openssl生成证书链多级证书

操作系统CentOS6.6

注：windows版本的Openssl无法做这个实验，由于所有编译的window版本openssl没有对openssl目录重新定向，导致在windows下找不到pki目录

初始化

```
rm -rf /etc/pki/CA/*.old
touch /etc/pki/CA/index.txt
echo 01 > /etc/pki/CA/serial
echo 02 > /etc/pki/CA/serial
rm -rf keys
mkdir keys
```

生成根CA并自签(Common Name填RootCA)

```
openssl genrsa -des3 -out keys/RootCA.key 2048
openssl req -new -x509 -days 3650 -key keys/RootCA.key -out keys/RootCA.crt
```

生成二级CA(Common Name填secondCA)

```
openssl genrsa -des3 -out keys/secondCA.key 2048
openssl rsa -in keys/secondCA.key -out keys/secondCA.key
openssl req -new -days 3650 -key keys/secondCA.key -out keys/secondCA.csr
openssl ca -extensions v3_ca -in keys/secondCA.csr -config /etc/pki/tls/openssl.cnf -days 3650 -
out keys/secondCA.crt -cert keys/RootCA.crt -keyfile keys/RootCA.key
```

生成三级CA(Common Name填thirdCA)

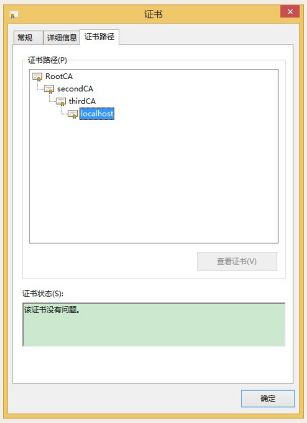
```
openssl genrsa -des3 -out keys/thirdCA.key 2048
openssl rsa -in keys/thirdCA.key -out keys/thirdCA.key
openssl req -new -days 3650 -key keys/thirdCA.key -out keys/thirdCA.csr
openssl ca -extensions v3_ca -in keys/thirdCA.csr -config /etc/pki/tls/openssl.cnf -days 3650 -o
ut keys/thirdCA.crt -cert keys/secondCA.crt -keyfile keys/secondCA.key
```

使用三级CA签发服务器证书

```
openssl genrsa -des3 -out keys/server.key 2048
openssl rsa -in keys/server.key -out keys/server.key
openssl req -new -days 3650 -key keys/server.key -out keys/server.csr
openssl ca -in keys/server.csr -config /etc/pki/tls/openssl.cnf -days 3650 -out keys/server.crt
-cert keys/thirdCA.crt -keyfile keys/thirdCA.key
```

最后将RootCA导入受信任的根证书颁发机构，其他两个证书导入中级CA机构，服务器证书根据需要导入

结果如下：



证书状态(S):

该证书没有问题。

笔者生成的证书下载：http://download.csdn.net/detail/gsls200808/8697635

报错情况记录

```
The mandatory stateOrProvinceName field was missing
```

原因openssl.cnf中CA policy有三个match，必须要填一样的，或者改成optional

```
# For the CA policy
[ policy_match ]
countryName             = match
stateOrProvinceName     = match
organizationName        = match
organizationalUnitName  = optional
commonName              = supplied
emailAddress            = optional
```

解决方法：

分别填CN、LiaoNing、ORG

清空文件再次生成证书报错

```
ERROR:Serial number 01 has already been issued,
      check the database/serial_file for corruption
```

官方承认这是个bug

解决方法：/etc/pki/CA/serial这个文件实际上清空还是会记录生成证书的次数，所以把它改成比较大的数

报错

```
failed to update database
TXT_DB error number 2
```

这个也是bug，三个方法

产生的原因是:
This thing happens when certificates share common data. You cannot have two certificates that look otherwise the same.
方法一:
修改demoCA下 index.txt.attr
将unique_subject = yes改为unique_subject = no
方法二:
删除demoCA下的index.txt,并再touch下rm index.txt touch index.txt
方法三:
将 common name设置成不同的

openssl官方在2014年6月修复了这个已经存在十年的问题
http://rt.openssl.org/Ticket/Display.html?id=502&user=guest&pass=guest

