



# **eduPKI Trust Profile for eduroam® Certificates**

Version 1.4

05.02.2016

## **Abstract**

This is the eduPKI Trust Profile for eduroam® Certificates specifying the minimum requirements of eduroam® in regards to digital Certificates and associated identity assertions used within eduroam®.

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Creation and maintenance of this document has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 691567 (GN4-1).

## Change History

<b>Version</b>	<b>Author</b>	<b>Date</b>	<b>Changes</b>
1.0	MS	10.12.2010	Init
1.1	MS	19.04.2011	Section 8, updated audit requirements
1.2	MS	23.01.2012	Section 5.7, rephrased the requirement to invalidate issued certificates Section 4.9, updated requirement to check revocation status of certificates by RPs
1.3	RKM	17.06.2013	Minimal editorial changes due to the transition from GN3 to GN3Plus
1.4	RKM	05.02.2016	Transition from GN3 to GN4 incl. new CD

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# 1 Introduction

## 1.1 Overview

This eduPKI Trust Profile (TP) document defines the requirements on PKIs issuing public key digital Certificates to RADIUS/TLS nodes participating in eduroam®.

This TP is formatted according to RFC 3647 [RFC3647].

Within this document the words 'MUST', 'MUST NOT', 'REQUIRED', 'SHALL', 'SHALL NOT', 'SHOULD', 'SHOULD NOT', 'RECOMMENDED', 'MAY', 'OPTIONAL' are to be interpreted as in RFC 2119 [RFC2119].

## 1.2 Document name and identification

This document is the *eduPKI Trust Profile for eduroam® Certificates* version 1.4. It is identified by the following Object Identifier (OID):

1.3.6.1.4.1.27262.1.13.1.1.1.4

The OID is constructed as follows:

ISO assigned OIDs	1
ISO Identified Organization	3
US Department of Defense	6
Internet	1
Internet Private	4
IANA-registered Private Enterprises	1
GEANT Ltd.	27262
GÉANT	1
eduPKI	13
eduPKI Trust Profiles	1
eduPKI Trust Profile for eduroam® Certificates	1
Major Version	1
Minor Version	4

### **1.3 PKI participants**

This TP affects Certification Authorities (CAs) issuing Certificates to RADIUS/TLS servers within GÉANT's eduroam® service.

The Subscribers of these CAs are organisations operating RADIUS Service Providers and RADIUS Identity Providers within eduroam®.

The Relying Parties (RPs) are RADIUS/TLS servers and their operators connecting to eduroam® RADIUS/TLS servers operated by the Subscribers.

This TP does not deal with Public Key Infrastructures (PKIs) used to authenticate RADIUS servers to 802.1x supplicants or vice versa.

### **1.4 Certificate Usage**

No stipulation.

### **1.5 eduPKI Trust Profile administration**

This TP is maintained by the eduPKI Policy Management Authority (eduPKI PMA).

The eduPKI PMA may be contacted by email at [pma@edupki.org](mailto:pma@edupki.org). Further information about the eduPKI PMA is available at its web-site [www.edupki.org](http://www.edupki.org).

Suitability of a CA's policy documents for this TP is collectively determined by the eduPKI PMA in accordance with the GÉANT eduPKI CA Accreditation Process [CA-ACC-PROC].

A CA applying for accreditation under this TP MUST deliver its Certificate Policy (CP) and Certification Practice Statement (CPS) to the eduPKI PMA.

The eduPKI PMA SHALL evaluate the CP and CPS for its compliance with this TP. In case of any discrepancies, the eduPKI PMA MAY propose changes to the CA's procedures or other measures to reach the compliance. When all stipulations of this TP are satisfied to the best knowledge of the eduPKI PMA, the eduPKI PMA SHALL inform the CA that it has been accredited to issue Certificates under this TP.

The eduPKI PMA MAY at its own discretion refuse to process any CA application.

The eduPKI PMA MAY at its own discretion require a compliance audit of any applying or accredited CA.

## **1.6 Definitions and acronyms**

### **Certification Authority (CA)**

A Certification Authority issues X.509 Certificates and publishes revocation and status information about the issued Certificates.

### **Conforming CA**

A Certification Authority acting in compliance with this Trust Profile.

### **eduroam®**

A Federation of organizations mutually providing their users access to the Internet connectivity.

### **eduroam® Service Provider**

A RADIUS/TLS server operated by a network visited by a user registered within a different network

### **eduroam® Identity Provider**

A RADIUS/TLS server operated by the network managing an account for a user visiting a different network

### **OCSP**

The Online Certificate Status Protocol as defined by IETF in RFC 2560 [RFC2560]

### **RADIUS/TLS**

RADIUS over TLS; a protocol defined by IETF in "TLS encryption for RADIUS" [RFC6614]

### **eduPKI Trust Profile (TP)**

Definition of minimum requirements of a GÉANT Service in regards to the quality of identity assertions and vetting procedures as well as the supporting assertion infrastructure.

