Company Confidential

PKI Hands-On 2.0.0

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Contents

1 Introduction

1.1 Glossary

SCEP - SCEP (Simple Certificate Enrollment Protocol) enables automated certificate management by allowing devices to securely request and retrieve certificates from a CA using HTTP-based communication.

Quantum-Safe OpenSSL Provider - oqsprovider is an open source OpenSSL provider developed as part of the Open Quantum Safe project.It integrates post quantum cryptographic algorithms into OpenSSL 3.x, enabling applications to generate and use quantum safe keys and operations seamlessly. This provider offers implementations of various

MQTTs Broker - An MQTTs broker is a server that routes messages between clients using a publish/subscribe model and TLS Certificate authentication and encapsulation method.

EST Enrollment method - EST enrollment technology automates certificate issuance by allowing devices to submit CSRs and receive signed certificates over secure channels.

CRL - (Certificate Revocation List) is a mechanism for maintaining and distributing a list of digital certificates that have been revoked by a Certificate Authority, ensuring that clients can verify certificate validity.

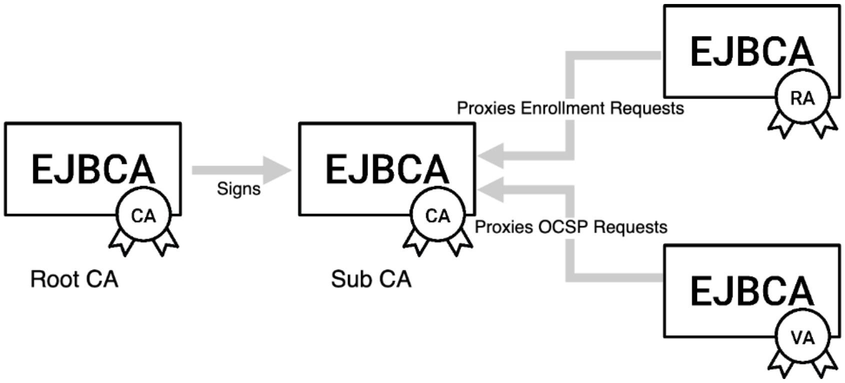
Certificate Revoking - Certificate revoking is the process of invalidating a digital certificate before its expiration, ensuring it can no longer be trusted.

OCSP - A real-time certificate status checking protocol that allows clients to verify whether a digital certificate has been revoked, without downloading the full CRL. OCSP improves performance and bandwidth usage compared to traditional revocation lists.

1.2 PKI Concept

Certification Authority (CA) part of Public Key Infrastructure (PKI) according to standards such as X.509 and IETF-PKIX

PKI Architecture



From : https://docs.keyfactor.com/ejbca/9.0/ejbca-concepts

Root CA

A RootCA has a self-signed certificate and is also called Trusted Root. Verification of other certificates in the PKI ends with the RootCAs self-signed certificate. Since the RootCAs certificate is self-signed it must somehow be configured as a trusted root for all clients in the PKI.

Sub CA

A subordinate CA, or SubCA for short, is a CA whose certificate is signed by another CA, which can be another SubCA or a RootCA. Since the SubCAs certificate is signed by another CA, it does not have to be configured as a trusted root. It is part of a certificate chain that ends in the RootCA.

Registration Authority (RA)

A Registration Authority (RA) is an administrative function that registers entities in the PKI. The RA is trusted to identify and authenticate entities according to the CAs policy. There can be one or more RAs connected to each CA in the PKI.

Validation Authority (VA)

A Validation Authority (VA) is responsible for providing information on whether a certificate is currently valid or not. The VA does not issue or revoke certificates, but it validates certificates by providing a list of revoked certificates for a CA, known as a Certificate Revocation List (CRL). Another method that the VA can support is the Online Certificate Status Protocol (OCSP). It is a real-time lookup of a certificate status, compared to the CRL which is generated on a set schedule. The VA can respond to OCSP requests and reply if a certificate is good, revoked, or unknown. There can be one or more VAs connected to each CA in the PKI.

1.3 Overview

This certificate management system offers an intuitive UI and endpoints to submit CSRs and manage certificates—allowing users to view, download, revoke, and delete them. It also provides access to CA chains, CRLs, and certificate statuses, while supporting advanced protocols like SCEP, EST, and OCSP for comprehensive lifecycle management.

Features

The platform supports the following features either UI or API methods

Note all https commands are Server-only TLS unless stated mTLS (Mutual TLS) for Both server and client authenticate with certificates. (default mTLS port 4443)

CA General	Download CA Chain	curl -k https://pikachu-ca.iot-rad.com/downloads/chain	Returns full CA chain file
	Download CRL	curl -k https://pikachu-ca.iot-rad.com/downloads/crl	Generates and downloads latest Certificate Revocation List
	Certificate Status	curl -k https://pikachu-ca.iot-rad.com/status/0xc75f573d9cb2b581	Returns status as valid, revoked, or not found in JSON
	Expired Certificates	curl -k https://pikachu-ca.iot-rad.com/expired	Returns list of certificate IDs that are expired
	Download CSR	curl -k https://pikachu-ca.iot-rad.com/requests/1/download	Serves saved CSR if available
SCEP	SCEP CRL	sscep getcrl -d -u http://pikachu-ca.iot-rad.com/scep -c ca_rsa.crt -w crl.pem -l local.crt -k local.key	
	SCEP Enrolment	sscep enroll -d -v -u http://pikachu-ca.iot-rad.com/scep -c rad_ca_sub_rsa.crt -k client1.key -r client1.csr -l client1.crt	

	SCEP CA Certs	sscep getcap -d -u http://pikachu-ca.iot-rad.com/scep -c cap.pem	
EST	EST Enrollment	curl -k -X POST --data-binary @etx.csr.der https://openxpki.iot-rad.com/.well-known/est/simpleenroll -H "Content-Type: application/pkcs10" --output etx.crt.p7 estclient -server openxpki.iot-rad.com -insecure -cacerts ca-bundle.pem -key device.key -csr device.csr -out device.crt enroll	Accepts DER CSR and returns signed certificate in PKCS#7
	EST CA Certs	curl -k https://pikachu-ca.iot-rad.com/.well-known/est/cacerts --output chain.crt estclient -server openxpki.iot-rad.com -insecure cacerts -out ca-bundle.pem	Returns CA chain in PKCS#7 format
EST mTLS	EST Enrollment	curl --cert https.crt --key https.key -X POST --data-binary @etx.csr.der https://openxpki.iot-rad.com:4443/.well-known/est/simpleenroll -H "Content-Type: application/pkcs10" --output etx.crt.p7 estclient -server openxpki.iot-rad.com -cert https.crt -key https.key -cacerts ca-bundle.pem -key device.key -csr device.csr -out device.crt enroll	Config.ini trusted_port variable 4443
	EST CA Certs	curl --cert https.crt --key https.key https://pikachu-ca.iot-rad.com:4443/.well-known/est/cacerts --output chain.crt estclient -server openxpki.iot-rad.com -cert https.crt -key https.key cacerts -out ca-bundle.pem	Config.ini trusted_port variable 4443
OCSP	OCSP Responder	openssl ocsp -reqout ocsp_request.der -issuer rad_ca_sub.crt -cert valid.crt -url http://pikachu-ca.iot-rad.com/ocsp -resp_text -respout ocsp_response.der	Returns OCSP status for a given certificate in DER format
CA General	Download CA Chain	curl -k https://pikachu-ca.iot-rad.com:5443/downloads/chain	Returns full CA chain file
	Download CRL	curl -k https://pikachu-ca.iot-rad.com:4443/downloads/crl	Generates and downloads latest Certificate Revocation List

	Certificate Status	curl -k https://pikachu-ca.iot-rad.com:4443/status/0xc75f573d9cb2b581	Returns status as valid, revoked, or not found in JSON
	Expired Certificates	curl -k https://pikachu-ca.iot-rad.com/expired	Returns list of certificate IDs that are expired
	Download CSR	curl -k https://pikachu-ca.iot-rad.com:5443///requests/1/download	Serves saved CSR if available

Quantum safe keys

Quantum safe keys are encryption keys generated using algorithms that resist attempts by quantum computers, helping secure data against emerging quantum threats.

For instance,

- **mldsa44** – which corresponds to NIST Level 1 (Dilithium2)
- **mldsa65** – corresponding roughly to Dilithium3 (NIST Level 3)
- **mldsa87** – corresponding roughly to Dilithium5 (NIST Level 5)

1.4 Purpose

The purpose of this platform is to provide a robust PKI solution that securely provisions and manages RAD devices and servers—such as those operating with MQTT—by seamlessly integrating with CA servers.

1.5 Scope

in non-production environments, with a strong emphasis on tenant isolation, robust security measures, and high availability.

2 PKI platform

The Lifecycle maintenance ansible playbook contains files and ansible playbooks. Once installed the user can perform the maintenance operations.

2.1 Server OS requirements

Operating System	Version
Rocky	9.x

2.2 Installation

Python

Install python 3 and complimentary packages

```
sudo dnf install -y epel-release

#sudo dnf module enable -y python3.11

sudo dnf install -y python3.11 python3.11-devel python3.11-pip git

sudo dnf groupinstall -y "Development Tools"


sudo alternatives --install /usr/bin/python3 python3 /usr/bin/python3.11 100
sudo alternatives --install /usr/bin/pip3 pip3 /usr/bin/pip3.11 100

pip3 install flask cryptography oscrypto asn1crypto flask_sqlalchemy
```

allow python39 programs to use privileged ports (below 1024)

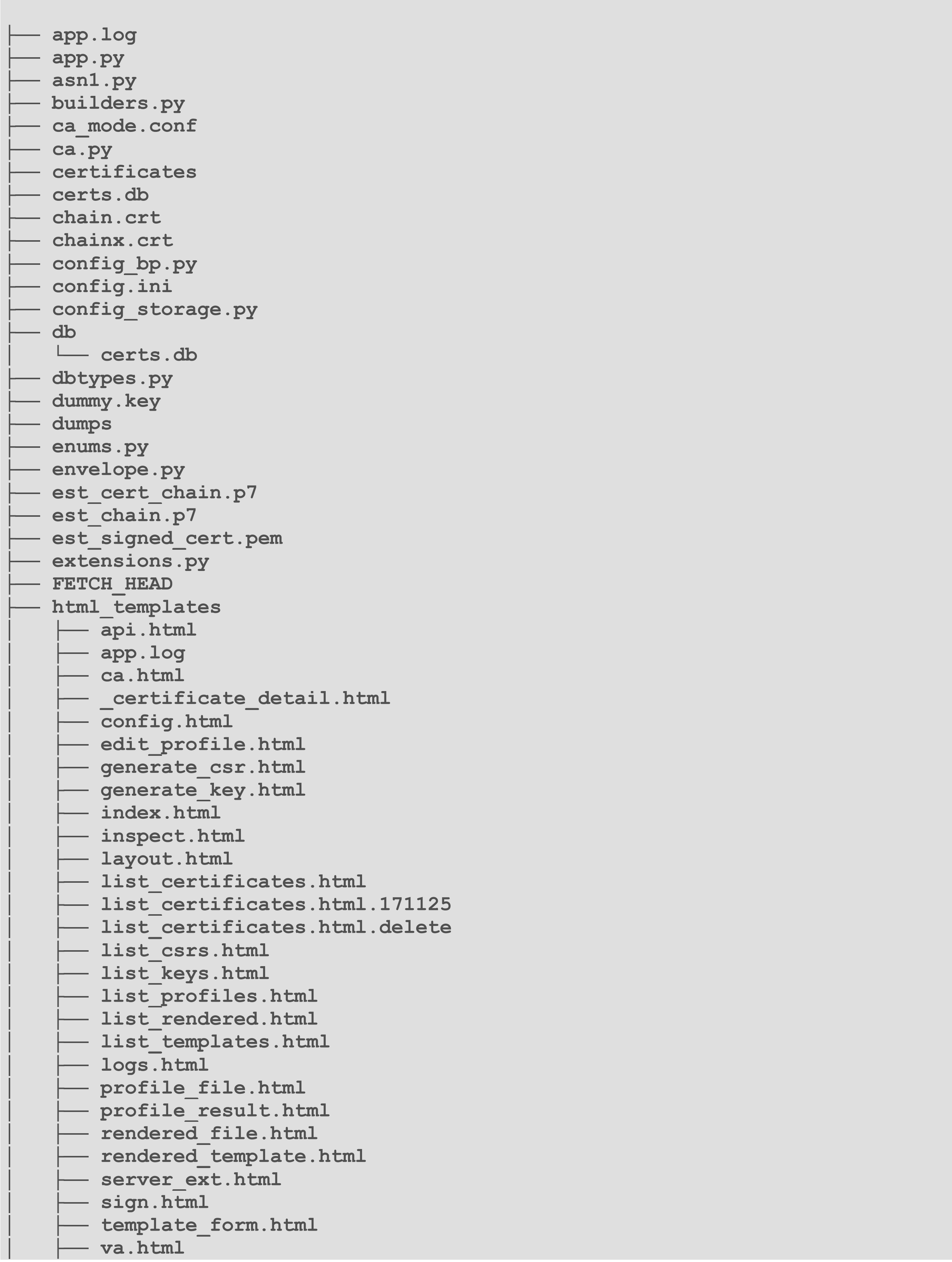
```
sudo setcap 'cap_net_bind_service=+ep' /usr/bin/python3.11
```

Server

Extract the pki_server_102.tar.gz

```
tar xvfz pki_server_102.tar.gz
cd pki-server-2
```

it will open the following directories and files



```
├── app.log
├── app.py
├── asn1.py
├── builders.py
├── ca_mode.conf
├── ca.py
├── certificates
├── certs.db
├── chain.crt
├── chainx.crt
├── config_bp.py
├── config.ini
├── config_storage.py
├── db
│   └── certs.db
├── dbtypes.py
├── dummy.key
├── dumps
├── enums.py
├── envelope.py
├── est_cert_chain.p7
├── est_chain.p7
├── est_signed_cert.pem
├── extensions.py
├── FETCH_HEAD
├── html_templates
│   ├── api.html
│   ├── app.log
│   ├── ca.html
│   ├── _certificate_detail.html
│   ├── config.html
│   ├── edit_profile.html
│   ├── generate_csr.html
│   ├── generate_key.html
│   ├── index.html
│   ├── inspect.html
│   ├── layout.html
│   ├── list_certificates.html
│   ├── list_certificates.html.171125
│   ├── list_certificates.html.delete
│   ├── list_csrs.html
│   ├── list_keys.html
│   ├── list_profiles.html
│   ├── list_rendered.html
│   ├── list_templates.html
│   ├── logs.html
│   ├── profile_file.html
│   ├── profile_result.html
│   ├── rendered_file.html
│   ├── rendered_template.html
│   ├── server_ext.html
│   ├── sign.html
│   ├── template_form.html
│   ├── va.html
│   ├── view_csr.html
│   ├── view.html
│   └── view_key.html
├── logs
│   ├── server.log
│   └── server.log.1
├── pki-https
│   ├── pikachu_issued_https.crt
│   ├── pikachu_issued_https.key
│   ├── tls.cert.pem
│   └── tls.key.pem
├── pki-misc
│   ├── crl.pem
│   ├── server_ext.cnf
│   └── validity.conf
├── pki-root
│   └── rad_ca_root.crt
├── pki-server-2.code-workspace
├── pki-subca
│   ├── rad_ca_sub_ec.crt
│   ├── rad_ca_sub_ec.key
│   ├── rad_ca_sub_rsa.crt
│   ├── rad_ca_sub_rsa.key
│   ├── rad_chain_ec.crt
│   └── rad_chain_rsa.crt
├── __pycache__
├── README.md
├── static
│   ├── favicon-16x16.png
│   ├── favicon-32x32.png
│   ├── help.pdf -> PKI-Hands-On1.03.pdf
│   ├── PKI-Hands-On1.02.pdf
│   └── PKI-Hands-On1.03.pdf
├── version.txt
├── x509_keys.py
├── x509_profiles
│   ├── 6w_ca_root_2.cnf
│   ├── 6w_ca_root_2x.cnf
│   ├── 6w_ca_root.cnf
│   ├── 6w_ca_root_x.cnf
│   ├── bitbucket_server.cnf
├── x509_profiles.py
├── x509_requests.py
└── x509_templates
    ├── 6w_ca_root_2.cnf.j2
    ├── 6w_ca_root.cnf.j2
    ├── 6w_ca_root_ext.cnf.j2
    ├── 6w_ca_sub.cnf.j2
    ├── crl_ocsp_ext_alt.cnf.j2
    ├── crl_ocsp_ext.cnf.j2
    ├── eon_server_ext.cnf.j2
```

Complementary

Following installation of commands and libraries essential for testing and using the server

SSCEP

Rocky 9 lack OS repository installation there for it needed to be complied, linked and installed

```
git clone https://github.com/zhaozg/openscep.git
cd openscep
chmod u+x configure
./configure

make

sudo make install
```

Note : If missing libraries install using the OS dnf

EST-Client

From repo https://github.com/globalsign/est

```
sudo dnf install -y golang

git clone https://github.com/globalsign/est.git

go install github.com/globalsign/est/cmd/estclient@latest

sudo cp go/bin/estclient   /usr/local/bin/estclient
```

Quantum Safe Algorithm

Quantum safe algorithms successful installation requires openssl 3.x and other development packages

