

: Astra Linux Directory

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- Astra Linux Special Edition .10015-01 (1.7), . 10015-10
- Astra Linux Special Edition .10015-17
- Astra Linux Special Edition .10015-37 (7.7)
- Astra Linux Special Edition .10015-03 (7.6)
- Astra Linux Special Edition .10152-02 (4.7)
- Astra Linux Special Edition .10015-01 (1.6)
- Astra Linux Special Edition .10015-16 . 1
- Astra Linux Special Edition .10015-16 . 2
- Astra Linux Special Edition .10265-01 (8.1)
- Astra Linux Common Edition 2.12

1.

, Astra Linux Directory (ALD):

- : SMARTCARD.ALD;
- :
 - Astra Linux Special Edition 1.6 [20190222SE16 \(2\)](#) ;
 - Astra Linux Directory (ALD) (. [Astra Linux Directory \(ALD\)](#));
 - : kdc;
- :
 - Astra Linux Special Edition 1.6 [20190222SE16 \(2\)](#) ;
 - : client;
- ;
- , ;
- (. [Astra Linux](#)).

2. Kerberos

- (ticket) – , , .
- (client) – (,), Kerberos.
- (key distribution center, KDC) – , Kerberos.
- (realm) – , Kerberos, KDC . realm , , .
- (principal) – , Kerberos. root[/instance]@REALM.

3.

Astra Linux:

1. - :
 - libccid;
 - pcscd;
 - libpcsclite1;
 - opensc;
 2. Kerberos -:
 - krb5-pkinit;
 - libpam-krb5.
- libengine-pkcs11-openssl1.1.

:

```
sudo apt install libccid pcscd libpcsclite1 pcsc-tools opensc krb5-pkinit  
libpam-krb5 libengine-pkcs11-openssl1.1
```

- , [librtpkcs11ecp.so](https://www.rutoken.ru/support/download/pkcs/), — <https://www.rutoken.ru/support/download/pkcs/>



: librtpkcs11ecp_2.0.2.0-1astra_e2k-8c.deb

:

```
sudo apt install ./librtpkcs11ecp_*.deb
```

"Download is performed unsandboxed"/" ", .

(-) (-) () OpenSSL. OpenSSL — SSL/TLS. RSA, DH, DSA, X.509, , CSR CRT.

:

1. (- CA). .:

```
sudo mkdir /etc/ssl/CA
```

2. :

```
cd /etc/ssl/CA
```

3. CA, . Common Name . : SMARTCARD.ALD:

```
sudo openssl genrsa -out cakey.pem 2048  
sudo openssl req -key cakey.pem -new -x509 -days 3650 -out cacert.pem
```

-days (- 3650). :

```
You are about to be asked to enter information that will be incorporated  
into your certificate request.  
What you are about to enter is what is called a Distinguished Name or a DN.  
There are quite a few fields but you can leave some blank  
For some fields there will be a default value,  
If you enter '.', the field will be left blank.  
-----
```

```
Country Name (2 letter code) [AU]:ru  
State or Province Name (full name) [Some-State]:Moscow  
Locality Name (eg, city) []:Astra Linux  
Organization Name (eg, company) [Internet Widgits Pty Ltd]:Astra Linux  
Organizational Unit Name (eg, section) []:Wiki  
Common Name (e.g. server FQDN or YOUR name) []:SMARTCARD.ALD
```

4. KDC, . Common Name kdc. :

```
sudo openssl genrsa -out kdckey.pem 2048  
sudo openssl req -new -out kdc.req -key kdckey.pem
```

5. . . , : :

```
export REALM=SMARTCARD.ALD
export CLIENT=kdc
```

, , :

```
env | grep -E "REALM|CLIENT"
```

6. pkinit_extensions : [pkinit_extensions](#). :

```
[ kdc_cert ]
basicConstraints=CA:FALSE

# Here are some examples of the usage of nsCertType. If it is omitted
keyUsage = nonRepudiation, digitalSignature, keyEncipherment, keyAgreement

#Pkinit EKU
extendedKeyUsage = 1.3.6.1.5.2.3.5

subjectKeyIdentifier=hash
authorityKeyIdentifier=keyid,issuer

# Copy subject details
issuerAltName=issuer:copy

# Add id-pkinit-san (pkinit subjectAlternativeName)
subjectAltName=otherName:1.3.6.1.5.2.2;SEQUENCE:kdc_princ_name

[kdc_princ_name]
realm = EXP:0, GeneralString:${ENV::REALM}
principal_name = EXP:1, SEQUENCE:kdc_principal_seq

[kdc_principal_seq]
name_type = EXP:0, INTEGER:1
name_string = EXP:1, SEQUENCE:kdc_principals

[kdc_principals]
princ1 = GeneralString:krbtgt
princ2 = GeneralString:${ENV::REALM}

[ client_cert ]

# These extensions are added when 'ca' signs a request.

basicConstraints=CA:FALSE

keyUsage = digitalSignature, keyEncipherment, keyAgreement

extendedKeyUsage = 1.3.6.1.5.2.3.4
subjectKeyIdentifier=hash
authorityKeyIdentifier=keyid,issuer

subjectAltName=otherName:1.3.6.1.5.2.2;SEQUENCE:princ_name

# Copy subject details
issuerAltName=issuer:copy

[princ_name]
realm = EXP:0, GeneralString:${ENV::REALM}
principal_name = EXP:1, SEQUENCE:principal_seq

[principal_seq]
name_type = EXP:0, INTEGER:1
name_string = EXP:1, SEQUENCE:principals

[principals]
princ1 = GeneralString:${ENV::CLIENT}
```