Definitions and acronyms are also available in an online glossary [GLOSSARY].

## 2 Publication and repository responsibilities

A Conforming CA SHALL make publicly available information needed for using its services, namely:

- the issuing CA Certificate and all Certificates required to verify an end-entity Certificate chain up to a self-signed root;
- the current Certificate Revocation List (CRL) issued by the issuing CA and all CRLs required to verify all Certificates in the end-entity Certificate chain;
- the CP and CPS documents;
- an official email address for inquiries and fault reporting.

The information SHALL be published in the CA's official repository as well as in the TERENA Academic CA Repository (TACAR) which is used as the eduPKI Trust Anchor Repository.



## **3 Identification and authentication**

### **3.1 Naming**

A Conforming CA SHALL assign each RADIUS/TLS service a unique Subject Name. The Subject Name MUST be a valid X.500 Distinguished Name.

Any Subject Name MUST be assigned to one and only one RADIUS/TLS service instance and MUST never be assigned to a different service.

Certificates issued under this TP MUST contain fully qualified domain name(s) of the RADIUS/TLS server included as *dnsName* in the *SubjectAltName* extension.

Certificates issued under this TP MAY contain IP address(es) of the RADIUS/TLS server included as *iPAddress* in the *SubjectAltName* extension.

Certificates issued under this TP MAY contain one or more email address(es) of the RADIUS service administrator included as *rfc822Name* in the *SubjectAltName* extension.

All names SHALL be interpreted as defined in RFC 5280 [RFC5280].

### **3.2 Initial identity validation**

A Conforming CA MUST verify that the Requester is authorised to use all names contained in the requested Certificate under this TP.

A Requester SHALL be identified by his/her email address verified and asserted by the corresponding eduroam® National Roaming Operator.

A Requester MUST prove to the CA its entitlement to operate a RADIUS/TLS service participating in eduroam®. The entitlement MUST be approved by the eduroam® National Roaming Operator pertinent to the RADIUS/TLS service.

### **3.3 Identification and authentication for re-key requests**

A Conforming CA SHALL NOT support Certificate re-keying. Any application for a Certificate renewal of any kind is treated like an initial Certificate Application.

### **3.4 Identification and authentication for revocation request**

Requests for Certificate revocation made by Subscribers, Registration Authorities (RAs), and the CA MUST be properly authenticated. Other entities MAY request Certificate revocation if they can prove compromise or exposure of the corresponding private key.

## **4 Certificate life-cycle operational requirements**

### **4.1 Certificate Application**

A Certificate Application SHALL contain the public key and all the names to be certified.

Certificate Applications MUST be delivered to the CA using a secure and authenticated method.

### **4.2 Certificate Application processing**

Upon receiving a Certificate Application, the RA SHALL:

1. verify the identity of the Requester
2. verify the authorisation of the Requester
3. verify all requested names in the application

Only if all steps above are successful, the application SHALL be relayed to the CA to issue the Certificate.

### **4.3 Certificate issuance**

No stipulation.

### **4.4 Certificate acceptance**

No stipulation.

### **4.5 Key pair and Certificate usage**

The Certificate and the corresponding key pair may be used only in compliance with the relevant CP and for purposes indicated in the Certificate, primarily for authenticating RADIUS/TLS servers within eduroam®.

### **4.6 Certificate renewal**

A Conforming CA SHALL NOT support Certificate renewal for Certificates issued compliant to this TP. Any application for a Certificate renewal of any kind is treated like an initial Certificate Application.

#### **4.7 Certificate re-key**

A Conforming CA SHALL NOT support Certificate re-keying for Certificates issued compliant to this TP. Any application for a Certificate renewal of any kind is treated like an initial Certificate Application.

#### **4.8 Certificate modification**

A Conforming CA SHALL NOT support Certificate modification for Certificates issued compliant to this TP. Any application for a Certificate renewal of any kind is treated like an initial Certificate Application.

#### **4.9 Certificate revocation and suspension**

A Certificate MUST be revoked if any of the following circumstances occurs:

1. The private key associated with the Certificate has been compromised or exposed.
2. The content of the Certificate is not representing the truth.
3. The Subscriber has breached its obligations.

Revocation MAY be requested by the Subscriber, by an RA, by the CA or by any entity that can prove a circumstance for revocation.

The entity detecting that a circumstance for revocation has occurred MUST request the Certificate revocation immediately, but not later than within one working day.

Revocation requests SHALL be submitted to an RA or to the CA.

The RA or CA MUST react to the submitted revocation request immediately, but not later than within one working day.

RP's MUST check the revocation status of a Certificate and all Certificates in its certification path before relying on it.