Prerequisite installation of Ninja

```
sudo dnf config-manager --set-enabled crb
sudo dnf install -y epel-release
sudo dnf install -y ninja-build

sudo dnf groupinstall -y "Development Tools"
sudo dnf install -y cmake ninja-build git openssl-devel libffi-devel
```

install quantum resistant algorithms (like Dilithium, Falcon, Kyber, and SPHINCS+)

```
git clone https://github.com/open-quantum-safe/oqs-provider.git
cd oqs-provider
./scripts/fullbuild.sh
sudo cmake --install _build
```

find the openssl.cnf file and add it manually

```
ls -l /etc/ssl/openssl.cnf
lrwxrwxrwx. 1 root root 24 Aug 21  2024 /etc/ssl/openssl.cnf ->
/etc/pki/tls/openssl.cnf

# add the new provider

sudo vi /etc/pki/tls/openssl.cnf

[provider_sect]
default = default_sect
oqsprovider = oqsprovider_sect
[default_sect]
activate = 1
[oqsprovider_sect]
activate = 1
```

test the openssl

```
#run command
openssl list -providers
#output
Providers:
  default
    name: OpenSSL Default Provider
    version: 3.2.2
    status: active
  oqsprovider
```

```
    name: OpenSSL OQS Provider
    version: 0.8.1-dev
    status: active
```

we can see that oqsprovider provider is active

MQTTs broker

Using distribution mosquitto with docker compose

```
mkdir mqtt
cd mqtt


cat > docker-compose.yml <<EOL


version: '3'
services:
  mosquitto:
    image: eclipse-mosquitto:latest
    container_name: mosquitto
    network_mode: "host"  # Use host network mode
    ports:
      - "1883:1883"    # Default MQTT
      - "2883:2883"    # Secure MQTT with TLS
      - "9001:9001"    # WebSocket (if needed)
    volumes:
      - ./mosquitto.conf:/mosquitto/config/mosquitto.conf
      - ./mosquitto/certs:/mosquitto/certs
    restart: unless-stopped
EOL
```

make configuration file

```
cat > mosquitto.conf <<EOL

per_listener_settings true

listener 1883 0.0.0.0
allow_anonymous true
log_type all

listener 2883 0.0.0.0
cafile /mosquitto/certs/CA.cert
certfile /mosquitto/certs/est_mqtt_server_1.pem
```

```
keyfile /mosquitto/certs/est_mqtt_server_1.key

crlfile /mosquitto/certs/crl.pem

require_certificate true
use_identity_as_username true
log_type all
EOL
```

populate certification directory

```
mkdir certs
cd certs
```

with files

```
est_mqtt_server_1.pem
est_mqtt_server_1.key
crl_client_2.pem
CA.cert
```

By executing the following command Server is up and running

```
cd pki-srever-2
python app.py
```

all logs are written to the stdout and file output.log

2.3 Generate Root and intermediate certification

Every CA server is based on Root certificate and one or more intermediate (sub) certificates

Following procedure on how to generate a root and intermediate certificates for the CA server

Generate Root Certificate

Create root EC key

```
openssl ecparam -name prime256v1 -genkey -noout -out rad_ca_root.key
```

Prepare certificate configuration file

```
cat > rad_ca_root.cnf <<EOL
# CA Certificate Configuration Template for Root ECC Certificates
[ req ]
default_bits       = 4096
default_md         = sha256
prompt             = no
distinguished_name = dn
x509_extensions    = v3_ca

[ dn ]
C  = IL
ST = TLV
L  = Tel Aviv
O  = RAD
OU = RD
CN = RAD Test ECDSA

[ v3_ca ]
subjectKeyIdentifier   = hash
authorityKeyIdentifier = keyid:always,issuer
basicConstraints       = critical, CA:true, pathlen:1
EOL
```

Self-sign root certificate

```
openssl req -config rad_ca_root.cnf -key rad_ca_root.key -new -x509 -days
3650 -sha256 -out rad_ca_root.crt
```

Prepare signing server extension configuration file

```
cat > ca_root_ext.cnf <<EOL
[ v3_intermediate ]
subjectKeyIdentifier   = hash
authorityKeyIdentifier = keyid,issuer
basicConstraints       = critical, CA:true, pathlen:0
keyUsage               = keyCertSign, cRLSign
crlDistributionPoints  = URI:https://pikachu-ca.rnd-rad.com/downloads/crl
EOL
```

Generating Intermediate (Sub) Certificate

EC based Key Certificate

Create sub key

```
openssl ecparam -name prime256v1 -genkey -noout -out rad_ca_sub_ec.key
```

Prepare certificate configuration file

```
cat > rad_ca_sub_ec.cnf<<EOL
[ req ]
default_bits       = 2048
default_md         = sha256
prompt             = no
distinguished_name = dn
req_extensions     = v3_intermediate
[ dn ]
C  = IL
ST = TLV
L  = Tel Aviv
O  = RAD
OU = RD
CN = RADSubTestECDSA
[ v3_intermediate ]
subjectKeyIdentifier    = hash
#authorityKeyIdentifier = keyid,issuer
basicConstraints        = critical, CA:true, pathlen:0
keyUsage                = keyCertSign, cRLSign
EOL
```

Generate Certificate request

```
openssl req -new -config rad_ca_sub_ec.cnf  -key rad_ca_sub_ec.key -out
rad_ca_sub_ec.csr
```

Sign certificate

```
openssl x509 -req -in rad_ca_sub_ec.csr -CA rad_ca_root.crt -CAkey
rad_ca_root.key -CAcreateserial -out rad_ca_sub_ec.crt -days 3650 -sha256 -
extfile ca_root_ext.cnf -extensions v3_intermediate
```

RSA based Key Certificate

Create sub key

```
openssl genpkey -algorithm RSA -out rad_ca_sub_rsa.key -pkeyopt
rsa_keygen_bits:4096
```

Prepare certificate configuration file

```
cat > rad_ca_sub_rsa.cnf<<EOL
[ req ]
default_bits       = 4096
default_md         = sha256
prompt             = no
distinguished_name = dn
req_extensions     = v3_intermediate
[ dn ]
C  = IL
ST = TLV
L  = Tel Aviv
O  = RAD
OU = RD
CN = RADSubTestECDSA
[ v3_intermediate ]
subjectKeyIdentifier    = hash
#authorityKeyIdentifier = keyid,issuer
basicConstraints        = critical, CA:true, pathlen:0
keyUsage                = keyCertSign, cRLSign
EOL
```

Generate certificate request

```
openssl req -new -config rad_ca_sub_rsa.cnf  -key rad_ca_sub_rsa.key -out
rad_ca_sub_rsa.csr
```

Sign certificate

```
openssl x509 -req -in rad_ca_sub_rsa.csr -CA rad_ca_root.crt -CAkey
rad_ca_root.key -CAcreateserial -out rad_ca_sub_rsa.crt -days 3650 -sha256 -
extfile ca_root_ext.cnf -extensions v3_intermediate
```

Copy keys Certificates

The Certificates and Keys must be located according to the attributes in the CA server configuration file (config.ini)

```
PROJ_DIR=~/pki-server-2
Cp rad_ca_root.key rad_ca_root.crt $PROJ_DIR/pki-root/
cp rad_ca_sub_ec.crt rad_ca_sub_rsa.crt rad_ca_sub_ec.key rad_ca_sub_rsa.key
$PROJ_DIR/pki-subca

cd $PROJ_DIR

cat pki-subca/rad_ca_sub_ec.crt pki-root/rad_ca_root.crt > pki-subca/rad_chain_ec.crt
cat pki-subca/rad_ca_sub_rsa.crt pki-root/rad_ca_root.crt > pki-
subca/rad_chain_rsa.crtv
```

2.4 Configuration

The server is configured by config.ini file , secret protected

```
[DEFAULT]
# general Flask settings
SECRET_KEY = *******

[CA]
# Which subordinate CA to use by default: "EC" or "RSA"
mode = EC

# Paths for both modes; the get_ca_config() helper below will pick the right
SUBCA_KEY_PATH_EC    = pki-subca/rad_ca_sub_ec.key
SUBCA_CERT_PATH_EC   = pki-subca/rad_ca_sub_ec.crt
CHAIN_FILE_PATH_EC   = pki-subca/rad_chain_ec.crt

SUBCA_KEY_PATH_RSA   = pki-subca/rad_ca_sub_rsa.key
SUBCA_CERT_PATH_RSA  = pki-subca/rad_ca_sub_rsa.crt
CHAIN_FILE_PATH_RSA  = pki-subca/rad_chain_rsa.crt

ROOT_CERT_PATH       = pki-root/rad_ca_root.crt

[SCEP]
# enable or disable SCEP entirely
enabled = true

# optional path to a file where we persist the serial across restarts
serial_file = pki-subca/serial.txt

# Dump directory for raw SCEP requests (optional)
dump_dir = pki-subca/dumps

# HTTP port for unauthenticated SCEP
http_port = 8090

[HTTPS]
# HTTPS certificate & key for your main CA UI
ssl_cert = pki-https/tls.cert.pem
ssl_key  = pki-https/tls.key.pem
port     = 443

[TRUSTED_HTTPS]
# HTTPS certificate & key for your main CA UI
trusted_ssl_cert = pki-https/pikachu_issued_https.crt
trusted_ssl_key  = pki-https/pikachu_issued_https.key
trusted_port     = 4443

[PATHS]
# everything else that was hard-coded
crl_path       = pki-misc/crl.pem
server_ext_cfg = pki-misc/server_ext.cnf
validity_conf  = pki-misc/validity.conf
db_path        = db/certs.db
```

2.5 Run Server

Shell Command

By executing the following command Server is up and running

```
cd pki-srever-2
nohup python app.py > app.log 2>&1 &
```

all logs are written to the stdout and file output.log

OS Service

Create the main service: pikachu-ca.service

```
sudo tee /etc/systemd/system/pikachu-ca.service > /dev/null << 'EOF'
[Unit]
Description=Pikachu CA Python App
After=network-online.target
Wants=network-online.target

[Service]
Type=simple
User=rocky
Group=rocky
WorkingDirectory=/home/rocky/pki-server-2
ExecStart=/usr/bin/python3.11 /home/rocky/pki-server-2/app.py
Restart=always
RestartSec=5s
Environment=PYTHONUNBUFFERED=1

# Allow binding to ports <1024
AmbientCapabilities=CAP_NET_BIND_SERVICE
CapabilityBoundingSet=CAP_NET_BIND_SERVICE
NoNewPrivileges=true

StandardOutput=journal
StandardError=journal

[Install]
WantedBy=multi-user.target
EOF
```

Create the healthcheck service: pikachu-ca-healthcheck.service

```
sudo tee /etc/systemd/system/pikachu-ca-healthcheck.service > /dev/null <<
'EOF'
[Unit]
Description=Healthcheck for pikachu-ca (restart if https://localhost fails)
After=pikachu-ca.service

[Service]
Type=oneshot
ExecStart=/usr/bin/bash -c '/usr/bin/curl -ksf --max-time 5
https://localhost/ || /usr/bin/systemctl restart pikachu-ca.service'
EOF
```

Create the healthcheck timer: pikachu-ca-healthcheck.timer

```
sudo tee /etc/systemd/system/pikachu-ca-healthcheck.timer > /dev/null <<
'EOF'
[Unit]
Description=Periodic healthcheck for pikachu-ca

[Timer]
OnBootSec=30s
OnUnitActiveSec=60s
Unit=pikachu-ca-healthcheck.service

[Install]
WantedBy=timers.target
EOF
```

Reload systemd to pick up the new units

```
sudo systemctl daemon-reload
```

Enable services & timer at boot

```
sudo systemctl enable pikachu-ca.service
sudo systemctl enable pikachu-ca-healthcheck.timer
```

Start everything now

```
sudo systemctl start pikachu-ca.service
sudo systemctl start pikachu-ca-healthcheck.timer
```

Check status / logs

```
# Main service status
sudo systemctl status pikachu-ca.service

# Timer and healthcheck
sudo systemctl status pikachu-ca-healthcheck.timer
sudo systemctl status pikachu-ca-healthcheck.service

# See timers
systemctl list-timers | grep pikachu

# Logs
journalctl -u pikachu-ca.service -f
journalctl -u pikachu-ca-healthcheck.service -f
```

server can be access using the URL https://pikachu-ca.iot-rad.com:4443

2.6 Ports

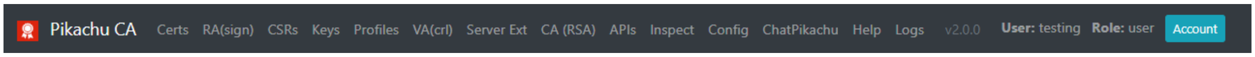
The application as development tool can be used in the following ways

Capability	Configuration	Support Technology	Description

HTTPS without client certificate	[HTTPS] Port = 443	All	One-way TLS Server-authenticated TLS Standard HTTPS
HTTPS that *requires* client certificates	[TRUSTED_HTTPS] trusted_port = 4443	All	Mutual TLS (mTLS) Two-way TLS TLS with client authentication
HTTP (OCSP)	[DEFAULT] http_port = 80	OCSP	For older technologies
HTTP (SCEP)	[SCEP] http_port = 8090		

2.7 Layout

Navigate Tiles



Certs - list certificates (Main view)

RA (sign) – Sign certificate

CSR Requests – create, delete, view and list certificates requests

Keys - create, delete, download view and list of keys

Profiles - create, edit, delete, view and list of profiles

VA (crl) – list revoked certificates and updated CRL

Server Ext – view edit and load profile to Extension configuration

CA(mode) – show the root and sub/intermediate certificates details

Templates - Create Profile based on Templates (user with admin role only)

APIs – list of all APIs download CRL, CA certificate. Enrolments techniques Manual, SCEP and EST, and RA OCSP.

Inspect – Inspect PEM block or Base64-encoded DER data

Config – show content of server config.ini file

ChatPikachu – ChatGPT GPT for the server

Help – open new browser tab with help Pdf file

Logs – show the server log data

Version – 2.00

Logged in user and role – testing, user

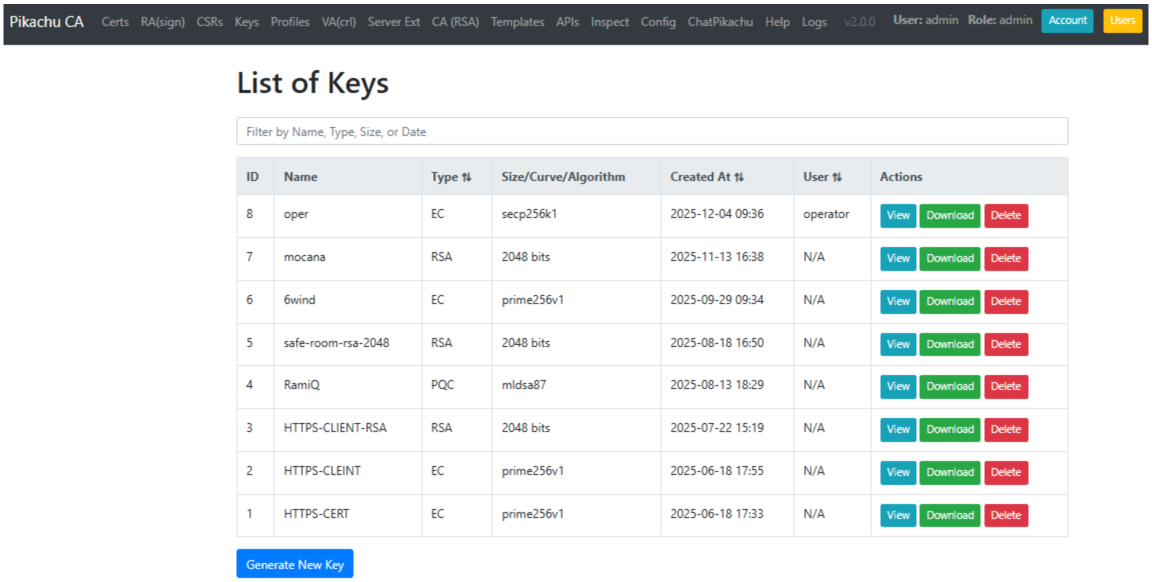
Account – change password , logout

Users – Manage users (user with admin role only)

2.8 Keys Management

At the main view under management Links select Keys

Redirected to view with list of Keys



List of Keys

Filter by Name, Type, Size, or Date

ID	Name	Type ⇅	Size/Curve/Algorithm	Created At ⇅	User ⇅	Actions
8	oper	EC	secp256k1	2025-12-04 09:36	operator	View Download Delete
7	mocana	RSA	2048 bits	2025-11-13 16:38	N/A	View Download Delete
6	6wind	EC	prime256v1	2025-09-29 09:34	N/A	View Download Delete
5	safe-room-rsa-2048	RSA	2048 bits	2025-08-18 16:50	N/A	View Download Delete
4	RamiQ	PQC	mldsa87	2025-08-13 18:29	N/A	View Download Delete
3	HTTPS-CLIENT-RSA	RSA	2048 bits	2025-07-22 15:19	N/A	View Download Delete
2	HTTPS-CLEINT	EC	prime256v1	2025-06-18 17:55	N/A	View Download Delete
1	HTTPS-CERT	EC	prime256v1	2025-06-18 17:33	N/A	View Download Delete

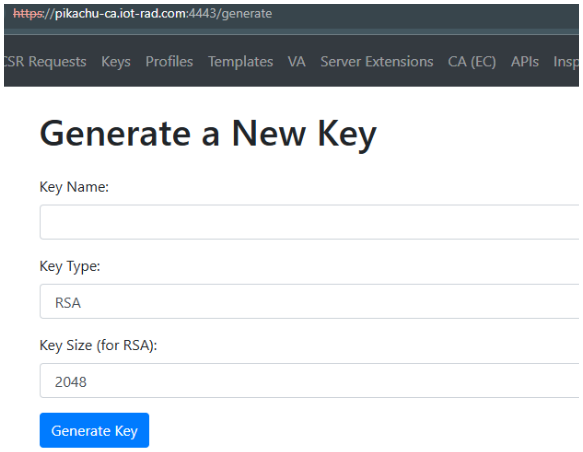
https://openxpki.iot-rad.com:4443/keys

filter the list by any list column (except for user)