7. KDC:

```
sudo -E openssl x509 -req -in kdc.req -CAkey cakey.pem -CA cacert.pem -
out kdc.pem -extfile pkinit_extensions -extensions kdc_cert -
CAcreateserial -days 365
```

8. kdc.pem, kdckey.pem, cacert.pem /var/lib/krb5kdc/:

```
sudo cp kdc.pem kdckey.pem cacert.pem /var/lib/krb5kdc/
```

9. /etc/krb5kdc/kdc.conf, /etc/krb5kdc/kdc.conf, [kdcdefaults] :

```
pkinit_identity = FILE:/var/lib/krb5kdc/kdc.pem,/var/lib/krb5kdc/kdckey.pem
pkinit_anchors = FILE:/var/lib/krb5kdc/cacert.pem
```

10. :

```
sudo systemctl restart krb5-admin-server krb5-kdc
```

4. -.

, .

4.1.

:

1. librtpkcs11ecp.so:

```
find /usr/*(lib|lib64) -name librtpkcs11ecp.so
```

```
/usr/lib/librtpkcs11ecp.so.
```

2. , :

```
pkcs11-tool --module /usr/lib/librtpkcs11ecp.so -T
```

```
root@server:/home/u/KDC# pkcs11-tool --module /usr/lib/librtpkcs11ecp.so -T
Available slots:
Slot 0 (0x0): Aktiv Rutoken ECP 00 00
token label      : AstraLinux
token manufacturer : Aktiv Co.
token model      : Rutoken ECP
token flags      : login required, rng, SO PIN to be changed, token initialized, PIN initialized
hardware version : 20.4
firmware version : 18.0
serial num       : 2f996caf
pin min/max      : 4/32
```

4.2.





pkcs11-tool:

```
pkcs11-tool --slot 0 --init-token --so-pin 87654321 --label 'AstraLinux' --module /usr/lib/librtpkcs11ecp.so
```



```
--slot 0 —, . . . , 0, - 1,2 ..;
--init-token - ;
--so-pin 87654321 - PIN- . . 87654321;
--label 'AstraLinux' - ;
--module /usr/lib/librtpkcs11ecp.so — librtpkcs11ecp.so.
```

```
root@server:/home/u/KDC# pkcs11-tool --slot 0 --init-token --so-pin 87654321 --label 'AstraLinux' --module /usr/lib/librtpkcs11ecp.so
Token successfully initialized
root@server:/home/u/KDC# pkcs11-tool --module /usr/lib/librtpkcs11ecp.so -T
Available slots:
Slot 0 (0x0): Aktiv Rutoken ECP 00 00
token label      : AstraLinux
token manufacturer : Aktiv Co.
token model      : Rutoken ECP
token flags      : login required, rng, SO PIN to be changed, token initialized, PIN initialized
hardware version  : 20.4
firmware version  : 18.0
serial num       : 2f996caf
pin min/max      : 4/32
```

4.3. PIN-

PIN- :

```
pkcs11-tool --slot 0 --init-pin --so-pin '87654321' --login --pin '12345678' --module /usr/lib/librtpkcs11ecp.so
```



```
--init-pin - PIN-;
--login - ;
--pin 12345678 - PIN-;
```

4.4.

:

```
pkcs11-tool --slot 0 --login --pin 12345678 --keypairgen --key-type rsa:2048 --id 33 --label "2fa_test1_key" --module /usr/lib/librtpkcs11ecp.so
```



```
-keypairgen --key-type rsa:2048 —, RSA 2048;
--id 33 — CKA_ID . CKA_ID ;
--label "test1 key" — CKA_LABEL() . ;
```

4.5.