补充：

CentOS6.6完整的openssl.cnf配置文件

```
#
# OpenSSL example configuration file.
# This is mostly being used for generation of certificate requests.
#

# This definition stops the following lines choking if HOME isn't
# defined.
HOME            = .
RANDFILE        = $ENV::HOME/.rnd

# Extra OBJECT IDENTIFIER info:
#oid_file        = $ENV::HOME/.oid
oid_section        = new_oids

# To use this configuration file with the "-extfile" option of the
# "openssl x509" utility, name here the section containing the
# X.509v3 extensions to use:
# extensions        =
# (Alternatively, use a configuration file that has only
# X.509v3 extensions in its main [= default] section.)

[ new_oids ]

# We can add new OIDs in here for use by 'ca', 'req' and 'ts'.
# Add a simple OID like this:
```

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1. Re:关闭win10自动更新
f
--高山流水200808
2. Re:在win8.1上搭建OpenVPN服务器三（证书分配和配置文件篇）
可以提个问题吗？ 我也共享了本地连接给 本地连接2 了 ，可是虚拟出来的VPN 那个网卡还是 没有Intel 链接。 好郁闷啊
--wzboyer
3. Re:对12306新验证码的简单破解
我擦，这是自动识别啊
--世界杯2009

```
# testoid1=1.2.3.4
# Or use config file substitution like this:
# testoid2=${testoid1}.5.6

# Policies used by the TSA examples.
tsa_policy1 = 1.2.3.4.1
tsa_policy2 = 1.2.3.4.5.6
tsa_policy3 = 1.2.3.4.5.7

####################################################################
[ ca ]
default_ca    = CA_default        # The default ca section

####################################################################
[ CA_default ]

dir        = /etc/pki/CA        # Where everything is kept
certs        = $dir/certs        # Where the issued certs are kept
crl_dir        = $dir/crl        # Where the issued crl are kept
database    = $dir/index.txt    # database index file.
#unique_subject    = no            # Set to 'no' to allow creation of
                    # several ctificates with same subject.
new_certs_dir    = $dir/newcerts        # default place for new certs.

certificate    = $dir/cacert.pem     # The CA certificate
serial        = $dir/serial         # The current serial number
crlnumber    = $dir/crlnumber    # the current crl number
                    # must be commented out to leave a V1 CRL
crl        = $dir/crl.pem         # The current CRL
private_key    = $dir/private/cakey.pem# The private key
RANDFILE    = $dir/private/.rand    # private random number file

x509_extensions    = usr_cert        # The extentions to add to the cert

# Comment out the following two lines for the "traditional"
# (and highly broken) format.
name_opt     = ca_default        # Subject Name options
cert_opt     = ca_default        # Certificate field options

# Extension copying option: use with caution.
# copy_extensions = copy

# Extensions to add to a CRL. Note: Netscape communicator chokes on V2 CRLs
# so this is commented out by default to leave a V1 CRL.
# crlnumber must also be commented out to leave a V1 CRL.
# crl_extensions    = crl_ext

default_days    = 365            # how long to certify for
default_crl_days= 30            # how long before next CRL
default_md    = default        # use public key default MD
preserve    = no            # keep passed DN ordering

# A few difference way of specifying how similar the request should look
# For type CA, the listed attributes must be the same, and the optional
# and supplied fields are just that :-)
policy        = policy_match

# For the CA policy
[ policy_match ]
countryName        = match
stateOrProvinceName    = match
organizationName    = match
organizationalUnitName    = optional
commonName        = supplied
emailAddress        = optional

# For the 'anything' policy
# At this point in time, you must list all acceptable 'object'
# types.
[ policy_anything ]
countryName        = optional
stateOrProvinceName    = optional
localityName        = optional
organizationName    = optional
organizationalUnitName    = optional
commonName        = supplied
emailAddress        = optional

####################################################################
[ req ]
default_bits        = 2048