Order list by selected column ⇅

to generate new key press button, Generate New Key

Redirected to Generate a New Key



Generate a New Key

Key Name:

Key Type: RSA

Key Size (for RSA): 2048

Users can use either RSA, EC (elastic curve) and PQC (post-quantum) Key Type

RSA contains key sizes 2048,3072 and 4096

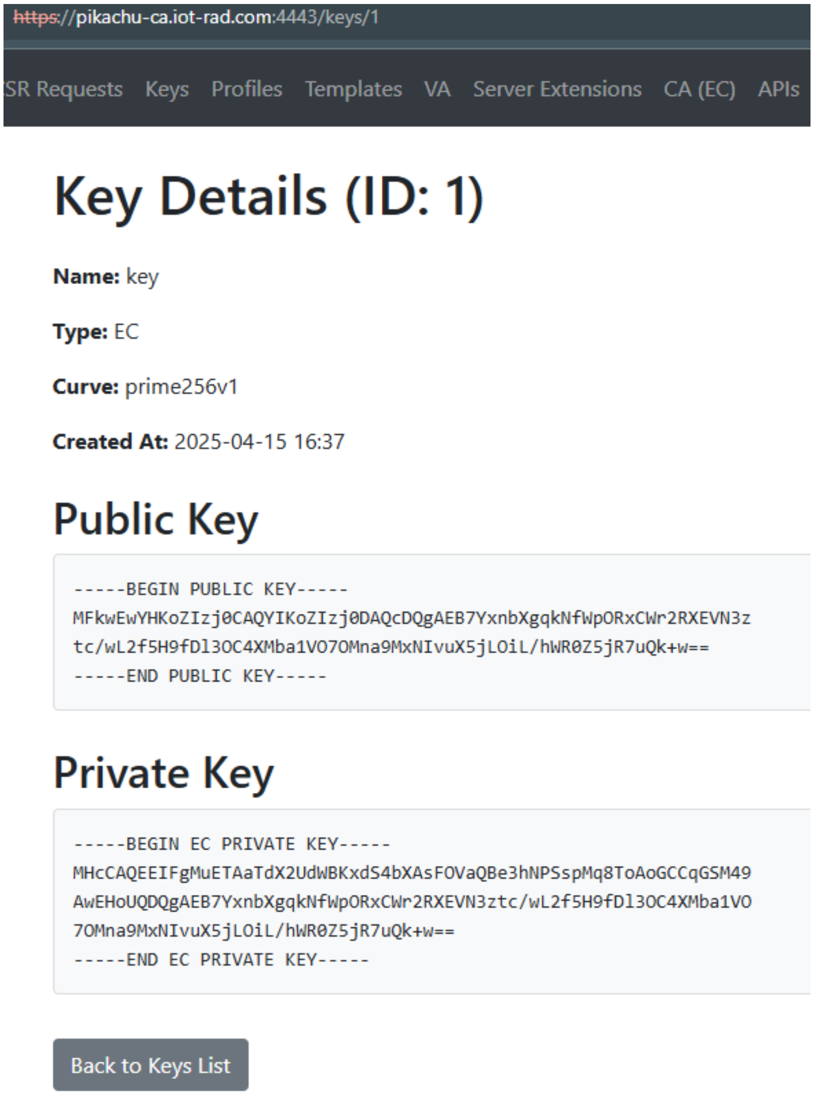
EC has curves prime256v1(secp256r1), secp384r1, secp521r1 and secp256k1

PQC has algorithms mldsa44 (Dilithium2 / NIST L1), mldsa65 (Dilithium3 / NIST L3) and mlds87 (Dilithium5 / NIST L5)

Add a key name and press button generate Key

The view will be redirected to List of Keys view

Press View at the key you wish to see details



Key Details (ID: 1)

Name: key

Type: EC

Curve: prime256v1

Created At: 2025-04-15 16:37

Public Key

```
-----BEGIN PUBLIC KEY-----
MFkwEwYHKoZIzj0CAQYIKoZIzj0DAQcDQgAEB7YxnbXgqkNfWpORxCWr2RXEVN3z
tc/wL2f5H9fDl3OC4XMba1VO7OMna9MxNIvuX5jLOiL/hWR0Z5jR7uQk+w==
-----END PUBLIC KEY-----
```

Private Key

```
-----BEGIN EC PRIVATE KEY-----
MHcCAQEEIFgMuETAaTdX2UdWBKxdS4bXAsFOVaQBe3hNPSspMq8ToAoGCCqGSM49
AwEHoUQDQgAEB7YxnbXgqkNfWpORxCWr2RXEVN3ztc/wL2f5H9fDl3OC4XMba1VO
7OMna9MxNIvuX5jLOiL/hWR0Z5jR7uQk+w==
-----END EC PRIVATE KEY-----
```

User can copy the Private and Public key data for any purpose

2.9 Profiles Management

The profile is used for various purposes

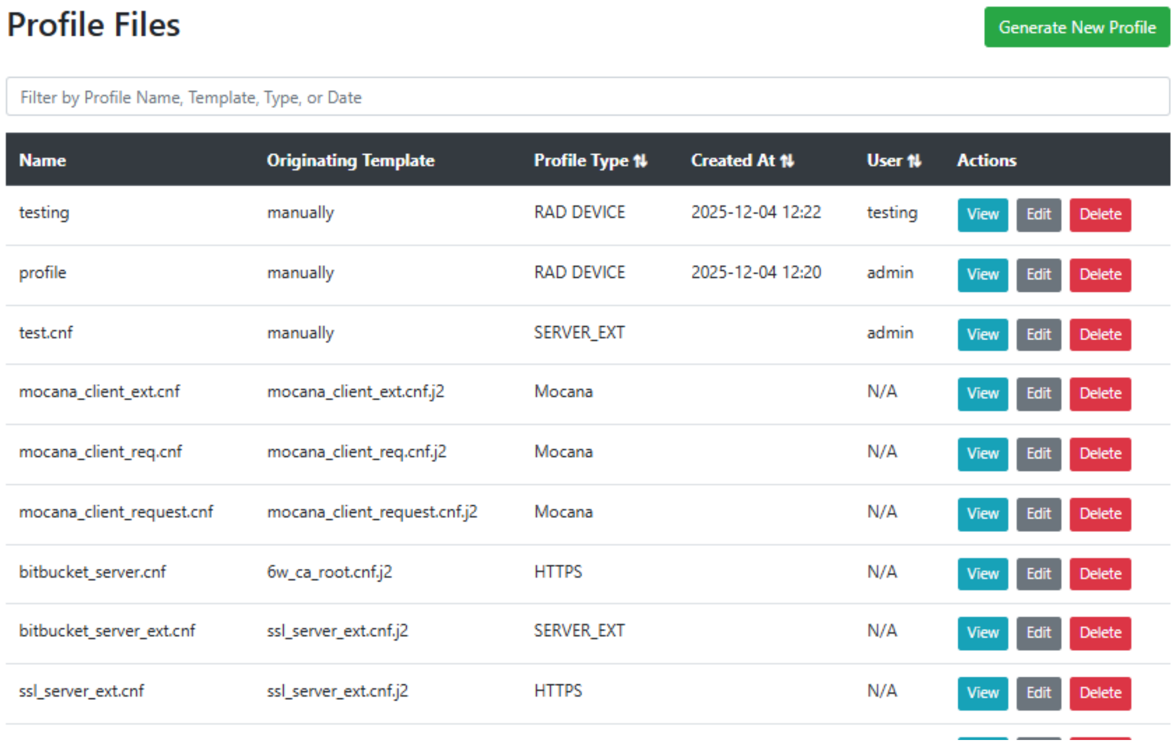
1. Certificate configuration to generate CSRs

2. CA server extension configuration to sing a CSR

The profile can be created either by editing or rendered from template

Profiles

View List of Profile Files contains all profiles able to view, create, edit or delete



Profile Files

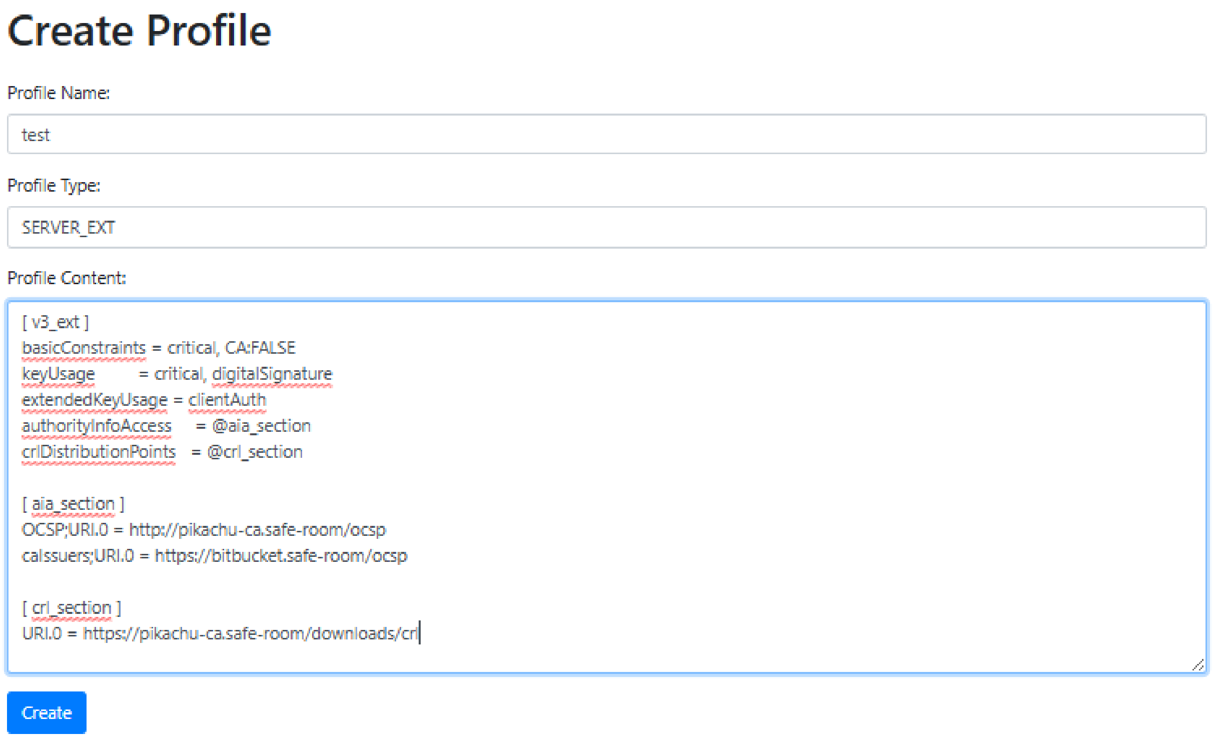
Name	Originating Template	Profile Type ⇅	Created At ⇅	User ⇅	Actions
testing	manually	RAD DEVICE	2025-12-04 12:22	testing	View Edit Delete
profile	manually	RAD DEVICE	2025-12-04 12:20	admin	View Edit Delete
test.cnf	manually	SERVER_EXT		admin	View Edit Delete
mocana_client_ext.cnf	mocana_client_ext.cnf.j2	Mocana		N/A	View Edit Delete
mocana_client_req.cnf	mocana_client_req.cnf.j2	Mocana		N/A	View Edit Delete
mocana_client_request.cnf	mocana_client_request.cnf.j2	Mocana		N/A	View Edit Delete
bitbucket_server.cnf	6w_ca_root.cnf.j2	HTTPS		N/A	View Edit Delete
bitbucket_server_ext.cnf	ssl_server_ext.cnf.j2	SERVER_EXT		N/A	View Edit Delete
ssl_server_ext.cnf	ssl_server_ext.cnf.j2	HTTPS		N/A	View Edit Delete

https://openxpki.iot-rad.com/profiles/

filter the list by any list column (except for user)

Order list by selected column ⇅

to create new profiles, use Generate New Profile Action



Create Profile

Profile Name:

test

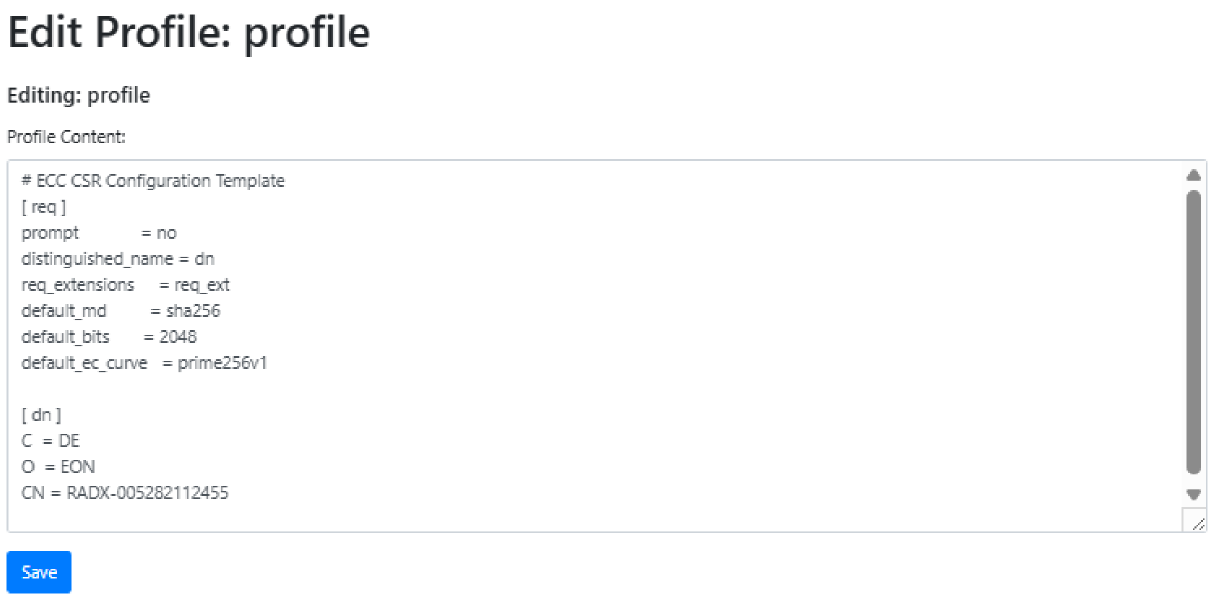
Profile Type:

SERVER_EXT

Profile Content:

```
[ v3_ext ]
basicConstraints = critical, CA:FALSE
keyUsage        = critical, digitalSignature
extendedKeyUsage = clientAuth
authorityInfoAccess    = @aia_section
crlDistributionPoints   = @crl_section

[ aia_section ]
OCSP;URI.0 = http://pikachu-ca.safe-room/ocsp
caIssuers;URI.0 = https://bitbucket.safe-room/ocsp

[ crl_section ]
URI.0 = https://pikachu-ca.safe-room/downloads/crl
```

to edit profile, use the Edit Action



Edit Profile: profile

Editing: profile

Profile Content:

```
# ECC CSR Configuration Template
[ req ]
prompt           = no
distinguished_name = dn
req_extensions     = req_ext
default_md         = sha256
default_bits       = 2048
default_ec_curve   = prime256v1

[ dn ]
C  = DE
O  = EON
CN = RADX-005282112455
```

Templates (admin role only)

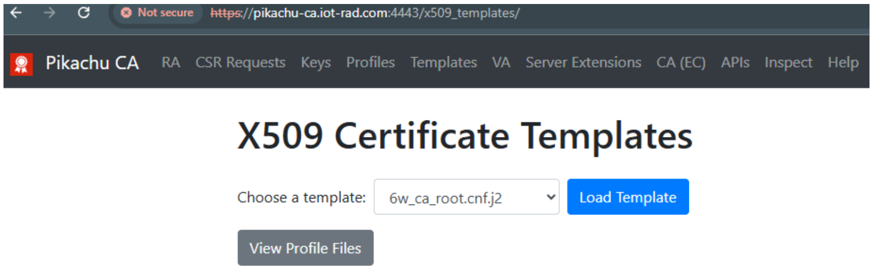
Templates added manually to the server under folder x509_templates

Template is jinja j2 style template for example

```
# CA Certificate Configuration Template for Root ECC Certificates
[ req ]
# Note: For ECC keys the “default_bits” option is not used.
default_md          = sha256
default_days        = 3650
prompt              = no
distinguished_name = dn
x509_extensions     = v3_ca
default_ec_curve    = prime256v1

[ dn ]
C  = {{ ca_country | default("FR") }}
ST = {{ ca_state | default("Ile-de-France") }}
L  = {{ ca_city | default("Paris") }}
O  = {{ ca_organization | default("6WIND") }}
OU = {{ ca_organizational_unit | default("CA Division") }}
CN = {{ ca_common_name | default("6WIND Test ECDSA RCA") }}

[ v3_ca ]
subjectKeyIdentifier   = hash
authorityKeyIdentifier = keyid:always,issuer
basicConstraints       = critical, CA:true, pathlen:0
keyUsage               = critical, digitalSignature, keyCertSign, cRLSign
```