:

openssl

openssl :

```
OpenSSL> engine dynamic -pre SO_PATH:/usr/lib/x86_64-linux-gnu/engines-1.1/pkcs11.so -pre ID:pkcs11 -pre  
LIST_ADD:1 -pre LOAD -pre MODULE_PATH:/usr/lib/librtpkcs11ecp.so
```

```
(dynamic) Dynamic engine loading support  
[Success]: SO_PATH:/usr/lib/x86_64-linux-gnu/engines-1.1/pkcs11.so  
[Success]: ID:pkcs11  
[Success]: LIST_ADD:1  
[Success]: LOAD  
[Success]: MODULE_PATH:/usr/lib/librtpkcs11ecp.so  
Loaded: (pkcs11) pkcs11 engine
```

```
OpenSSL> req -engine pkcs11 -new -key 0:33 -keyform engine -out client.req
```

```
engine "pkcs11" set.  
Enter PKCS#11 token PIN for Rutoken ECP <AstraLinux>:  
You are about to be asked to enter information that will be incorporated  
into your certificate request.  
What you are about to enter is what is called a Distinguished Name or a DN.  
There are quite a few fields but you can leave some blank  
For some fields there will be a default value,  
If you enter '.', the field will be left blank.  
-----  
Country Name (2 letter code) [AU]:RU  
State or Province Name (full name) [Some-State]:Moscow  
Locality Name (eg, city) []:  
Organization Name (eg, company) [Internet Widgits Pty Ltd]: Rusbitech  
Organizational Unit Name (eg, section) []: Astra  
Common Name (e.g. server FQDN or YOUR name) []:test1 (!__!)  
Email Address []: (!__!)  
  
OpenSSL> exit
```



-new -key 0:33, 0 — , 33 — CKA_ID .

Common Name .

4.6.

, (/etc/ssl/CA).

:

```
export REALM=SMARTCARD.ALD  
export CLIENT=test1
```



SMARTCARD.ALD -
test1 -

, , :

```
env | grep -E "REALM|CLIENT"
```

:

```
sudo -E openssl x509 -CAkey cakey.pem -CA cacert.pem -req -in client.req -  
extensions client_cert -extfile pkinit_extensions -out client.pem -days 365
```

PEM DER:

```
sudo openssl x509 -in client.pem -out client.cer -inform PEM -outform DER
```

:

```
pkcs11-tool --slot 0 --login --pin 12345678 --write-object client.cer --  
type 'cert' --label 'test1' --id 33 --module /usr/lib/librtpkcs11ecp.so
```



```
--write-object ./client.cer—, — ;  
--type 'cert'—, — ;  
'cert' --label 'test1'— CKA_LABEL() . ;
```

5. .

1. /etc/krb5/;
2. /etc/krb5/ (cacert.pem) c .
3. Kerberos, /etc/krb5.conf [libdefaults] :

```
[libdefaults]  
default_realm = SMARTCARD.ALD  
pkinit_anchors = FILE:/etc/krb5/cacert.pem  
#  
pkinit_identities = PKCS11:/usr/lib/librtpkcs11ecp.so
```

4. :

```
$ kinit
```

PIN- . . , kerberos , :

```
klist
```

:

```
kdestroy
```



kinit :

```
env KRB5_TRACE=/dev/stdout kinit <_>
```

```
Astra Linux CE 2.12.14 (orel) orel12 tty2
Hint: Num Lock on

orel12 login: test1
AstraLinux PIN:

Astra Linux Directory is active with default domain '.smartcard.ald'.

Last login: Wed Jul 10 11:24:04 MSK 2019 on tty2
Creating directory '/ald_home/test1'...
Changing ownership for '/ald_home/test1' (2501:2501)...
Mounting CIFS user home '/ald_home/test1'...
Mounting CIFS user home '/ald_home/test1'...
Execute /etc/ald/ald.session
test1@orel12:~$
```

. Login , Password <PIN> . , , <PIN>:

```
login test1
```

5.1.

[pam_krb5.so](#) /etc/pam.d/common-auth [pam_krb5.so](#):

```
# here are the per-package modules (the "Primary" block)
auth      [success=4 default=ignore]      pam_krb5.so minimum_uid=2500 use_pkinit
auth      [success=1 default=ignore]      pam_succeed_if.so quiet user ingroup astra-admin
auth      [success=ignore default=die]    pam_tally.so per_user deny=8
auth      [success=1 default=ignore]      pam_unix.so nullok_secure try_first_pass
# here's the fallback if no module succeeds
```

– try_pkinit — PKCS-11, Kerberos ;
 – use_pkinit — PKCS-11, ;
 – pkinit_prompt — PKCS-11 .



pam-auth-update, pkinit .

, , /usr/share/pam-configs/krb5 Auth-Initial .

```
Name: Kerberos authentication
Default: yes
Priority: 704
Conflicts: krb5-openafs
Auth-Type: Primary
Auth:
    [success=end default=ignore]      pam_krb5.so minimum_uid=2500 try_first_pass
Auth-Initial:
    [success=end default=ignore]      pam_krb5.so minimum_uid=2500 use_pkinit
```

. man.

6.

- [Kerberos](#)
-
- [Kerberos V5 System Administrator's Guide](#)
- https://k5wiki.kerberos.org/wiki/Pkinit_configuration