

BASICS

Checking version

openssl version -a

How fast it runs on the system using four CPU cores and testing RSA algorithm

openssl speed -multi 4 rsa

Get basic help

openssl help

Generate 20 random bytes and show them on screen

openssl rand -hex 20

ENCODING / DECODING

Encoding a file using Base64

openssl base64 -in file.data

Encoding some text using Base64

echo -n "some text" | openssl base64

Base64 decode a file with output to another file

openssl base64 -d -in encoded.data -out decoded.data

WORKING WITH HASHES

List digest algorithms available

openssl list -digest-algorithms

Hash a file using SHA256

openssl dgst -sha256 file.data

Hash a file using SHA256 with its output in binary form (no output hex encoding)

No ASCII or encoded characters will be printed out to the console, just pure bytes. You can append ' | xxd'

openssl dgst -binary -sha256 file.data

Hash text using SHA3-512

echo -n "some text" | openssl dgst -sha3-512

Create HMAC - SHA384 of a file using a specific key in bytes

openssl dgst -SHA384 -mac HMAC -macopt hexkey:369bd7d655 file.data

Create HMAC - SHA512 of some text

echo -n "some text" | openssl dgst -mac HMAC -macopt hexkey:369bd7d655 -sha512

ASYMMETRIC ENCRYPTION

List elliptic curves available

openssl ecparam -list_curves

Create 4096 bits RSA public-private key pair

openssl genrsa -out pub_priv.key 4096

Display detailed private key information

openssl rsa -text -in pub_priv.key -noout

Encrypt public-private key pair using AES-256 algorithm

openssl rsa -in pub_priv.key -out encrypted.key -aes256

Remove keys file encryption and save them to another file

openssl rsa -in encrypted.key -out cleartext.key

Copy the public key of the public-private key pair file to another file

openssl rsa -in pub_priv.key -RSAPublicKey_out -out pubkey.key

Encrypt a file using RSA public key

openssl rsautl -encrypt -inkey pubkey.key -pubin -in cleartext.file -out ciphertext.file

Decrypt a file using RSA private key

openssl rsautl -decrypt -inkey pub_priv.key -in ciphertext.file -out decrypted.file

Create private key using the P-224 elliptic curve

openssl ecparam -name secp224k1 -genkey -out ecpriv.key

Encrypt private key using 3DES algorithm

openssl ec -in ecP384priv.key -des3 -out ecP384priv_enc.key

SYMMETRIC ENCRYPTION

List all supported symmetric encryption ciphers

openssl enc -list

Encrypt a file using an ASCII encoded password provided and AES-128-ECB algorithm

openssl enc -aes-128-ecb -in cleartext.file -out ciphertext.file -pass pass:thisisthepassword

Encrypt a file using a specific encryption key (K) provided as hex digits

openssl enc -aes-128-ecb -in cleartext.file -out ciphertext.file -K 1881807b2d1b3d22f14e9ec52563d981 -nosalt



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SYMMETRIC ENCRYPTION (cont)

Encrypt a file using ARIA 256 in CBC block cipher mode using a specified encryption key (K:256 bits) and initialization vector (iv:128 bits)

```
openssl enc -aria-256-cbc -in cleartext.file -out ciphertxt.file -K
f92d2e986b7a2a01683b4c40d0cbcf6feaa669ef2bb5ec3a25ce85d9548291c1
-iv 470bc29762496046882b61ecee68e07c -nosalt
```

Encrypt a file using Camellia 192 algorithm in COUNTER block cipher mode with key and iv provided

```
openssl enc -camellia-192-ctr -in cleartext.file -out ciphertxt.file -K
6c7a1b3487d28d3bf444186d7c529b48d67dd6206c7a1b34 -iv
470bc29762496046882b61ecee68e07c
```

DIGITAL SIGNATURES

Generate DSA parameters for the private key. 2048 bits length

```
openssl dsaparam -out dsaparam.pem 2048
```

Generate DSA public-private key for signing documents and protect it using AES128 algorithm

```
openssl gendsa -out dsaprivatekey.pem -aes-128-cbc dsaparam.pem
```

Copy the public key of the DSA public-private key file to another file

```
openssl dsa -in dsaprivatekey.pem -pubout -out dsapublickey.pem
```

To print out the contents of a DSA key pair file

```
openssl dsa -in dsaprivatekey.pem -text -noout
```

Signing the sha-256 hash of a file using RSA private key

```
openssl dgst -sha256 -sign rsakey.key -out signature.data document.pdf
```

Signing the sha3-512 hash of a file using DSA private key

```
openssl pkeyutl -sign -pkeyopt digest:sha3-512 -in document.docx -inkey
dsaprivatekey.pem -out signature.data
```

Verify DSA signature

```
openssl pkeyutl -verify -sigfile dsasignature.data -inkey dsakey.pem -in
document.docx
```

Create a private key using P-384 Elliptic Curve

```
openssl ecparam -name secp384r1 -genkey -out ecP384priv.key
```

Encrypt private key using 3DES algorithm

```
openssl ec -in ecP384priv.key -des3 -out ecP384priv_enc.key
```

DIGITAL SIGNATURES (cont)

Sign a PDF file using Elliptic Curves with the generated key

```
openssl pkeyutl -sign -inkey ecP384priv_enc.key -
pkeyopt digest:sha3-512 -in document.pdf -out
signature.data
```

Verify the file's signature. If it's ok you must receive "Signature Verified Successfully"

```
openssl pkeyutl -verify -in document.pdf -sigfile
signature.data -inkey ecP384priv_enc.key
```