At the main view under management Links select Templates

Redirected to view Select an X509 Template



Not secure https://pikachu-ca.iot-rad.com:4443/x509_templates/

X509 Certificate Templates

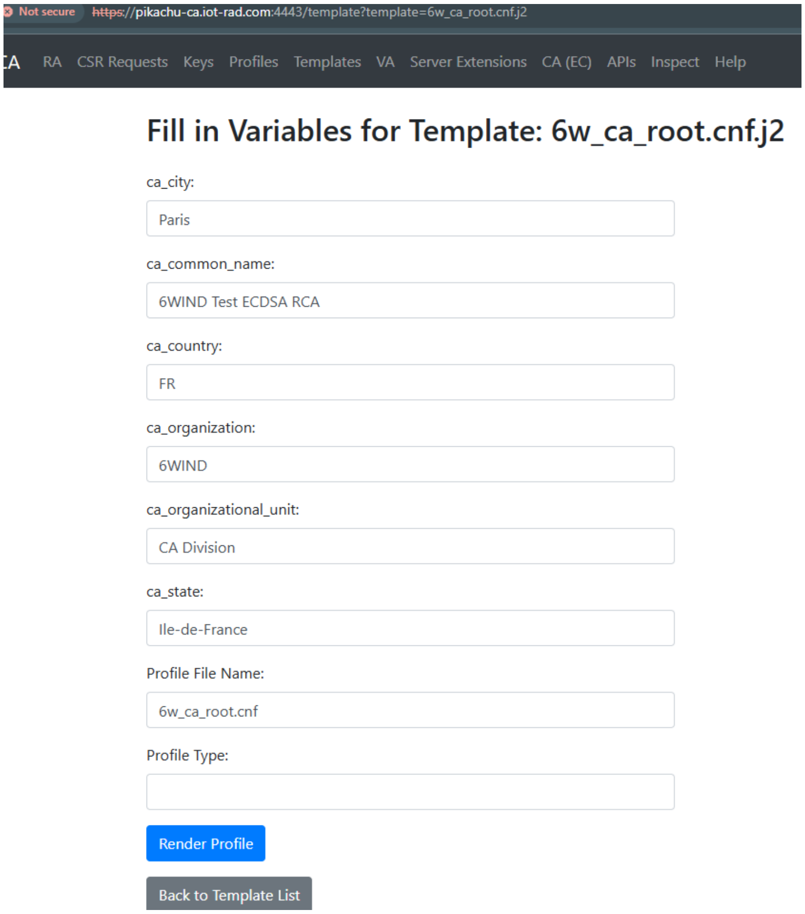
Choose a template: 6w_ca_root.cnf.j2

https://openxpki.iot-rad.com:4443/x509_templates/

Choose template and Load template by pressing Load Template button

The view will be redirected to Fill in Variables for Template

Change the defaults value to any you wish


Not secure
https://pikachu-ca.iot-rad.com:4443/template?template=6w_ca_root.cnf.j2
CA RA CSR Requests Keys Profiles Templates VA Server Extensions CA (EC) APIs Inspect Help

Fill in Variables for Template: 6w_ca_root.cnf.j2

ca_city: Paris

ca_common_name: 6WIND Test ECDSA RCA

ca_country: FR

ca_organization: 6WIND

ca_organizational_unit: CA Division

ca_state: Ile-de-France

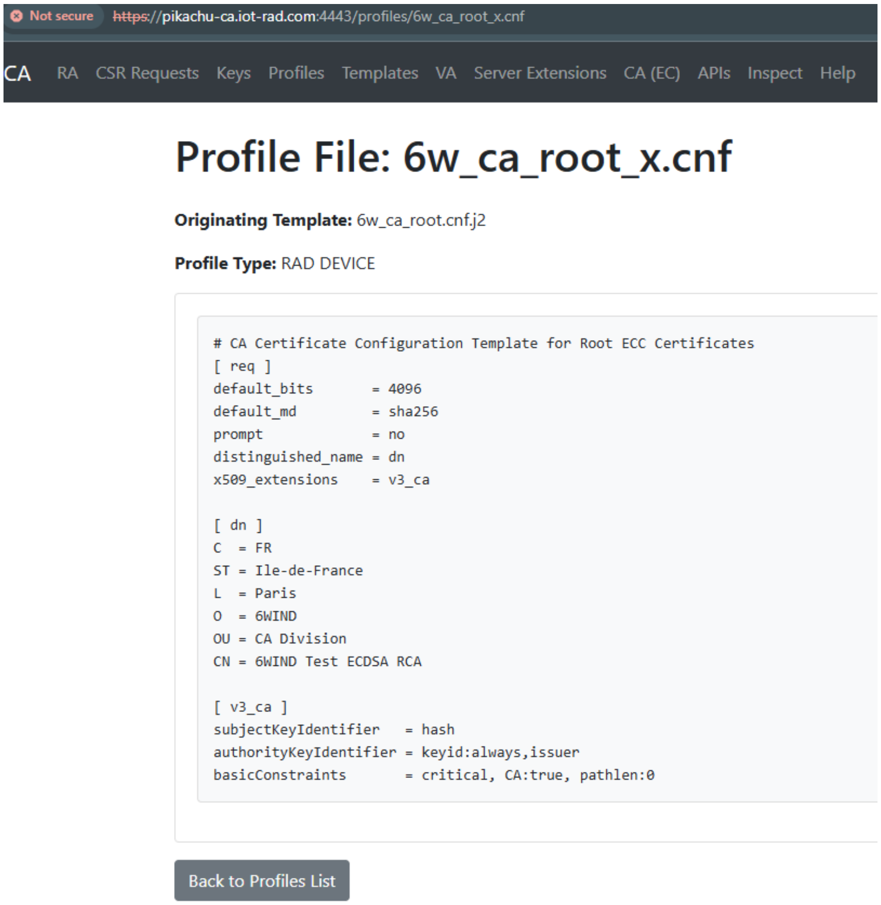
Profile File Name: 6w_ca_root.cnf

Profile Type:

Render Profile
Back to Template List

Press Render profile to create a profile

The view will be redirected to Profile File with generate profile details



Profile File: 6w_ca_root_x.cnf

Originating Template: 6w_ca_root.cnf.j2

Profile Type: RAD DEVICE

```
# CA Certificate Configuration Template for Root ECC Certificates
[ req ]
default_bits       = 4096
default_md         = sha256
prompt             = no
distinguished_name = dn
x509_extensions    = v3_ca

[ dn ]
C  = FR
ST = Ile-de-France
L  = Paris
O  = 6WIND
OU = CA Division
CN = 6WIND Test ECDSA RCA

[ v3_ca ]
subjectKeyIdentifier   = hash
authorityKeyIdentifier = keyid:always,issuer
basicConstraints       = critical, CA:true, pathlen:0
```

A file with the name that has been given created at folder x509_profiles

Users can either press either the “Back to Template List” button or “View All Profiles Files” one

2.10 Certificate actions

Once certificate has been signed and issued the user can perform the following actions

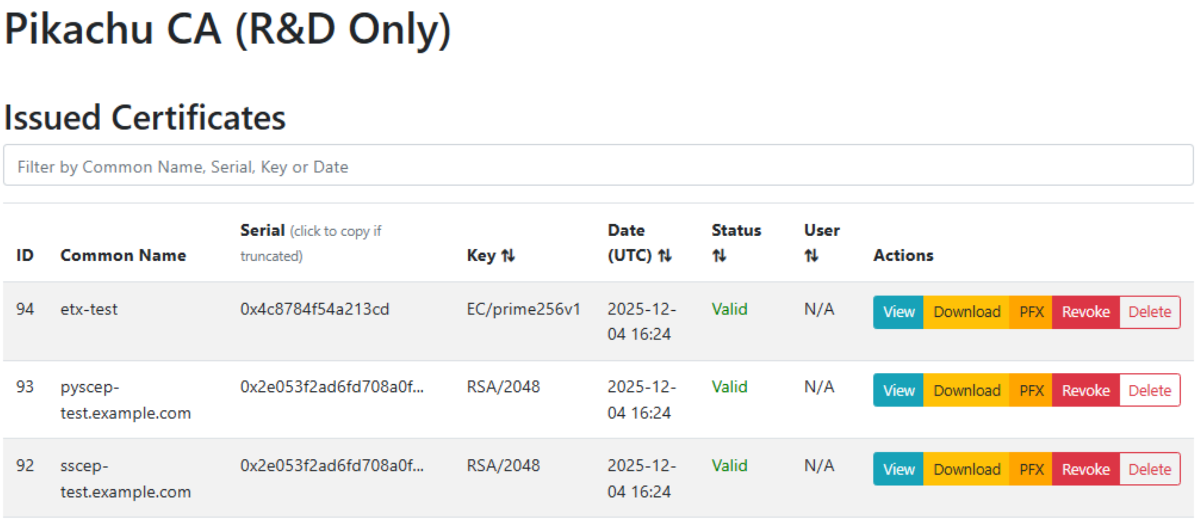
1. View – Display the certificate’s details and metadata.
2. Download – Retrieve the certificate file for local use or storage.
3. PFX – Generate and download a PFX/PKCS#12 bundle containing the certificate and private key.
4. Revoke – Mark the certificate as invalid so it can no longer be trusted or used.
5. Delete – Permanently remove the certificate record from the system.

The Actions Delete, revoke and PFX are secret protected

Note: Users can also view the Root and intermediate (Sub) Certificate

List

All certificates are contained in the Issued Certificates Table



Pikachu CA (R&D Only)

Issued Certificates

Filter by Common Name, Serial, Key or Date

ID	Common Name	Serial (click to copy if truncated)	Key ⇅	Date (UTC) ⇅	Status ⇅	User ⇅	Actions
94	etx-test	0x4c8784f54a213cd	EC/prime256v1	2025-12-04 16:24	Valid	N/A	View Download PFX Revoke Delete
93	pyscep-test.example.com	0x2e053f2ad6fd708a0f...	RSA/2048	2025-12-04 16:24	Valid	N/A	View Download PFX Revoke Delete
92	sscep-test.example.com	0x2e053f2ad6fd708a0f...	RSA/2048	2025-12-04 16:24	Valid	N/A	View Download PFX Revoke Delete

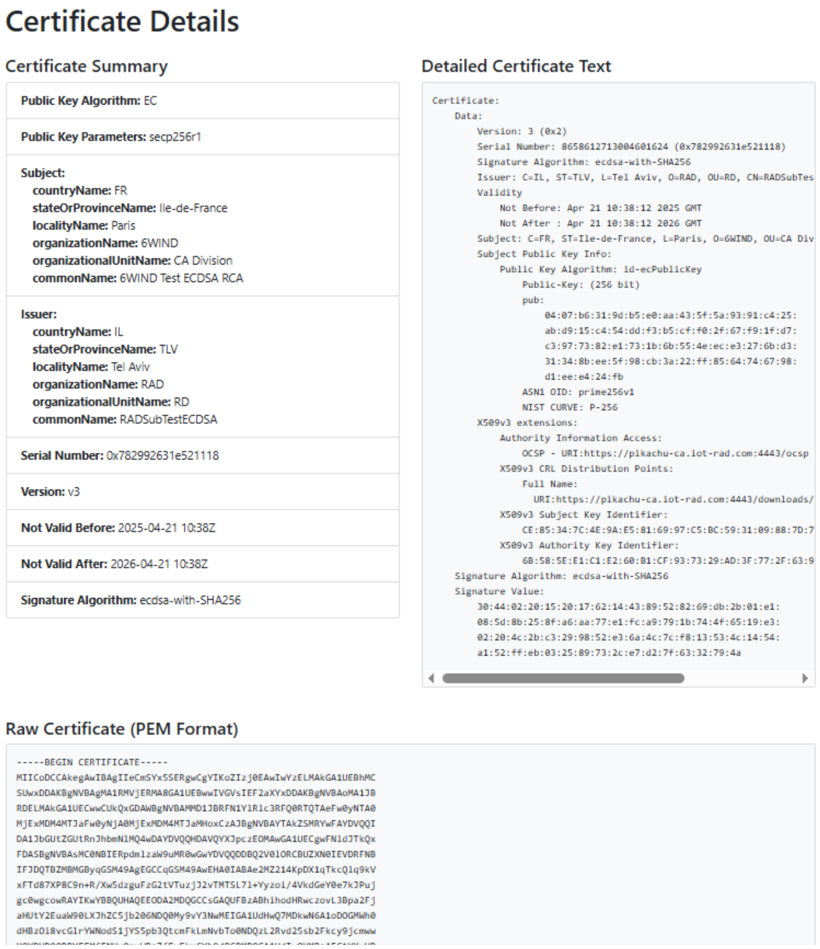
The table can be filtered by either part of Common Name, Serial values, Key and Date

Order list by selected column ⇅

View

Pressing the View Action open new page (pressing back to home return to the main view)

Change



Certificate Details

Certificate Summary

Public Key Algorithm: EC

Public Key Parameters: secp256r1

Subject:
countryName: FR
stateOrProvinceName: Ile-de-France
localityName: Paris
organizationName: 6WIND
organizationalUnitName: CA Division
commonName: 6WIND Test ECDSA RCA

Issuer:
countryName: IL
stateOrProvinceName: TLV
localityName: Tel Aviv
organizationName: RAD
organizationalUnitName: RD
commonName: RADSubTestECDSA

Serial Number: 0x782992631e521118

Version: v3

Not Valid Before: 2025-04-21 10:38Z

Not Valid After: 2026-04-21 10:38Z

Signature Algorithm: ecdsa-with-SHA256

Detailed Certificate Text

```
Certificate:
    Data:
        Version: 3 (0x2)
        Serial Number: 8658612713004601624 (0x782992631e521118)
        Signature Algorithm: ecdsa-with-SHA256
        Issuer: C=IL, ST=TLV, L=Tel Aviv, O=RAD, OU=RD, CN=RADSubTes
        Validity
            Not Before: Apr 21 10:38:12 2025 GMT
            Not After : Apr 21 10:38:12 2026 GMT
        Subject: C=FR, ST=Ile-de-France, L=Paris, O=6WIND, OU=CA Div
        Subject Public Key Info:
            Public Key Algorithm: id-ecPublicKey
                Public-Key: (256 bit)
                pub:
                    04:07:b6:31:9d:b5:e0:aa:43:5f:5a:93:91:c4:25:
                    ab:d9:15:c4:54:dd:f3:b5:cf:f0:2f:67:f9:1f:d7:
                    c3:97:73:82:e1:73:1b:6b:55:4e:ec:e3:27:6b:d3:
                    31:34:8b:ee:5f:98:cb:3a:22:ff:85:64:74:67:98:
                    d1:ee:e4:24:fb
                ASN1 OID: prime256v1
                NIST CURVE: P-256
        X509v3 extensions:
            Authority Information Access:
                OCSP - URI:https://pikachu-ca.iot-rad.com:4443/ocsp
            X509v3 CRL Distribution Points:
                Full Name:
                  URI:https://pikachu-ca.iot-rad.com:4443/downloads/
            X509v3 Subject Key Identifier:
                CE:85:34:7C:4E:9A:E5:81:69:97:C5:BC:59:31:09:88:7D:7
            X509v3 Authority Key Identifier:
                6B:58:5E:E1:C1:E2:60:B1:CF:93:73:29:AD:3F:77:2F:63:9
    Signature Algorithm: ecdsa-with-SHA256
    Signature Value:
        30:44:02:20:15:20:17:62:14:43:89:52:82:69:db:2b:01:e1:
        08:5d:8b:25:8f:a6:aa:77:e1:fc:a9:79:1b:74:4f:65:19:e3:
        02:20:4c:2b:c3:29:98:52:e3:6a:4c:7c:f8:13:53:4c:14:54:
        a1:52:ff:eb:03:25:89:73:2c:e7:d2:7f:63:32:79:4a
```

Raw Certificate (PEM Format)

```
-----BEGIN CERTIFICATE-----
MIICoDCCAkegAwIBAgIIeCmSYx5SERgwCgYIKoZIzj0EAwIwYzELMAkGA1UEBhMC
SUwxDDAKBgNVBAgMA1RMVjERMA8GA1UEBwwIVGVsIEF2aXYxDDAKBgNVBAoMA1JB
RDELMAkGA1UECwwCUkQxGDAWBgNVBAMMD1JBRFN1YlRlc3RFQ0RTQTAeFw0yNTA0
MjExMDM4MTJaFw0yNjA0MjExMDM4MTJaMHoxCzAJBgNVBAYTAkZSMRYwFAYDVQQI
DA1JbGUtZGUtRnJhbmNlMQ4wDAYDVQQHDAVQYXJpczEOMAwGA1UECgwFNldJTkQx
FDASBgNVBAsMC0NBIERpdmlzaW9uMR0wGwYDVQQDDBQ2V0lORCBUZXN0IEVDRFNB
IFJDQTBZMBMGByqGSM49AgEGCCqGSM49AwEHA0IABAe2MZ214KpDX1qTkcQlq9kV
xFTd87XP8C9n+R/Xw5dzguFzG2tVTuzjJ2vTMTSL7l+Yyzoi/4VkdGeY0e7kJPuj
gc0wgcowRAYIKwYBBQUHAQEEODA2MDQGCCsGAQUFBzABhihodHRwczovL3Bpa2Fj
aHUtY2EuaW90LXJhZC5jb206NDQ0My9vY3NwMEIGA1UdHwQ7MDkwN6A1oDOGMWh0
dHBzOi8vcGlrYWNodS1jYS5pb3QtcmFkLmNvbTo0NDQzL2Rvd25sb2Fkcy9jcmww
```

Download

Pressing the Download Action, download a file containing

1. Required Certificate
2. Intermediate issuer certificate (sub-CA)
3. Root CA certificate

PFX

Download PFX/PKCS#12 bundle secret protected file contains the private key, certificate and intermediate (sub) CA certificate

Can be used to load to windows certification manager

Revoke

Certificate revoking is the process of invalidating a digital certificate before its expiration, ensuring it can no longer be trusted.