default_md        = sha1
default_keyfile     = privkey.pem
distinguished_name    = req_distinguished_name
attributes        = req_attributes
x509_extensions    = v3_ca    # The extentions to add to the self signed cert

# Passwords for private keys if not present they will be prompted for
# input_password = secret
# output_password = secret

# This sets a mask for permitted string types. There are several options.
# default: PrintableString, T61String, BMPString.
# pkix     : PrintableString, BMPString (PKIX recommendation before 2004)
# utf8only: only UTF8Strings (PKIX recommendation after 2004).
# nombstr : PrintableString, T61String (no BMPStrings or UTF8Strings).
# MASK:XXXX a literal mask value.
# WARNING: ancient versions of Netscape crash on BMPStrings or UTF8Strings.
string_mask = utf8only

# req_extensions = v3_req # The extensions to add to a certificate request

[ req_distinguished_name ]
countryName            = Country Name (2 letter code)
countryName_default        = XX
countryName_min            = 2
countryName_max            = 2

stateOrProvinceName        = State or Province Name (full name)
#stateOrProvinceName_default    = Default Province

localityName            = Locality Name (eg, city)
localityName_default    = Default City

0.organizationName        = Organization Name (eg, company)
0.organizationName_default    = Default Company Ltd

# we can do this but it is not needed normally :-)
#1.organizationName        = Second Organization Name (eg, company)
#1.organizationName_default    = World Wide Web Pty Ltd

organizationalUnitName        = Organizational Unit Name (eg, section)
#organizationalUnitName_default    =

commonName            = Common Name (eg, your name or your server\'s hostname)
commonName_max            = 64

emailAddress            = Email Address
emailAddress_max        = 64

# SET-ex3            = SET extension number 3

[ req_attributes ]
challengePassword        = A challenge password
challengePassword_min        = 4
challengePassword_max        = 20

unstructuredName        = An optional company name

[ usr_cert ]

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

# This goes against PKIX guidelines but some CAs do it and some software
# requires this to avoid interpreting an end user certificate as a CA.

basicConstraints=CA:FALSE

# Here are some examples of the usage of nsCertType. If it is omitted
# the certificate can be used for anything *except* object signing.

# This is OK for an SSL server.
# nsCertType            = server

# For an object signing certificate this would be used.
# nsCertType = objsign

# For normal client use this is typical
# nsCertType = client, email

# and for everything including object signing:
# nsCertType = client, email, objsign

# This is typical in keyUsage for a client certificate.
# keyUsage = nonRepudiation, digitalSignature, keyEncipherment

# This will be displayed in Netscape's comment listbox.
nsComment            = "OpenSSL Generated Certificate"

# PKIX recommendations harmless if included in all certificates.
subjectKeyIdentifier=hash
authorityKeyIdentifier=keyid,issuer

# This stuff is for subjectAltName and issuerAltname.
# Import the email address.
# subjectAltName=email:copy
# An alternative to produce certificates that aren't
# deprecated according to PKIX.
# subjectAltName=email:move

# Copy subject details
# issuerAltName=issuer:copy

#nsCaRevocationUrl        = http://www.domain.dom/ca-crl.pem
#nsBaseUrl
#nsRevocationUrl
#nsRenewalUrl
#nsCaPolicyUrl
#nsSslServerName
```

```
# This is required for TSA certificates.
# extendedKeyUsage = critical,timeStamping

[ v3_req ]

# Extensions to add to a certificate request

basicConstraints = CA:FALSE
keyUsage = nonRepudiation, digitalSignature, keyEncipherment

[ v3_ca ]


# Extensions for a typical CA


# PKIX recommendation.

subjectKeyIdentifier=hash

authorityKeyIdentifier=keyid:always,issuer

# This is what PKIX recommends but some broken software chokes on critical
# extensions.
#basicConstraints = critical,CA:true
