4675498.50

" Random read " 3666782.75

" Random write " 320951.78

NTFS:



"Output is in kBytes/sec"

" Initial write " 417858.84

" Rewrite " 668326.19

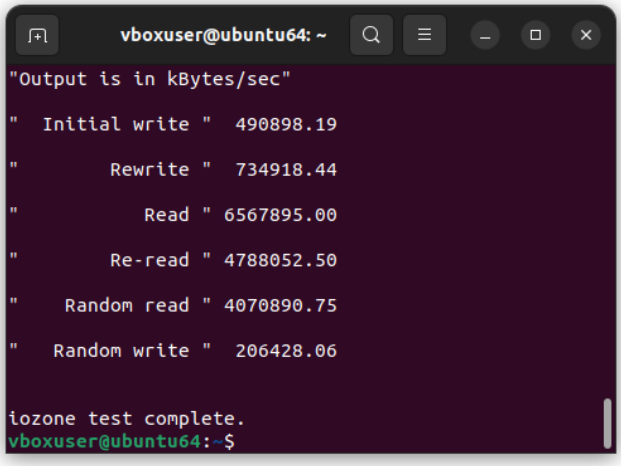
" Read " 5884987.00

" Re-read " 4846183.50

" Random read " 4073709.25

" Random write " 122066.22

Minix:



"Output is in kBytes/sec"

" Initial write " 490898.19

" Rewrite " 734918.44

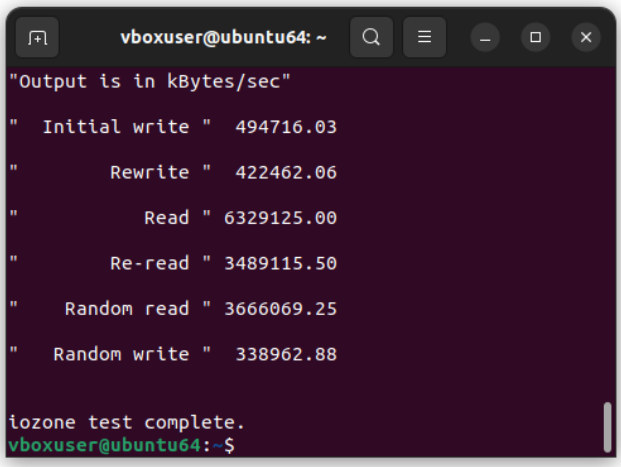
" Read " 6567895.00

" Re-read " 4788052.50

" Random read " 4070890.75

" Random write " 206428.06

ZFS



"Output is in kBytes/sec"

" Initial write " 494716.03

" Rewrite " 422462.06

" Read " 6329125.00

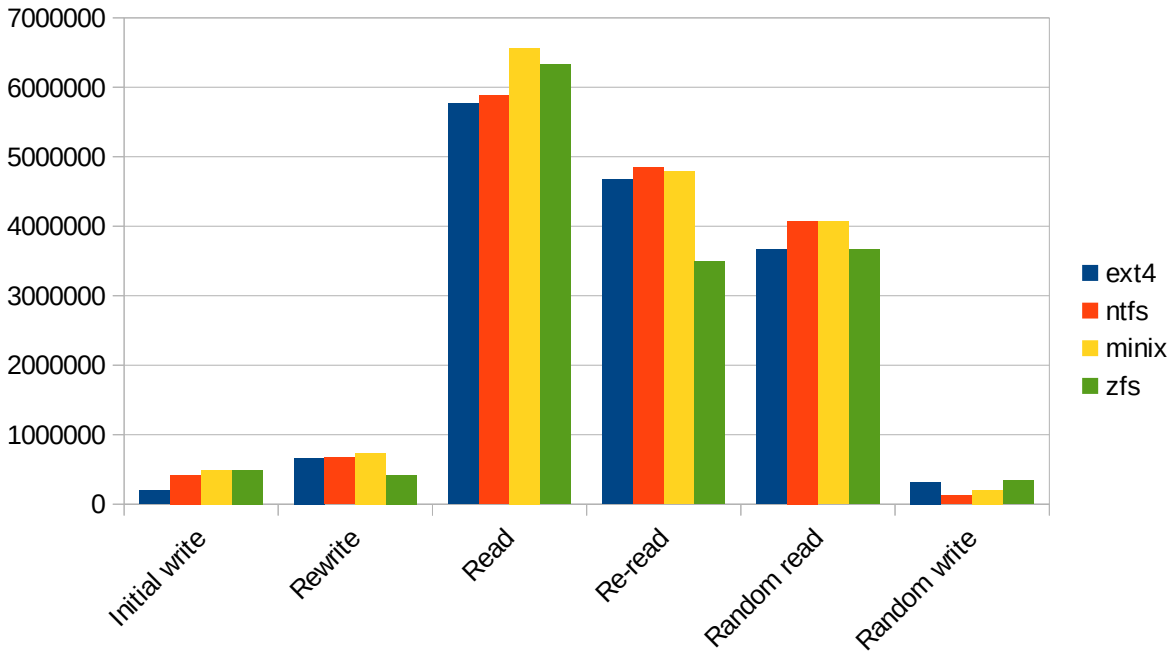
" Re-read " 3489115.50

" Random read " 3666069.25

" Random write " 338962.88

Сравнение:

Output is in kBytes/sec	ext4	ntfs	minix	zfs
Initial write	197994.77	417858.84	490898.19	494716.03
Rewrite	667083.69	668326.19	734918.44	422462.06
Read	5767645.5	5884987	6567895	6329125
Re-read	4675498.5	4846183.5	4788052.5	3489115.5
Random read	3666782.75	4073709.25	4070890.75	3666069.25
Random write	320951.78	122066.22	206428.06	338962.88
	15295956.99	16013131	16859082.94	14740450.72



Вывод:

Лучшей файловой системой по результатам iozone бренчмарка стала Minix, а хуже всего себя показала экзотическая ф.с. ZFS.