Pressing the Revoke Action revoking the certificate and later on adding it to the CRL list

Delete

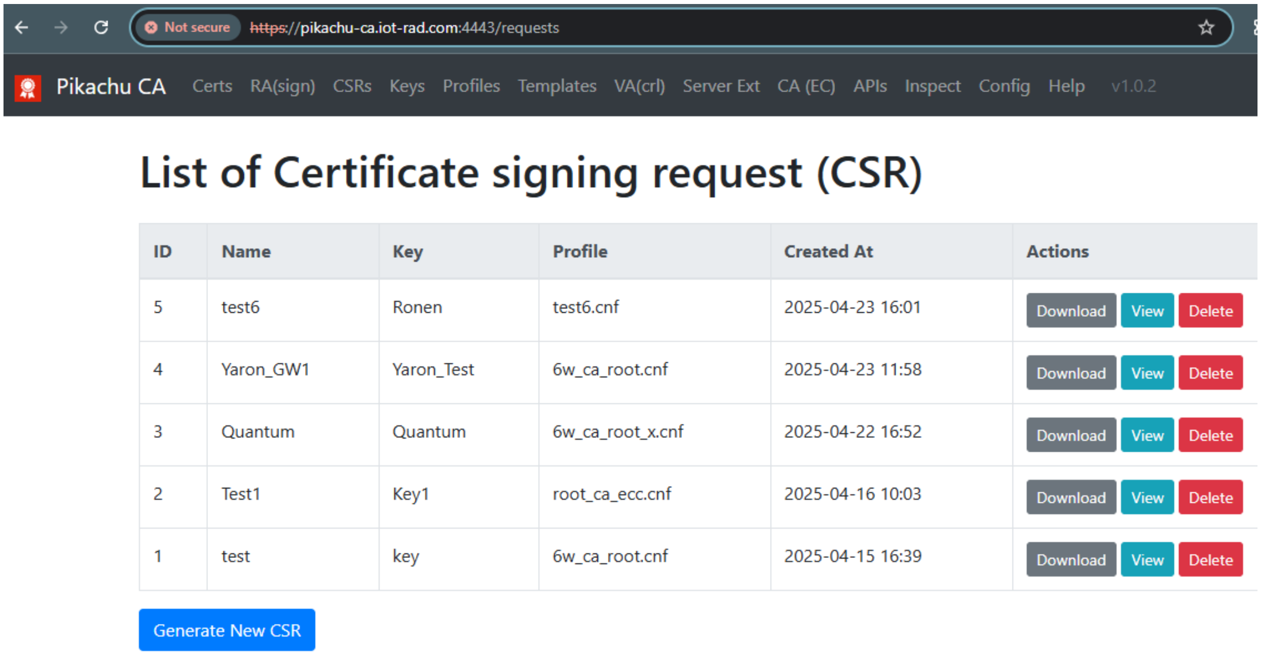
Pressing the Delete Action, Certificate is deleted from DB and form the table

2.11 Certificate Requests

UI

At the main view under management Links select CSR Requests

Redirected to view with list of certificate requests (CSR)



List of Certificate signing request (CSR)

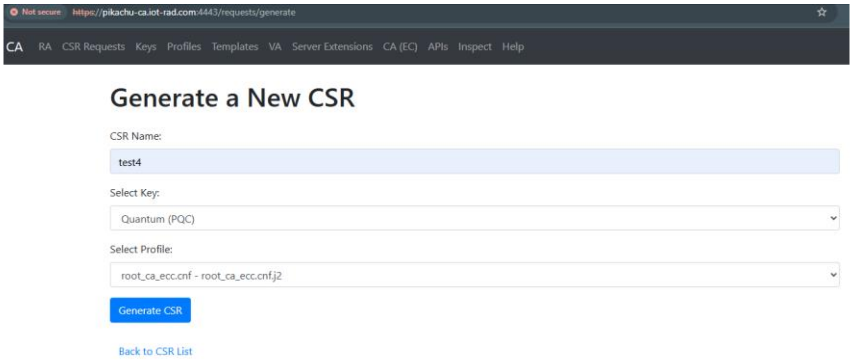
ID	Name	Key	Profile	Created At	Actions
5	test6	Ronen	test6.cnf	2025-04-23 16:01	Download View Delete
4	Yaron_GW1	Yaron_Test	6w_ca_root.cnf	2025-04-23 11:58	Download View Delete
3	Quantum	Quantum	6w_ca_root_x.cnf	2025-04-22 16:52	Download View Delete
2	Test1	Key1	root_ca_ecc.cnf	2025-04-16 10:03	Download View Delete
1	test	key	6w_ca_root.cnf	2025-04-15 16:39	Download View Delete

https://openxpki.iot-rad.com/requests

to generate new CSR press button, Generate New CSR

Redirected to Generate a New CSR

In order to make ne CSR select key from list , enter a Name and select a profile



Generate a New CSR

CSR Name: test4

Select Key: Quantum (PQC)

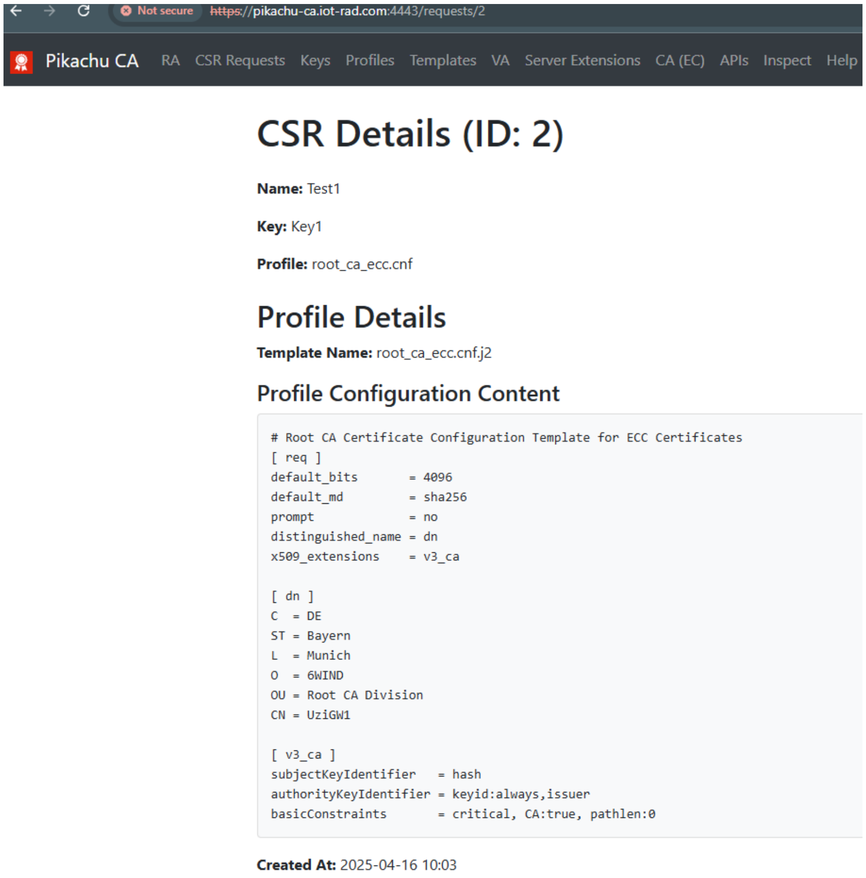
Select Profile: root_ca_ecc.cnf - root_ca_ecc.cnf.j2

https://openxpki.iot-rad.com:4443/requests/generate

press button Generate CSR to generate new one

The view will be redirected to CSR list

Press View at the CSR you wish to see details



CSR Details (ID: 2)

Name: Test1

Key: Key1

Profile: root_ca_ecc.cnf

Profile Details

Template Name: root_ca_ecc.cnf.j2

Profile Configuration Content

```
# Root CA Certificate Configuration Template for ECC Certificates
[ req ]
default_bits       = 4096
default_md         = sha256
prompt             = no
distinguished_name = dn
x509_extensions    = v3_ca

[ dn ]
C  = DE
ST = Bayern
L  = Munich
O  = 6WIND
OU = Root CA Division
CN = UziGW1

[ v3_ca ]
subjectKeyIdentifier   = hash
authorityKeyIdentifier = keyid:always,issuer
basicConstraints       = critical, CA:true, pathlen:0
```

Created At: 2025-04-16 10:03

User can copy the PEM certificate and use for any purpose

Linux

Generate Key

```
openssl genrsa -out client1.key 2048
```

Generate request

prepare configuration to be added to the certificate request

for instance,

```
cat > client1.cnf <<EOL
[ req ]
default_bits        = 2048
default_md          = sha256
distinguished_name = req_distinguished_name
attributes          = req_attrs
prompt              = no

[ req_distinguished_name ]
CN                  = client1.example.com
O                   = My Organization
C                   = US

[ req_attrs ]
challengePassword  = SecretChallenge
EOL
```

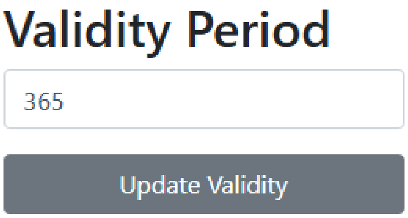
Make the request

```
openssl req -new -key client1.key -config client1.cnf -out client1.csr
```

this request can be used for either UI signing or API based SCEP or EST

2.12 Validity Period

User enrolls Certificate using Validity period (days)



Validity Period

365

Update using “Update Validity” button

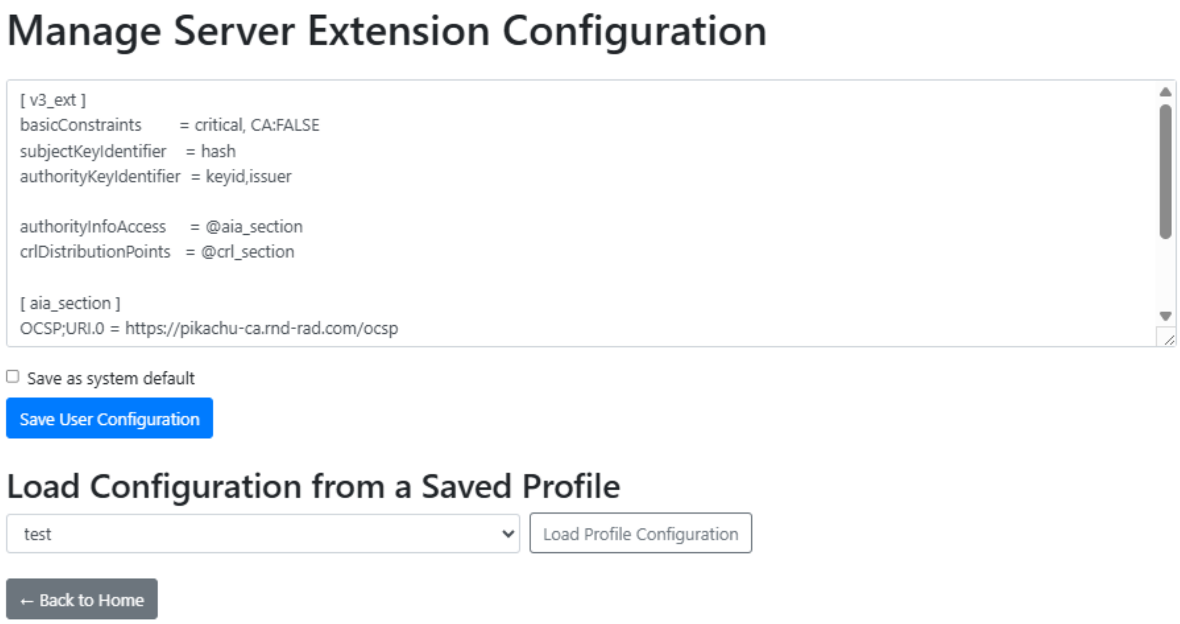
2.13 Server Certificate Extension

Users generate a CSR with custom attributes, but the server may omit, modify, or add attributes before generating the key. Server extension ensure needed X509 extensions are in the signed certificate

Examples:

1. Adding AIA for OCSP
2. Adding URL for CRL retiring
3. Adding URL for CA chain certificate retiring
4. Omit suggested password given by the used for the enrolment but not needed anymore

To Edit the Server extension configuration, press the link “Manage Server Extensions” in a new view Edit and using Save button save the configuration



Manage Server Extension Configuration

```
[ v3_ext ]
basicConstraints       = critical, CA:FALSE
subjectKeyIdentifier    = hash
authorityKeyIdentifier  = keyid,issuer

authorityInfoAccess     = @aia_section
crlDistributionPoints   = @crl_section

[ aia_section ]
OCSP;URI.0 = https://pikachu-ca.rnd-rad.com/ocsp
```

☐ Save as system default

Load Configuration from a Saved Profile

Users can load from existing saved profile containing the [v3_ext] section.

User can save it as its user level extension for all enrolments

User with admin role can save it as the system level server extension.

Using link Back To Home return to main view

Notes :

1. only authorityInfoAccess (AIA) and subjectAltName (SAN) supported .

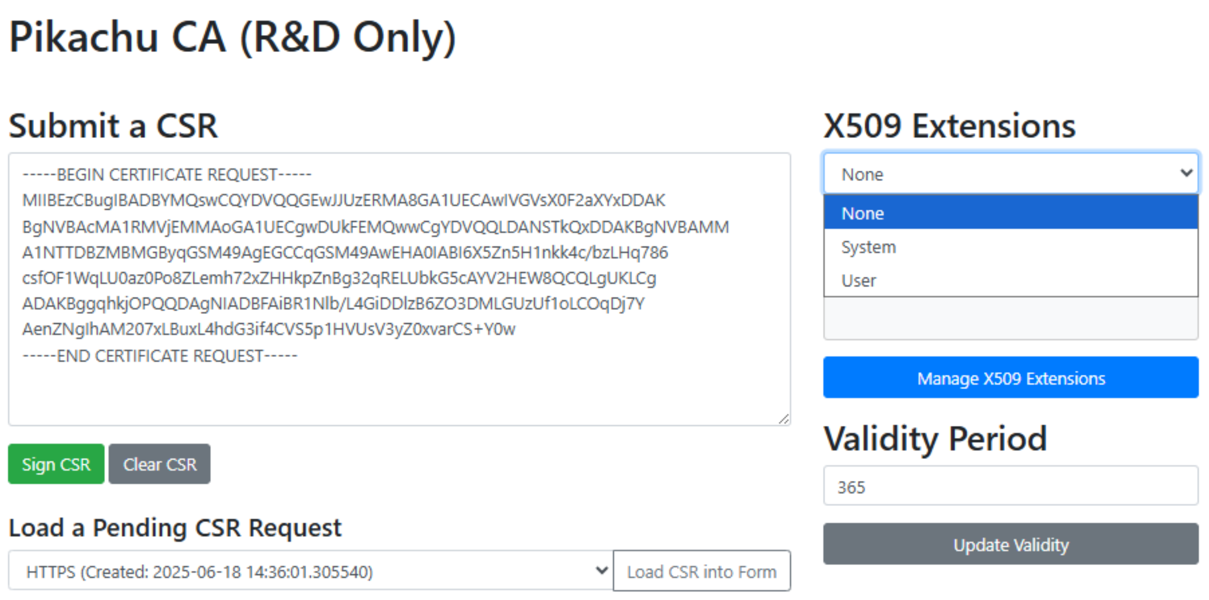
2.14 Enrollment

UI signing

Using the web browser under Submit a CSR past the certificate request content and press Sign CSR button

Users can load existing CSR from the list of Pending CSR Request

Chose server extension , either None , User or System one.



Pikachu CA (R&D Only)

Submit a CSR

```
-----BEGIN CERTIFICATE REQUEST-----
MIIBEzCBugIBADBYMQswCQYDVQQGEwJJUzERMA8GA1UECAwIVGVsX0F2aXYxDDAK
BgNVBAcMA1RMVjEMMAoGA1UECgwDUkFEMQwwCgYDVQQLDANSTkQxDDAKBgNVBAMM
A1NTTDBZMBMGByqGSM49AgEGCCqGSM49AwEHA0IABI6X5Zn5H1nkk4c/bzLHq786
csfOF1WqLU0az0Po8ZLemh72xZHHkpZnBg32qRELUbkG5cAYV2HEW8QCQLgUKLCg
ADAKBggqhkjOPQQDAgNIADBFAiBR1Nlb/L4GiDDlzB6ZO3DMLGUzUf1oLCOqDj7Y
AenZNglhAM207xLBuxL4hdG3if4CVS5p1HVUsV3yZ0xvarCS+Y0w
-----END CERTIFICATE REQUEST-----
```

Load a Pending CSR Request

HTTPS (Created: 2025-06-18 14:36:01.305540)

X509 Extensions

None

Validity Period

365

After signing   the certificate will appear in the issued certificates table below

The table can be filtered by either part of Common Name or Serial values

EST

EST enrollment technology automates certificate issuance by allowing devices to submit CSRs and receive signed certificates over secure channels.

