

(SSD):

-
- SSD
- SSD
- TRIM
 -
 - LVM
 - dm-crypt
- noatime
- SSD
 - TRIM (DRAT/DZAT)
 - TRIM
 - ATA- Secure Erase, Enhanced Erase
-



:

- Astra Linux Special Edition .10015-01 (1.7)
- Astra Linux Special Edition .10152-02 (4.7)
- Astra Linux Special Edition .10015-01 (1.6)
- Astra Linux Special Edition .10015-16 . 1 . 2
- Astra Linux Special Edition .10015-01 (1.5) ()
- Astra Linux Special Edition .10265-01 (8.1)
- Astra Linux Common Edition 2.12



, () , , , (), .

(SSD-) ,.. 2019- . , , , , , , .

, , SSD-, .

, Log- — SSD.

, :

- , TRIM;
- SSD, SSD-, , , , ;

SSD



SSD- FTL (Flash Translation Layer), , . SSD , . FTL , , , , , . , - . , , , SSD- .

- Ext{2,3,4} - . , .
- (Ext2) Ext3/Ext4.
, (TRIM) Ext4.



, Ext4 , Ext4 Astra Linux SE;

« () Ext2/Ext3/Ext4, (..) »
« , 1 » .10015-01 97 01-1, 2020., . 17.3.1 « »

- BTRFS - , Astra Linux Astra Linux Special Edition .10015-01 (1.5). SSD-, (, TRIM);, BTRFS , SSD, BTRFS SSD, (ssd, nossd, ssd_spread) , , BTRFS:



...
SSD , , .
...
, , , SSD .
...

Astra Linux SE BTRFS , Astra Linux.

- F2FS (Flash-Friendly File System) - , SSD-.
Astra Linux SE F2FS .
F2FS F2FS (Flash-Friendly File System).



Ext{3,4} ():

- , ;
- :

```
sudo  
fsck -f  
/dev  
/sdf1
```

- :

```
sudo  
tune2fs  
-0  
^has_jou  
rnal  
/dev  
/sdf1
```

- ;

SSD

FTL , .
SSD-, 75% , , FTL .
, SSD- , , 120 128 , 8 .

TRIM

 **TRIM** - ATA-, SSD-,
, TRIM (, SSD), TRIM SSD, , FTL , .

, TRIM hdparm (,):

```
sudo apt install hdparm  
sudo hdparm -I /dev/sdf | grep TRIM
```

 TRIM (,), offline (, TRIM).

Linux:

- TRIM Ext4, BTRFS, FAT, GFS2, JFS, XFS;
- offline TRIM Ext3, NILFS2, OCFS2.

TRIM NTFS Windows.

TRIM .

1. discard . TRIM , .. SSD- . , , . (TRIM).
2. fstrim.service/fstrim.timer

 Astra Linux Special Edition .10015-01 (1.5)

fstrim.service/fstrim.timer util-linux, .
, , . :

- a. Astra Linux Special Edition .10015-01 1.6 , /usr/share/doc/util-linux/examples/ /etc/systemd/system:

```
sudo cp /usr/share/doc/util-linux/examples/fstrim.service /etc  
/systemd/system  
sudo cp /usr/share/doc/util-linux/examples/fstrim.timer /etc  
/systemd/system
```

Astra Linux Special Edition x.7 ;

- b. :

```
sudo systemctl enable fstrim.timer
```

() , (-a..) TRIM , :

```
fstrim -av
```

3. fstrim cron

 Astra Linux Special Edition .10015-01 (1.5)

, /etc/crontab (fstrim -av 10):

 # m h dom mon dow user command
0 10 * * 1 root fstrim -av

LVM

```
TRIM LVM issue_discards 0 1 /etc/lvm/lvm.conf.  
TRIM 0 , ( , lvremove, lvreduce . ).  
( lvm.conf (5) / /etc/lvm/lvm.conf). , -, , «» TRIM ( ).
```

dm-crypt

TRIM dm-crypt discard /etc/crypttab, :

 # <target name> <source device> <key file> <options>
sda2_crypt /dev/sda2 none luks,discard

 TRIM dm-crypt , , .

noatime

SSD- **noatime**, .
, , , .

SSD

∴ [Astra Linux](#).

, SSD- FTL, .
"" (), .
,

 (Astra Linux Special Edition (**secdel secdelrnd**) SSD- , SSD-

 Astra Linux SE , (), (, , .) . , , .

. [ext4](#)

, , , , , , , , , , TRIM , , fstrim , () , ... TRIM .

TRIM (DRAT/DZAT)

, TRIM, Deterministic read data after TRIM (DRAT), (- Deterministic read zero after TRIM (DZAT)). , DRAT , , , SSD- , ,
"" , TRIM. , , , .

DRAT/DZAT hdparm:

```
$ sudo hdparm -I /dev/sdh | grep TRIM
* Data Set Management TRIM supported (limit 1 block)
* Deterministic read data after TRIM
```

TRIM

```
Linux- SSD- Ext4 TRIM , , .
.. Ext4 (, ).
, TRIM ( ,.. ) blkdiscard.
/dev/sdf1:
```

```
sudo blkdiscard /dev/sdf1
```

ATA- Secure Erase, Enhanced Erase

```
ATA- Secure erase/Enhanced erase, ATA (Secure erase) (Enhanced erase) .
, SSD- TRIM ( )..
, , .
```

```
i , hdparm -I :
i ....
supported: enhanced erase
120min for SECURITY ERASE UNIT. 120min for ENHANCED SECURITY ERASE UNIT.
...
.. , , , , .
```

```
, , , .
, USB-.
.
```

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[Critical Role of Firmware and FTL in SSD Design](#)