DIGITAL CERTIFICATES

Generating a CSR file and a 4096 bits RSA key pair

```
openssl req -newkey rsa:4096 -keyout private.key -out
request.csr
```

Display Certificate Signing Request (CSR) content

```
openssl req -text -noout -in request.csr
```

Display the public key contained in the CSR file

```
openssl req -pubkey -noout -in request.csr
```

Creating a Certificate Signing Request (CSR) using an existing private key. *This can be useful when you need to renew the public digital certificate without changing the private key.*

```
openssl req -new -key private.key -out request.csr
```

Create EC P384 curve parameters file to generate a CSR using Elliptic Curves in the next step.

```
openssl genpkey -genparam -algorithm EC -out
EC_params.pem -pkeyopt
ec_paramgen_curve:secp384r1 -pkeyopt
ec_param_enc:named_curve
```

Create a CSR file using Elliptic Curve P384 parameters file created in the previous step. *Instead of using RSA keys.*

```
openssl req -newkey ec:EC_params.pem -keyout
EC_P384_priv.key -out EC_request.csr
```

Create a self-signed certificate, a new 2048 bits RSA key pair with one year of validity

```
openssl req -newkey rsa:2048 -nodes -keyout priv.key
-x509 -days 365 -out cert.crt
```



DIGITAL CERTIFICATES (cont)

Create and sign a new certificate using the CSR file and the private key for signing (you must have a openssl.cnf file prepared)

```
openssl ca -in request.csr -out certificate.crt -config
./CA/config/openssl.cnf
```

Display PEM format certificate information

```
openssl x509 -text -noout -in cert.crt
```

Display certificate information in Abstract Syntax Notation One (ASN.1)

```
openssl asn1parse -in cert.crt
```

Extract the certificate's public key

```
openssl x509 -pubkey -noout -in cert.crt
```

Extract the public key's modulus in the certificate

```
openssl x509 -modulus -noout -in cert.crt
```

Convert a certificate from PEM to DER format

```
openssl x509 -inform PEM -outform DER -in cert.crt -out cert.der
```

Checking whether the certificate public key matches a private key and request file. One step per file. Must match in the output hashes.

```
openssl x509 -modulus -in certificate.crt -noout | openssl dgst -
sha256
```

```
openssl rsa -modulus -in private.key -noout | openssl dgst -
sha256
```

```
openssl req -modulus -in request.csr -noout | openssl dgst -
sha256
```

WORKING WITH TLS PROTOCOL

List all cipher suites supported

```
openssl ciphers -V 'ALL'
```

List all cipher suites supported with AES

```
openssl ciphers -V 'AES'
```

List all cipher suites supporting CAMELLIA & SHA256 algorithms.

```
openssl ciphers -V 'CAMELLIA+SHA256'
```

TLS connection to a server using port 443 (HTTPS)

```
openssl s_client -connect domain.com:443
```

TLS connection to a server using v1.2

```
openssl s_client -tls1_2 -connect domain.com:443
```

WORKING WITH TLS PROTOCOL (cont)

TLS connection & disable v1.0

```
openssl s_client -no_tls1 domain.com:443
```

TLS connection using a specific cipher suite

```
openssl s_client -cipher DHE-RSA-AES256-GCM-SHA384
domain.com:443
```

TLS connection displaying all certificates provided by server

```
openssl s_client -showcerts domain.com:443
```

Setting up a listening port to receive TLS connections using a certificate, the private key & supporting only TLS 1.2

```
openssl s_server -port 443 -cert cert.crt -key priv.key -tls1_2
```

PERSONAL SECURITY ENVIRONMENTS (PSE)

Convert a certificate from PEM (base64) to DER (binary) format

```
openssl x509 -in certificate.pem -outform DER -out certificate.d-
er
```

Insert certificate & private key into PKCS #12 format file. These files can be imported in windows certificate manager or to a Java Key Store (jks) file

```
openssl pkcs12 -export -out cert_key.p12 -inkey private.key -in
certificate.crt
```

To show the contents of a PKCS #12 file

```
openssl pkcs12 -in cert_key.p12
```

Convert the .p12 file into a Java Key Store. *This command uses java keytool instead of openssl.*

```
keytool -importkeystore -destkeystore javakeystore.jks -
srckeystore cert_key.p12 -srcstoretype pkcs12
```

Convert PEM certificate to PKCS #7 format

```
openssl crl2pkcs7 -nocrl -certfile certificate.crt -out cert.p7b
```

Convert a PKCS #7 file from PEM to DER

```
openssl pkcs7 -in cert.p7b -outform DER -out p7.der
```



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SIMPLE CA CONFIGURATION FILE (openssl.cnf)

```
[ ca ]
default_ca = CA_default

[ CA_default ]
dir = ./personalCA
database = $dir/index.txt
new_certs_dir = $dir/newcerts

certificate = $dir/cacert.pem
serial = $dir/serial
rand_serial = yes
private_key = $dir/private/cakey.pem
RANDFILE = $dir/private/.rand

default_days = 365
default_crl_days= 30
default_md = SHA256

policy = policy_any
email_in_dn = no

name_opt = ca_default
cert_opt = ca_default
copy_extensions = none

[ policy_any ]
countryName = supplied
stateOrProvinceName = optional
organizationName = optional
organizationalUnitName = optional
commonName = supplied
emailAddress = optional
```

FINAL NOTES

- All commands were tested using OpenSSL version 1.1.1g.
- The default format for almost all operations in openssl is PEM, however you can always specify a DER format using arguments or export to other formats with appropriate commands.



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