Convert the certificate request

```
openssl req -outform DER -in client1.csr -out client1.csr.der
```

Curl

send the enrolment command using curl

```
curl -k -X POST --data-binary @client1.csr.der \
https://openxpki.iot-rad.com/.well-known/est/simpleenroll \
  -H "Content-Type: application/pkcs10" \
  --output client1.crt.p7
```

For **mTLS** tests use the following curl

```
curl --cert https.crt --key https.key -X POST --data-binary @client1.csr.der\
https://openxpki.iot-rad.com:4443/.well-known/est/simpleenroll \
  -H "Content-Type: application/pkcs10" \
  --output client1.crt.p7
```

Extract the certificate

```
openssl pkcs7 -inform DER -in client1.crt.p7 -print_certs -out client1.crt
```

the certificate added to the UI issues certificates table

tested issued certificate using openssl

```
openssl x509 -in client1.crt  -noout -text
```

Estclient

enroll using command estclient

```
estclient enroll -server pikachu-ca.iot-rad.com -insecure -csr etx.csr -out
etx.crt
```

mTLS enroll using command estclient

```
estclient enroll -server pikachu-ca.iot-rad.com:4443 -cert https.crt -key
https.key -csr etx.csr -out etx.crt
```

SCEP

For SCEP you must provide the CA of either full chain (Root + Sub CA) or only the intimidate one (Sub CA)

send the enrolment command using sscep command (see Complementary section for installing it)

```
sscep enroll -u http://openxpki.iot-rad.com/scep \
-c ca.cert.pem \
-k client1.key \
-r client1.csr \
-l client1.crt
```

Note: to debug sscep command add -d option

the certificate added to the UI issues certificates table

tested issued certificate using openssl

```
openssl x509 -in client1.crt  -noout -text
```

Convert the certificate request

```
openssl req -outform DER -in client1.csr -out client1.csr.der
```

send the enrolment command using curl

```
curl -k -X POST --data-binary @client1.csr.der \
http://openxpki.iot-rad.com/.well-known/est/simpleenroll \
  -H "Content-Type: application/pkcs10" \
  --output client1.crt.p7
```

Extract the certificate

```
openssl pkcs7 -inform DER -in client1.crt.p7 -print_certs -out client1.crt
```

the certificate added to the UI issues certificates table

tested issued certificate using openssl

```
openssl x509 -in client1.crt  -noout -text
```

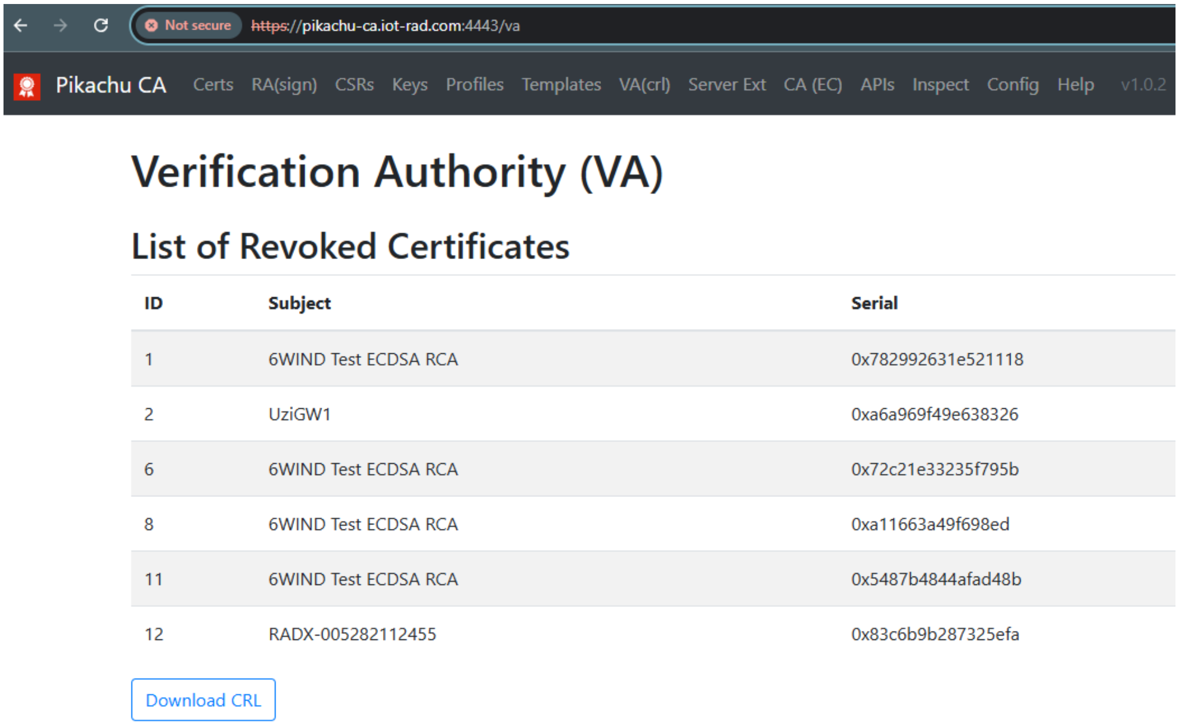
Note: based on GitHub repo https://github.com/mosen/SCEPy

2.15 Verification Authority (VA)

CRL (Certificate Revocation List) is a mechanism for maintaining and distributing a list of digital certificates that have been revoked by a Certificate Authority, ensuring that clients can verify certificate validity.

View

List of revoked certificates



Verification Authority (VA)

List of Revoked Certificates

ID	Subject	Serial
1	6WIND Test ECDSA RCA	0x782992631e521118
2	UziGW1	0xa6a969f49e638326
6	6WIND Test ECDSA RCA	0x72c21e33235f795b
8	6WIND Test ECDSA RCA	0xa11663a49f698ed
11	6WIND Test ECDSA RCA	0x5487b4844afad48b
12	RADX-005282112455	0x83c6b9b287325efa

Download

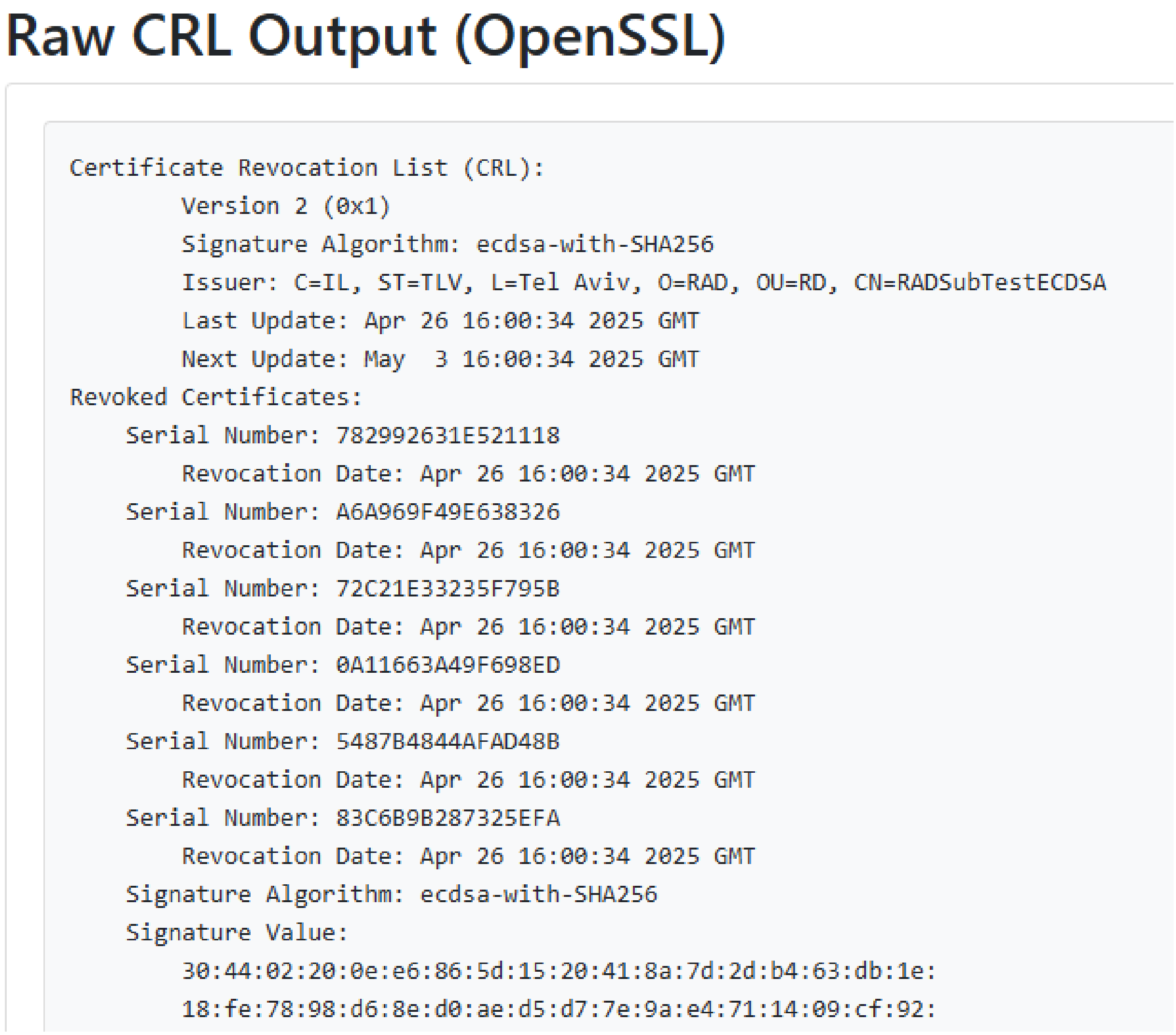
Download the CRL by two methods:

1. Using UI pressing the link Download CRL
2. Using API endpoint

```
curl -k https://openxpki.iot-rad.com:4443/downloads/crl --output crl.pem
```

Inspect

Openssl based info.



Raw CRL Output (OpenSSL)

```
Certificate Revocation List (CRL):
        Version 2 (0x1)
        Signature Algorithm: ecdsa-with-SHA256
        Issuer: C=IL, ST=TLV, L=Tel Aviv, O=RAD, OU=RD, CN=RADSubTestECDSA
        Last Update: Apr 26 16:00:34 2025 GMT
        Next Update: May  3 16:00:34 2025 GMT
Revoked Certificates:
    Serial Number: 782992631E521118
        Revocation Date: Apr 26 16:00:34 2025 GMT
    Serial Number: A6A969F49E638326
        Revocation Date: Apr 26 16:00:34 2025 GMT
    Serial Number: 72C21E33235F795B
        Revocation Date: Apr 26 16:00:34 2025 GMT
    Serial Number: 0A11663A49F698ED
        Revocation Date: Apr 26 16:00:34 2025 GMT
    Serial Number: 5487B4844AFAD48B
        Revocation Date: Apr 26 16:00:34 2025 GMT
    Serial Number: 83C6B9B287325EFA
        Revocation Date: Apr 26 16:00:34 2025 GMT
    Signature Algorithm: ecdsa-with-SHA256
    Signature Value:
        30:44:02:20:0e:e6:86:5d:15:20:41:8a:7d:2d:b4:63:db:1e:
        18:fe:78:98:d6:8e:d0:ae:d5:d7:7e:9a:e4:71:14:09:cf:92:
```

MQTTs with CRL file

Common Server using the CRL file to deny access of client with revoked certification is MQTT broker mosquitto.

MQTT added configuration in mosquitto.conf (see Paragraph 2.2 Insulation / complementary /MQTT Broker

```
crlfile /mosquitto/certs/crl_client_2.pem
```

the MQTT server deny revoked certificates-based connection attempts

The server must be periodically updated with new updated CRL

example adding crl updater to the docker compose

```
  crl-updater:
    image: alpine:latest
    container_name: crl_updater
    volumes:
      - ./mosquitto/certs:/mosquitto/
      - /var/run/docker.sock:/var/run/docker.sock  # So we can signal the
mosquitto container
    # Install curl and bash, then run a loop:
    command: >
      sh -c "apk add --no-cache curl bash &&
      while true; do
         echo 'Downloading new CRL file...';
         curl -k https://openxpki.iot-rad.com:4443/downloads/crl --output
/mosquitto/certs/crl.pem;
         echo 'Triggering Mosquitto to reload its configuration...';
         docker kill --signal=SIGHUP mosquitto;
         echo 'Sleeping for 24 hours before next update...';
         sleep 86400;
      done"
    restart: unless-stopped
```

Note: not tested yet

2.16 CA certificate management

User can retrieve the following CA certificate

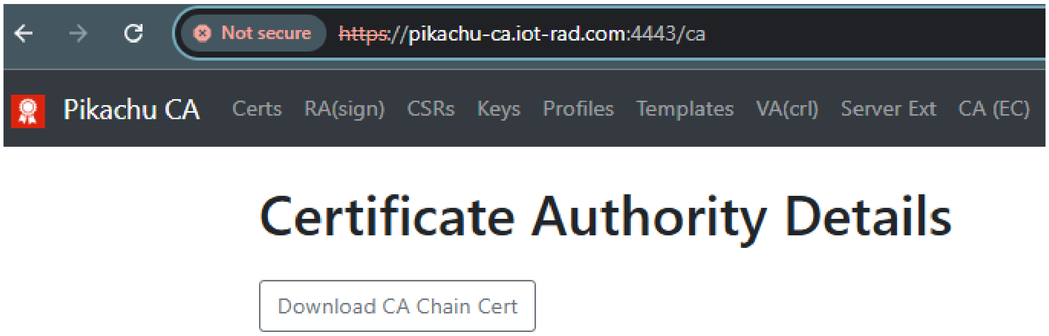
Root CA Certificate:
A trusted self-signed certificate that sits at the top of the certificate hierarchy. It is the anchor of trust used to verify all other certificates in the chain.

Sub CA (Intermediate) Certificate:
A certificate issued by the Root CA (or another intermediate) to delegate signing authority. It acts as a bridge between the Root CA and end-entity (leaf) certificates, improving security and scalability.

Download

Download the CA Chain Certificate by two methods:

1. Using UI pressing the link Download the CA Chain Cert



2. Using API endpoint

```
curl -k https://openxpki.iot-rad.com:4443/downloads/chain --output
ca.chain.pem
```

the ca.chain.pem file can be inspected using openssl

```
openssl x509 -in ca.chain.pem -noout -text
```

View

Pressing the buttons “View Root CA Certificate” and “View Sub CA Certificate” redirect to to view page with all needed Data

Update

Change the configuration file config.ini

```
[CA]
# Which subordinate CA to use by default: "EC" or "RSA"
mode = EC

# Paths for both modes; the get_ca_config() helper below will pick the right
SUBCA_KEY_PATH_EC    = /home/rocky/pki-subca/rad_ca_sub_ec.key
SUBCA_CERT_PATH_EC   = /home/rocky/pki-subca/rad_ca_sub_ec.crt
CHAIN_FILE_PATH_EC   = /home/rocky/pki-subca/rad_chain_ec.crt

SUBCA_KEY_PATH_RSA   = /home/rocky/pki-subca/rad_ca_sub_rsa.key
SUBCA_CERT_PATH_RSA  = /home/rocky/pki-subca/rad_ca_sub_rsa.crt
CHAIN_FILE_PATH_RSA  = /home/rocky/pki-subca/rad_chain_rsa.crt

ROOT_CERT_PATH       = /home/rocky/pki-root/rad_ca_root.crt
[HTTPS]
# HTTPS certificate & key for your main CA UI
ssl_cert = /home/rocky/pki-https/tls.cert.pem
ssl_key  = /home/rocky/pki-https/tls.key.pem
port     = 4443
```

Generate

Below example how to generate all needed CA files

Root CA

Generate Key using type EC and curve prime256v1(secp256r1)

Use root CA request configuration

```
cat > rad_ca_root.cnf <<EOL
# CA Certificate Configuration Template for Root ECC Certificates
[ req ]
# Note: For ECC keys the “default_bits” option is not used.
default_md          = sha256
default_days        = 3650
prompt              = no
distinguished_name = dn
x509_extensions     = v3_ca
default_ec_curve    = prime256v1

[ dn ]
C   = IL
ST = TLV
L   = Tel Aviv
O   = RAD
OU = RD
CN =  RADRootTestECDSA

[ v3_ca ]
subjectKeyIdentifier   = hash
authorityKeyIdentifier = keyid:always,issuer
basicConstraints       = critical, CA:true, pathlen:0
keyUsage               = critical, digitalSignature, keyCertSign, cRLSign
EOL
```

Sign the root by itself

```
openssl req -config rad_ca_root.cnf -key rad_ca_root.key -new -x509 -days
3650 -sha256 -out rad_ca_root.crt
```

Sub CA

Generate Key using type EC and curve prime256v1(secp256r1)

Use sub-CA request configuration

```
cat > rad_ca_sub.cnf <<EOL
# CA Certificate Configuration Template for Subordinate (Intermediate) ECC
Certificates
[ req ]
default_bits       = 2048
default_md         = sha256
prompt             = no
distinguished_name = dn
req_extensions     = v3_intermediate

[ dn ]
C  = IL
ST = TLV
L  = Tel Aviv
O  = RAD
OU = RD
CN = RADSubTestECDSA

[ v3_intermediate ]
subjectKeyIdentifier   = hash
#authorityKeyIdentifier = keyid,issuer
basicConstraints       = critical, CA:true, pathlen:0
keyUsage               = keyCertSign, cRLSign
EOL
```

Prepare the Sub-CA Certificate request

```
openssl req -config rad_ca_sub.cnf -key rad_ca_sub.key -new -out
rad_ca_sub.csr
```

add the Root-CA signing Server extension

```
cat > ca_root_ext.cnf <<EOL
[ v3_intermediate ]
subjectKeyIdentifier   = hash
authorityKeyIdentifier = keyid,issuer
basicConstraints       = critical, CA:true, pathlen:0
keyUsage               = digitalSignature,keyCertSign, cRLSign
crlDistributionPoints  = URI:https://openxpki.iot-rad.com:4443/downloads/crl
EOL
```

Sign the sub-CSR by the root CA

```
openssl x509 -req -in rad_ca_sub.csr -CA rad_ca_root.crt -CAkey
rad_ca_root.key -CAcreateserial -out rad_ca_sub.crt -days 3650 -sha256 -
extfile ca_root_ext.cnf -extensions v3_intermediate
```

this provides the certificates and keys for both root and sub CA.

2.17 Online Certificate Status Protocol (OCSP)

OCSP is A real-time certificate status checking protocol that allows clients to verify whether a digital certificate has been revoked, without downloading the full CRL. OCSP improves performance and bandwidth usage compared to traditional revocation lists.