# So we do this instead.
basicConstraints = CA:true

# Key usage: this is typical for a CA certificate. However since it will
# prevent it being used as an test self-signed certificate it is best
# left out by default.
# keyUsage = cRLSign, keyCertSign

# Some might want this also
# nsCertType = sslCA, emailCA

# Include email address in subject alt name: another PKIX recommendation
# subjectAltName=email:copy
# Copy issuer details
# issuerAltName=issuer:copy

# DER hex encoding of an extension: beware experts only!
# obj=DER:02:03
# Where 'obj' is a standard or added object
# You can even override a supported extension:
# basicConstraints= critical, DER:30:03:01:01:FF

[ crl_ext ]

# CRL extensions.
# Only issuerAltName and authorityKeyIdentifier make any sense in a CRL.

# issuerAltName=issuer:copy
authorityKeyIdentifier=keyid:always

[ proxy_cert_ext ]
# These extensions should be added when creating a proxy certificate

# This goes against PKIX guidelines but some CAs do it and some software
# requires this to avoid interpreting an end user certificate as a CA.

basicConstraints=CA:FALSE

# Here are some examples of the usage of nsCertType. If it is omitted
# the certificate can be used for anything *except* object signing.

# This is OK for an SSL server.
# nsCertType            = server

# For an object signing certificate this would be used.
# nsCertType = objsign

# For normal client use this is typical
# nsCertType = client, email

# and for everything including object signing:
# nsCertType = client, email, objsign

# This is typical in keyUsage for a client certificate.
# keyUsage = nonRepudiation, digitalSignature, keyEncipherment

# This will be displayed in Netscape's comment listbox.
nsComment            = "OpenSSL Generated Certificate"

# PKIX recommendations harmless if included in all certificates.
subjectKeyIdentifier=hash
authorityKeyIdentifier=keyid,issuer

# This stuff is for subjectAltName and issuerAltname.
# Import the email address.
# subjectAltName=email:copy
# An alternative to produce certificates that aren't
# deprecated according to PKIX.
# subjectAltName=email:move

# Copy subject details
# issuerAltName=issuer:copy

#nsCaRevocationUrl        = http://www.domain.dom/ca-crl.pem
#nsBaseUrl
#nsRevocationUrl
#nsRenewalUrl
#nsCaPolicyUrl
#nsSslServerName

# This really needs to be in place for it to be a proxy certificate.
proxyCertInfo=critical,language:id-ppl-anyLanguage,pathlen:3,policy:foo

####################################################################
[ tsa ]

default_tsa = tsa_config1    # the default TSA section

[ tsa_config1 ]

# These are used by the TSA reply generation only.
dir        = ./demoCA        # TSA root directory
serial        = $dir/tsaserial    # The current serial number (mandatory)
crypto_device    = builtin        # OpenSSL engine to use for signing
signer_cert    = $dir/tsacert.pem     # The TSA signing certificate
                    # (optional)
certs        = $dir/cacert.pem    # Certificate chain to include in reply
                    # (optional)
signer_key    = $dir/private/tsakey.pem # The TSA private key (optional)

default_policy    = tsa_policy1        # Policy if request did not specify it
                    # (optional)
other_policies    = tsa_policy2, tsa_policy3    # acceptable policies (optional)
digests        = md5, sha1        # Acceptable message digests (mandatory)
accuracy    = secs:1, millisecs:500, microsecs:100    # (optional)
clock_precision_digits  = 0    # number of digits after dot. (optional)
ordering        = yes    # Is ordering defined for timestamps?
                # (optional, default: no)
tsa_name        = yes    # Must the TSA name be included in the reply?
                # (optional, default: no)
ess_cert_id_chain    = no    # Must the ESS cert id chain be included?
                # (optional, default: no)
```

标签: openssl, 证书链, 多级CA

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