In order to perform the check the user must have the following files:

1. CA certificate (can be only Sub-CA)
2. Certificate

Check certificate status command ca certificate

```
openssl ocsp -reqout ocsp_request.der \
-CAfile ca.chain.pem \
-issuer ca.cert.pem
-cert client1.crt \
-url http://openxpki.iot-rad.com/ocsp\
-resp_text -respout ocsp_response.der
```

The command stdout return the certificate status

Valid certificate result :

```
Response verify OK
/home/rocky/pki-ocsp/cert_2.pem: good
        This Update: Apr  3 13:15:21 2025 GMT
        Next Update: Apr 10 13:15:21 2025 GMT
```

Revokes certificate result :

```
Response verify OK
/home/rocky/pki-ocsp/cert_revoked.pem: revoked
        This Update: Apr  3 13:15:57 2025 GMT
        Next Update: Apr 10 13:15:57 2025 GMT
        Reason: unspecified
        Revocation Time: Apr  3 13:15:57 2025 GMT
```

the output file ocsp_response.der contains the status as well

command

```
openssl ocsp -respin ocsp_response.der -text -noverify
```

stdout

```
OCSP Response Data:
    OCSP Response Status: successful (0x0)
    Response Type: Basic OCSP Response
    Version: 1 (0x0)
    Responder Id: 9DB644062A4D85759C46D1C4215F4DB7C345149D
    Produced At: Apr  3 10:58:10 2025 GMT
    Responses:
    Certificate ID:
      Hash Algorithm: sha1
      Issuer Name Hash: 616FC051FA23823B80B63EDD49EBFE18F4FB4E77
      Issuer Key Hash: 9DB644062A4D85759C46D1C4215F4DB7C345149D
      Serial Number: 0DCD62C3C11C144DD8AA313FF654067D3F413E5F
    Cert Status: revoked
    Revocation Time: Apr  3 10:58:10 2025 GMT
    Revocation Reason: unspecified (0x0)
    This Update: Apr  3 10:58:10 2025 GMT
    Next Update: Apr 10 10:58:10 2025 GMT
```

The support OCSP multi certificates checks in one request

Return OCSP response if certificate is unknown to the OCSP CA responder

Certificate based Servers using OCSP

In order for TLS based Servers to use OCSP the information of the URL to check must be embedded within the Certificate itself.

OCSP requires authorityInfoAccess (AIA)

Adding attributes by following paragraph 2.5 Server Certificate Extension

Some TLS servers like HAProxy only have mode configuration attribute the URL is taken from the certificate attributes.

2.18 Post-Quantum Keys

Users can issue certificate using stronger Keys algorithms

Prerequisite to do so is to add new provider (extension to openssl command)

Check if Quantum safe keys extension oqsprovider Is activated using the following command:

```
#run command
openssl list -providers
#output
Providers:
  default
    name: OpenSSL Default Provider
    version: 3.2.2
    status: active
  oqsprovider
    name: OpenSSL OQS Provider
    version: 0.8.1-dev
    status: active
```

Generate key

```
openssl genpkey -algorithm mldsa44 -provider oqsprovider -out client1.key
```

checking all possible algorithms for the oqsprovider provider with the command:

```
openssl list -public-key-algorithms -provider oqsprovider
```

Generate request

prepare configuration to be added to the certificate request

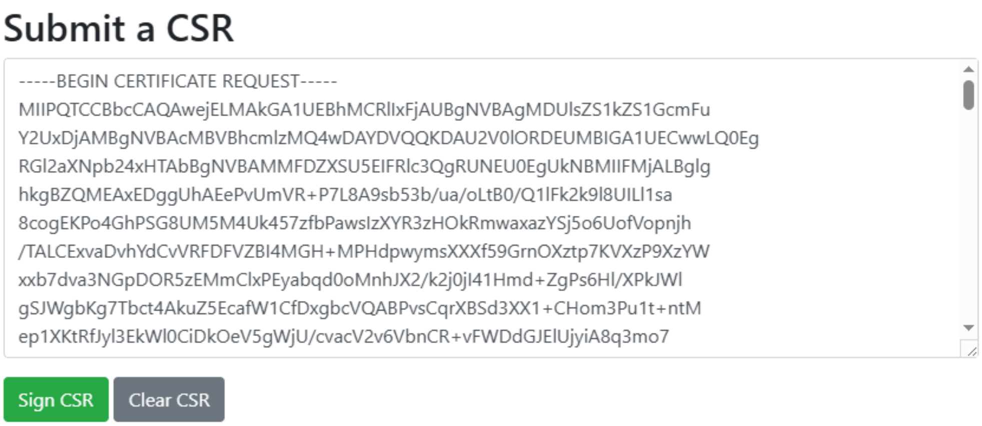
for instance,

```
cat > client1.cnf <<EOL
[ req ]
default_bits       = 2048
default_md         = sha256
distinguished_name = req_distinguished_name
attributes         = req_attrs
prompt             = no

[ req_distinguished_name ]
CN                 = client1.example.com
O                  = My Organization
C                  = US

[ req_attrs ]
challengePassword  = SecretChallenge
EOL
```

Make the request

```
openssl req -new -key client1.key -config client1.cnf -out client1.csr
```

using UI

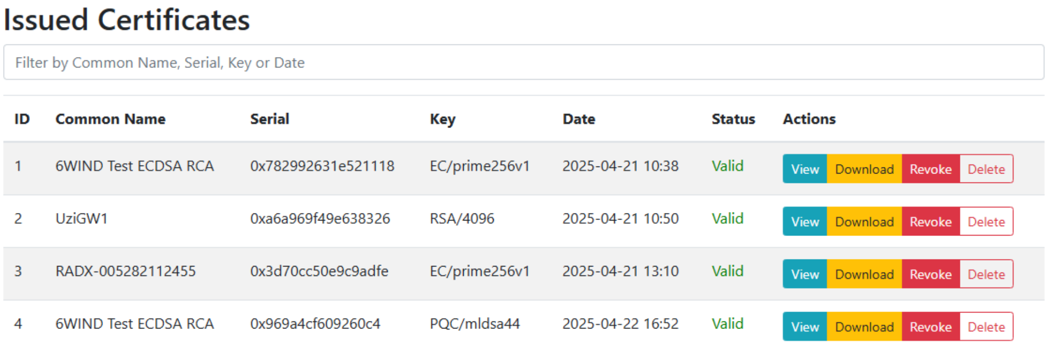


Submit a CSR

```
-----BEGIN CERTIFICATE REQUEST-----
MIIPQTCCBbcCAQAwejELMAkGA1UEBhMCRlIxFjAUBgNVBAgMDUlsZS1kZS1GcmFu
Y2UxDjAMBgNVBAcMBVBhcmlzMQ4wDAYDVQQKDAU2V0lORDEUMBIGA1UECwwLQ0Eg
RGl2aXNpb24xHTAbBgNVBAMMFDZXSU5EIFRlc3QgRUNEU0EgUkNBMIIFMjALBglg
hkgBZQMEAxEDggUhAEePvUmVR+P7L8A9sb53b/ua/oLtB0/Q1lFk2k9l8UILl1sa
8cogEKPo4GhPSG8UM5M4Uk457zfbPawsIzXYR3zHOkRmwaxazYSj5o6UofVopnjh
/TALCExvaDvhYdCvVRFDFVZBI4MGH+MPHdpwymsXXXf59GrnOXztp7KVXzP9XzYW
xxb7dva3NGpDOR5zEMmClxPEyabqd0oMnhJX2/k2j0jI41Hmd+ZgPs6Hl/XPkJWl
gSJWgbKg7Tbct4AkuZ5EcafW1CfDxgbcVQABPvsCqrXBSd3XX1+CHom3Pu1t+ntM
ep1XKtRfJyl3EkWl0CiDkOeV5gWjU/cvacV2v6VbnCR+vFWDdGJElUjyiA8q3mo7
```

Note: the 2.5 Enrollment using UI can’t be used for this operation, code is based on python libraries whereas quantum safe signing is based on OS openssl in the python code.

After signing the certificate will appear in the issued certificates table bellow



Issued Certificates

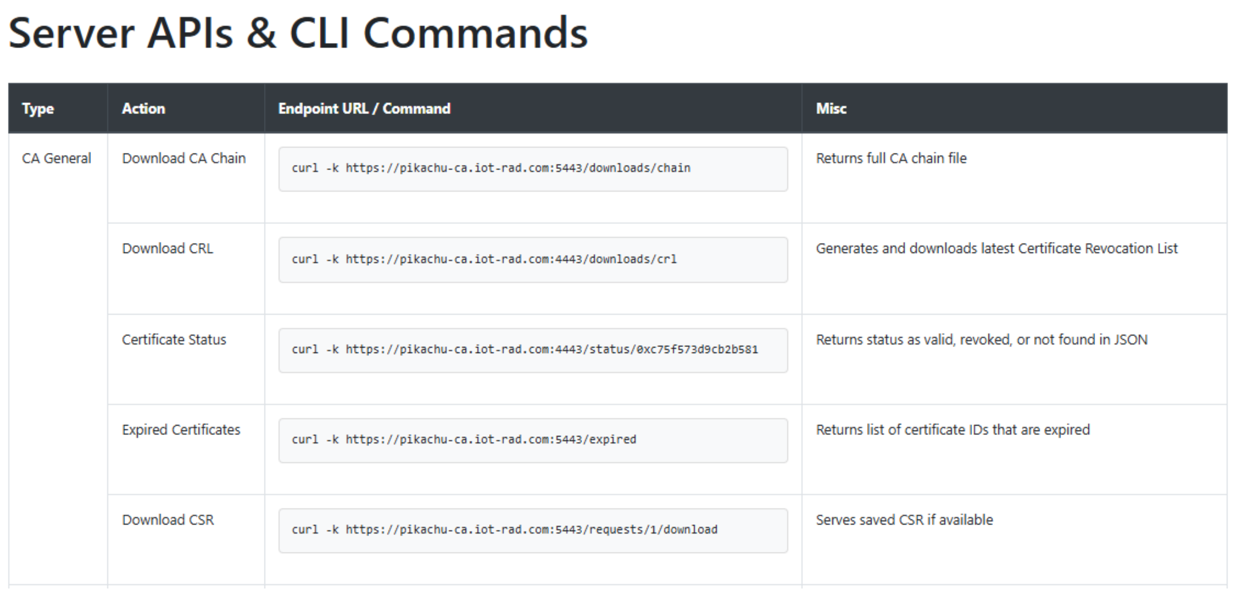
Filter by Common Name, Serial, Key or Date

ID	Common Name	Serial	Key	Date	Status	Actions
1	6WIND Test ECDSA RCA	0x782992631e521118	EC/prime256v1	2025-04-21 10:38	Valid	View Download Revoke Delete
2	UziGW1	0xa6a969f49e638326	RSA/4096	2025-04-21 10:50	Valid	View Download Revoke Delete
3	RADX-005282112455	0x3d70cc50e9c9adfe	EC/prime256v1	2025-04-21 13:10	Valid	View Download Revoke Delete
4	6WIND Test ECDSA RCA	0x969a4cf609260c4	PQC/mldsa44	2025-04-22 16:52	Valid	View Download Revoke Delete

2.19 APIs

List of supported server APIs

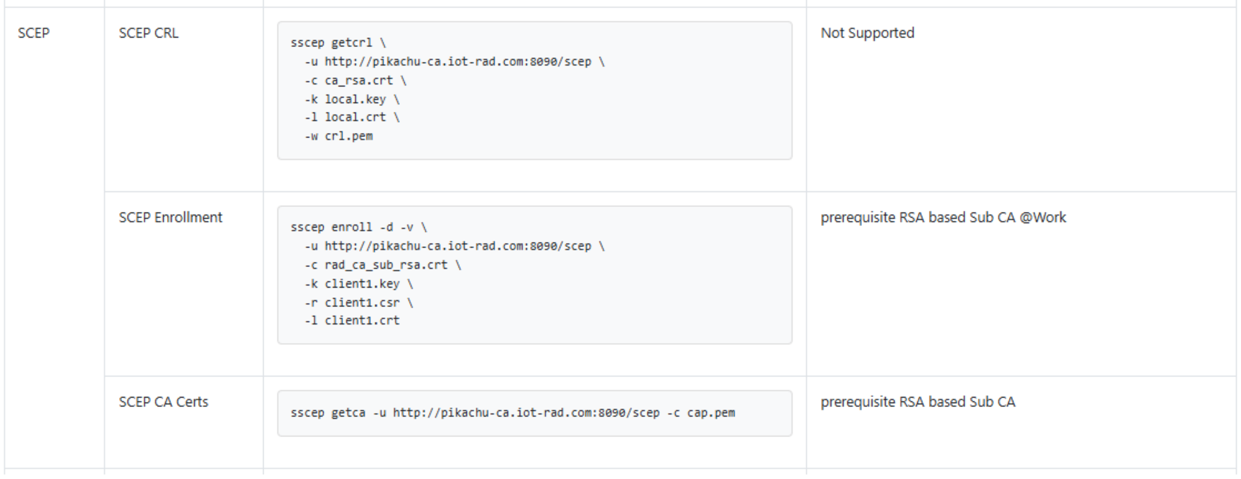
General Server APIs



Server APIs & CLI Commands

Type	Action	Endpoint URL / Command	Misc
CA General	Download CA Chain	`curl -k https://pikachu-ca.iot-rad.com:5443/downloads/chain`	Returns full CA chain file
	Download CRL	`curl -k https://pikachu-ca.iot-rad.com:4443/downloads/crl`	Generates and downloads latest Certificate Revocation List
	Certificate Status	`curl -k https://pikachu-ca.iot-rad.com:4443/status/0xc75f573d9cb2b581`	Returns status as valid, revoked, or not found in JSON
	Expired Certificates	`curl -k https://pikachu-ca.iot-rad.com:5443/expired`	Returns list of certificate IDs that are expired
	Download CSR	`curl -k https://pikachu-ca.iot-rad.com:5443/requests/1/download`	Serves saved CSR if available

SCEP supported APIs



SCEP	SCEP CRL	`sscep getcrl \`
		`-u http://pikachu-ca.iot-rad.com:8090/scep \`
		`-c ca_rsa.crt \`
		`-k local.key \`
		`-l local.crt \`
		`-w crl.pem`
			Not Supported

	SCEP Enrollment	`sscep enroll -d -v \`
		`-u http://pikachu-ca.iot-rad.com:8090/scep \`
		`-c rad_ca_sub_rsa.crt \`
		`-k client1.key \`
		`-r client1.csr \`
		`-l client1.crt`
			prerequisite RSA based Sub CA @Work

	SCEP CA Certs	`sscep getca -u http://pikachu-ca.iot-rad.com:8090/scep -c cap.pem`	prerequisite RSA based Sub CA

EST supporting Apis (curl and estclient)

EST	EST Enrollment	`curl -k -X POST \`
		`  --data-binary @etx.csr.der \`
		`  https://pikachu-ca.iot-rad.com:4443/.well-known/est/simpleenroll \`
		`  -H "Content-Type: application/pkcs10" \`
		`  --output etx.crt.p7`
		
		`estclient enroll \`
		`  -server pikachu-ca.iot-rad.com:4443 \`
		`  -insecure \`
		`  -csr etx.csr \`
		`  -out etx.crt`
			Using curl accepts DER CSR and returns signed cert in PKCS#7

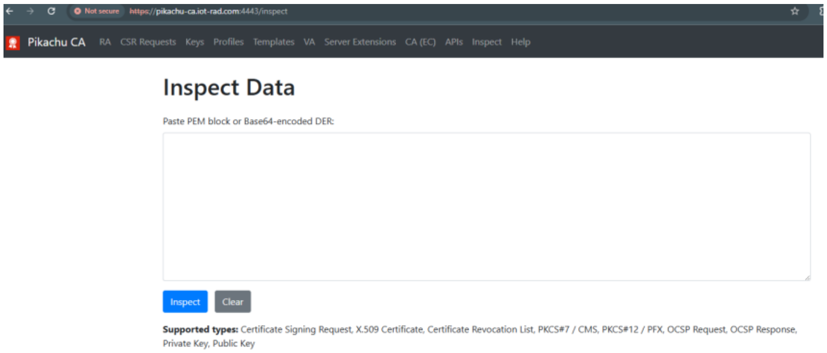
	EST CA Certs	`curl -k \`
		`  https://pikachu-ca.iot-rad.com:4443/.well-known/est/cacerts \`
		`  --output chain.crt`
		
		`estclient cacerts \`
		`  -server pikachu-ca.iot-rad.com:4443 \`
		`  -insecure \`
		`  -out ca.pem`
			Returns CA chain in PKCS#7 format

OCSP supporting API

OCSP	OCSP Responder	`openssl ocsp \`
		`  -reqout ocsp_request.der \`
		`  -issuer rad_ca_sub.crt \`
		`  -cert valid.crt \`
		`  -url https://pikachu-ca.iot-rad.com:4443/ocsp \`
		`  -resp_text \`
		`  -respout ocsp_response.der`
			Returns OCSP status in DER format

2.20 Inspect

User can inspect any PEM block or Base64-encoded DER data



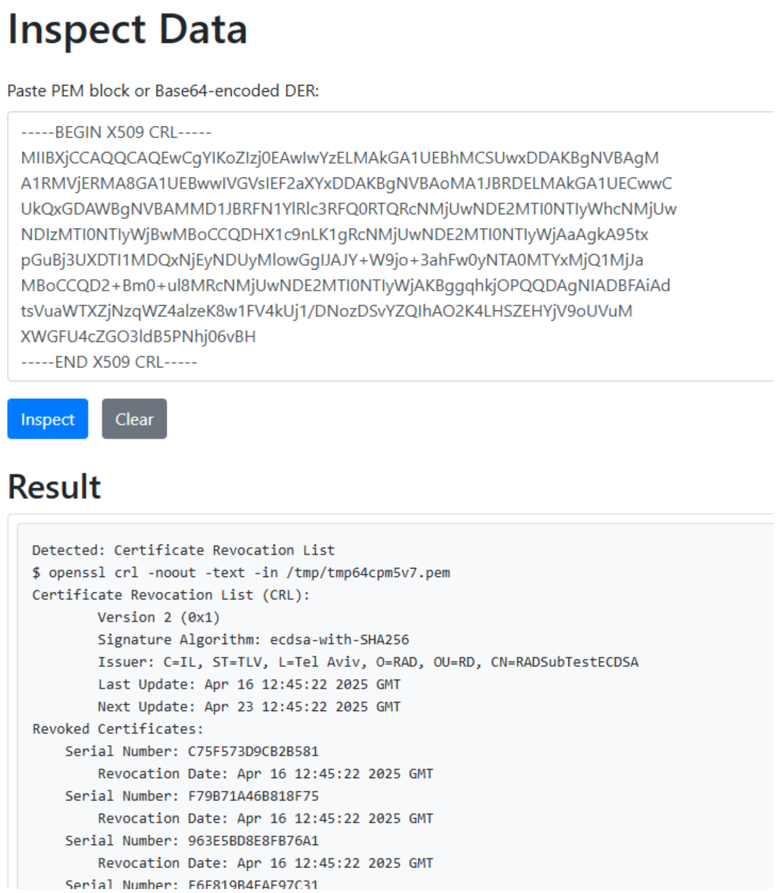
Inspect Data

Paste PEM block or Base64-encoded DER:

Supported types: Certificate Signing Request, X.509 Certificate, Certificate Revocation List, PKCS#7 / CMS, PKCS#12 / PFX, OCSP Request, OCSP Response, Private Key, Public Key

Supported types: Certificate Signing Request, X.509 Certificate, Certificate Revocation List, PKCS#7 / CMS, PKCS#12 / PFX, OCSP Request, OCSP Response, Private Key, Public Key

Inspect provides the designated openssl view stdout



Inspect Data

Paste PEM block or Base64-encoded DER:

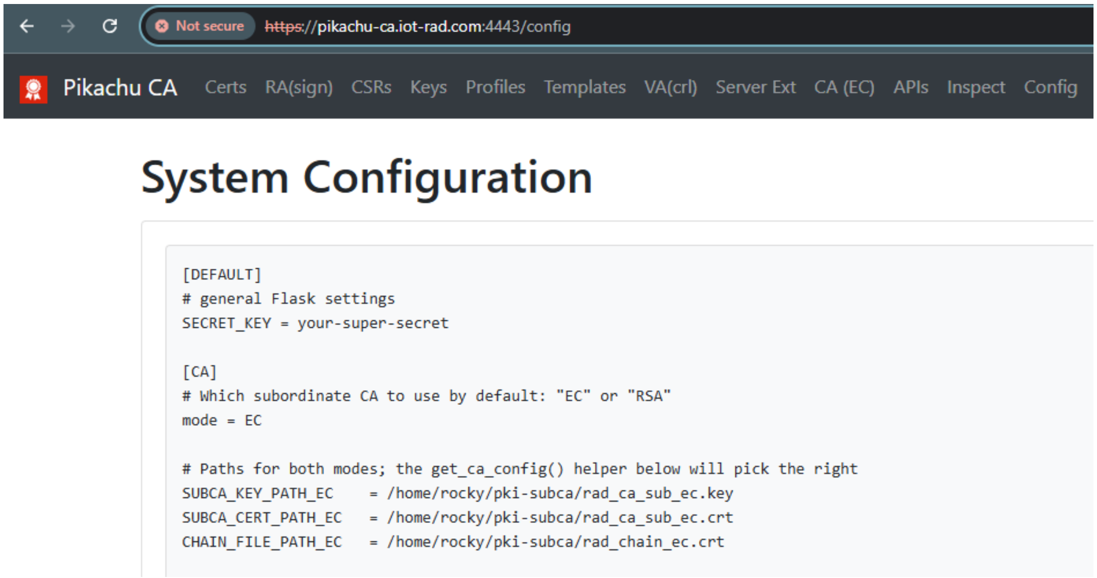
```
-----BEGIN X509 CRL-----
MIIBXjCCAQQCAQEwCgYIKoZIzj0EAwIwYzELMAkGA1UEBhMCSUwxDDAKBgNVBAgM
A1RMVjERMA8GA1UEBwwIVGVsIEF2aXYxDDAKBgNVBAoMA1JBRDELMAkGA1UECwwC
UkQxGDAWBgNVBAMMD1JBRFN1YlRlc3RFQ0RTQRcNMjUwNDE2MTI0NTIyWhcNMjUw
NDIzMTI0NTIyWjBwMBoCCQDHX1c9nLK1gRcNMjUwNDE2MTI0NTIyWjAaAgkA95tx
pGuBj3UXDTI1MDQxNjEyNDUyMlowGgIJAJY+W9jo+3ahFw0yNTA0MTYxMjQ1MjJa
MBoCCQD2+Bm0+ul8MRcNMjUwNDE2MTI0NTIyWjAKBggqhkjOPQQDAgNIADBFAiAd
tsVuaWTXZjNzqWZ4alzeK8w1FV4kUj1/DNozDSvYZQIhAO2K4LHSZEHYjV9oUVuM
XWGFU4cZGO3ldB5PNhj06vBH
-----END X509 CRL-----
```

Result

```
Detected: Certificate Revocation List
$ openssl crl -noout -text -in /tmp/tmp64cpm5v7.pem
Certificate Revocation List (CRL):
        Version 2 (0x1)
        Signature Algorithm: ecdsa-with-SHA256
        Issuer: C=IL, ST=TLV, L=Tel Aviv, O=RAD, OU=RD, CN=RADSubTestECDSA
        Last Update: Apr 16 12:45:22 2025 GMT
        Next Update: Apr 23 12:45:22 2025 GMT
Revoked Certificates:
    Serial Number: C75F573D9CB2B581
        Revocation Date: Apr 16 12:45:22 2025 GMT
    Serial Number: F79B71A46B818F75
        Revocation Date: Apr 16 12:45:22 2025 GMT
    Serial Number: 963E5BD8E8FB76A1
        Revocation Date: Apr 16 12:45:22 2025 GMT
    Serial Number: F6F819B4FAF97C31
```

2.21 Config

Config Navigation Tab shows the server current configuration, secret protected

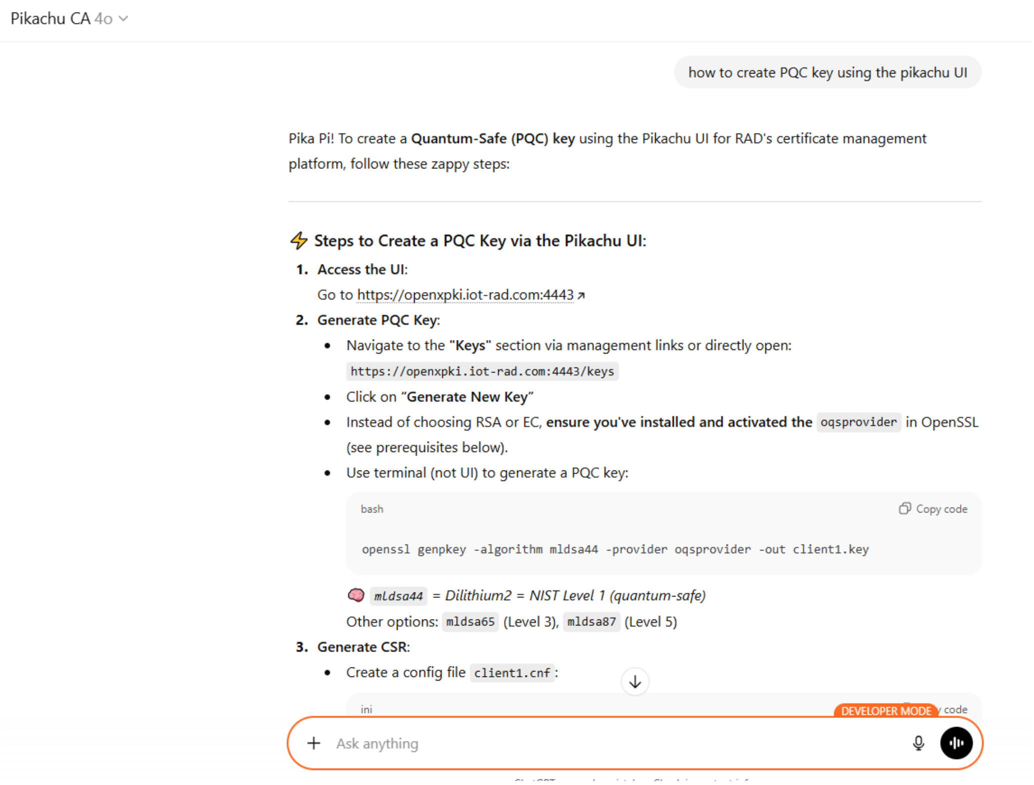


System Configuration

```
[DEFAULT]
# general Flask settings
SECRET_KEY = your-super-secret

[CA]
# Which subordinate CA to use by default: "EC" or "RSA"
mode = EC

# Paths for both modes; the get_ca_config() helper below will pick the right
SUBCA_KEY_PATH_EC    = /home/rocky/pki-subca/rad_ca_sub_ec.key
SUBCA_CERT_PATH_EC   = /home/rocky/pki-subca/rad_ca_sub_ec.crt
CHAIN_FILE_PATH_EC   = /home/rocky/pki-subca/rad_chain_ec.crt
```

2.22 ChatPikachu

ChatPGT PGT related to the CA server features and capabilities



how to create PQC key using the pikachu UI

Pika Pi! To create a **Quantum-Safe (PQC) key** using the Pikachu UI for RAD's certificate management platform, follow these zappy steps:

⚡ **Steps to Create a PQC Key via the Pikachu UI:**

1. **Access the UI:**
   Go to https://openxpki.iot-rad.com:4443 ↗
2. **Generate PQC Key:**
   - Navigate to the "**Keys**" section via management links or directly open: `https://openxpki.iot-rad.com:4443/keys`
   - Click on "**Generate New Key**"
   - Instead of choosing RSA or EC, **ensure you've installed and activated the** `oqsprovider` in OpenSSL (see prerequisites below).
   - Use terminal (not UI) to generate a PQC key:

     ```bash
     openssl genpkey -algorithm mldsa44 -provider oqsprovider -out client1.key
     ```

     🧠 `mldsa44` *= Dilithium2 = NIST Level 1 (quantum-safe)*
     Other options: `mldsa65` (Level 3), `mldsa87` (Level 5)
3. **Generate CSR:**
   - Create a config file `client1.cnf`:

     ini

2.23 Help

PDF format of this word document

Company Confidential

PKI Hands-On 1.04

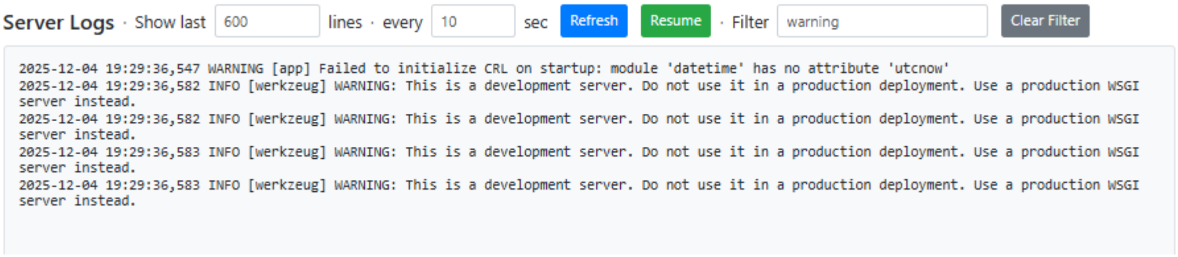
Last updated	19-Nov-2025
Doc. version	1.04
Doc. owner	Uzi Golan
Approved by	
Customer	R&D
Project or installation name	
Project number	
Solution name	Choose an item.
RAD products and versions included	
Content type	
Keywords	

2.24 Logs

Show the server logs

Configured display:

1. Show number Last Lines, default 600 lines
2. Refresh by demand or every number of seconds, default 60 seconds.
3. Pause / Resume button
4. Filtering by text



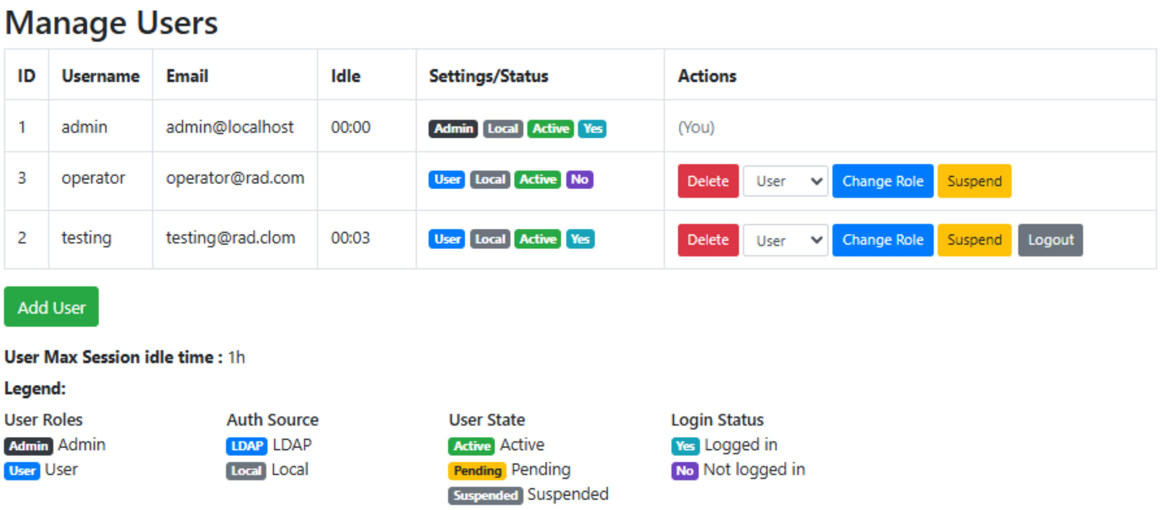
Server Logs · Show last 600 lines · every 10 sec Refresh Resume · Filter warning Clear Filter

```
2025-12-04 19:29:36,547 WARNING [app] Failed to initialize CRL on startup: module 'datetime' has no attribute 'utcnow'
2025-12-04 19:29:36,582 INFO [werkzeug] WARNING: This is a development server. Do not use it in a production deployment. Use a production WSGI
server instead.
2025-12-04 19:29:36,582 INFO [werkzeug] WARNING: This is a development server. Do not use it in a production deployment. Use a production WSGI
server instead.
2025-12-04 19:29:36,583 INFO [werkzeug] WARNING: This is a development server. Do not use it in a production deployment. Use a production WSGI
server instead.
2025-12-04 19:29:36,583 INFO [werkzeug] WARNING: This is a development server. Do not use it in a production deployment. Use a production WSGI
server instead.
```

2.25 Users

Users with admin roles can manage users

Manage Users display:



Manage Users

ID	Username	Email	Idle	Settings/Status	Actions
1	admin	admin@localhost	00:00	Admin Local Active Yes	(You)
3	operator	operator@rad.com		User Local Active No	Delete User Change Role Suspend
2	testing	testing@rad.clom	00:03	User Local Active Yes	Delete User Change Role Suspend Logout

Add User

User Max Session idle time : 1h

Legend:

User Roles	Auth Source	User State	Login Status
Admin Admin	LDAP LDAP	Active Active	Yes Logged in
User User	Local Local	Pending Pending	No Not logged in
		Suspended Suspended	

. Overview

The Manage Users page allows administrators to view, configure, and control all user accounts in the system. This includes editing user roles, authentication sources, status settings, and performing administrative actions such as suspending, logging out, or deleting accounts.

Users Table Overview

1. ID - Internal numeric identifier for the user.
2. Username - The name the user uses to log in.
3. Email - The assigned email address for the user.
4. Idle - How long the user has been idle in their current session.
5. Settings/Status - Displays role, authentication source, state, and login status.
6. Actions - Administrative controls available for each user.

Settings / Status Indicators

1. User Roles
   - Admin – Full administrative privileges.
   - User – Standard limited-permission account.
2. Authentication Source
   - Local – Account stored in the local system.
   - LDAP – Account authenticated via an external LDAP directory.
3. User State
   - Active – User can log in normally.
   - Pending – User account awaits approval or activation.
   - Suspended – User cannot log in until reactivated.
4. Login Status
   - Yes – User is logged in.
   - No – User is not logged in.

5. Actions

   • Delete – Permanently removes the user account.

   • Change Role – Switches a user's role between Admin and User.

   • Suspend – Temporarily disables user login.

   • Logout – Forces the user to log out (only available for logged-in users).

   • (You) – Indicates the current user; some actions cannot be performed on oneself.

6. Add User

   The Add User button creates a new account. Administrators can enter a username, email, authentication type, and role.

7. User Max Session Idle Time

   This field displays the maximum duration a user can remain idle before being automatically logged out.

8. Legend

The legend explains all label colors and meanings, including user roles, authentication sources, account states, and login indicators.

Change History

Date of Issue	Revision	Author	Responsible	Change Summary	Page Count
8-Apr-2025	1.0.0	Uzi G.		Document baseline	42
16-Apr-2025	1.0.1	Uzi G.		Update UI, CA details, Validity time manage	43
23-Apr-2025	1.0.2	Uzi G.		Update UI, New Navigate tabs. configuration based	52
18-Jun-2025	1.0.3	Uzi G.		Add manufacture certificate URL end point, Add generation of root and sub certificate procedure	57
19-Nov-2025	1.0.4	Uzi G.		OCSP tested with mocana stack, added secret protection for various commands, added PFX format, create profiles without templates by editing	64
4-Dec-2025	2.0.0	Uzi G.		Fix SCEP , add Multitenancy , fix bugs	66