A Conforming CA SHALL issue CRLs. A new CRL SHALL be issued after a Certificate revocation or not later than 24 hours before the time stated in the *nextUpdate* field in the current CRL. The *nextUpdate* field MUST NOT be set to a time later than 30 days after the time of the CRL issuance.

A Conforming CA SHALL NOT support Certificate suspension.

#### **4.10 Certificate status services**

No stipulation.

#### **4.11 End of subscription**

No stipulation.

#### **4.12 Key escrow and recovery**

A Conforming CA SHALL NOT support key escrow for Certificates issued compliant to this TP.

## **5 Facility, management, and operational controls**

### **5.1 Physical Controls**

The CA system SHALL be located in a secure location. Physical access to the location SHALL be monitored and enabled only to the CA personnel.

### **5.2 Procedural controls**

No stipulation.

### **5.3 Personnel controls**

The CA personnel SHALL be trained in using PKI technologies and in the CA procedures.

### **5.4 Audit Logging Procedures**

A Conforming CA SHALL keep logs of the following events:

- initialization of the CA systems
- CA private key activation and deactivation
- access to the CA systems
- Certificate issuance
- Certificate revocation
- CRL issuance

The logs SHALL be secured against unauthorized access.

The logs SHALL be available to the CA personnel and to auditors.

### **5.5 Records archival**

A Conforming CA SHALL keep the following types of records:

- the CA Certificate
- all issued Certificates
- all issued CRLs
- all CPs applied to issue Certificates
- all CPSs applied to issue Certificates
- all audit logs

A record SHALL be retained for at least one year after the relevant Certificates pertaining to that record have expired.

The record archive SHALL be protected against unauthorized access.

The records SHALL be accessible only to the CA personnel and to the auditors.

A Conforming CA SHOULD keep backup copies of the archived records. The backup SHOULD be stored in a secure off-site location. The backup MUST be protected against unauthorized access.

## **5.6 Key changeover**

During a CA signing key changeover, the CA MUST provide for a transition period when only the new key is being used to sign new Certificates and the old key is being used to issue CRLs for the old Certificates. The old key MUST be available as long as all Certificates signed by it have not expired.

## **5.7 Compromise and disaster recovery**

If the key material of a Conforming CA is compromised, the CA SHALL

- immediately inform all PKI participants,
- stop accepting Certificate Applications,
- invalidate all issued Certificates
  - by revoking all issued Certificates and publishing a CRL with the *nextUpdate* field set to a time after the expiration dates of all issued Certificates; or
  - if the CA's public key has been signed by another/other CA(s), by requesting revocation of all pertinent CA Certificates containing the CA's public key,
- stop operations,
- start analysis of the events leading to the key compromise,
- remove the cause of the key compromise,
- generate new keys,
- restart operations.

In case of a disaster not involving a CA key compromise, the system and the keys SHOULD be recovered from backups.

## **5.8 CA or RA Termination**

A Conforming CA SHALL announce its intent to cease operation at least three months before the termination.

At the date of termination, the CA SHALL:

- revoke all issued Certificates
- publish the CRL with the *nextUpdate* field set to a time after the expiration dates of all issued Certificates,
- destroy the CA keys,
- stop the operation.

A terminating RA SHALL relay all its documentation to the CA or the RA's organisation MUST keep the RA's documents according to the defined retention periods. The CA SHALL disable access of the RA to the CA systems.

## **6 Technical security controls**

### **6.1 Key pair generation and installation**

The CA keys **MUST** be generated by authorised CA personnel. The CA RSA keys **SHALL** be at least 2048 bits long.

End-entities RSA keys in Certificates issued compliant to this TP **SHALL** be at least 2048 bits long.

### **6.2 Private key protection and cryptographic module engineering controls**

Private keys of a Conforming CA **SHALL** be protected with a pass-phrase of at least 15 characters when stored in a software security token. Private keys of a Conforming CA stored in a hardware security module (HSM) **SHALL** be protected to achieve similar or better key protection.

Backups of the CA private keys **MUST** be protected at the same level as the operational copies.

The CA private key **SHALL** be activated only by authorised CA personnel.

The end-entity private key **MAY** be stored unencrypted on the RADIUS server file-system. In that case, the operating system **MUST** be set to prevent unauthorised access to the key.

Backups of end-entity private keys **MUST** always be encrypted using a key known only to the authorized personnel.

### **6.3 Other aspects of key pair management**

No stipulation.

### **6.4 Activation data**

The pass-phrase protecting a CA private key **SHALL** be known only to authorised CA personnel.

### **6.5 Computer security controls**

The computer hosting the CA system **MUST** run only software required to operate the CA.

### **6.6 Life cycle technical controls**

No stipulation.



## **6.7 Network security controls**

When a Conforming CA uses its private key from a software security token, the CA system **MUST** be kept disconnected of any network.

The CA system **MAY** be accessible from the Internet or other public network only if all the following conditions are met:

- The CA uses an HSM certified to at least FIPS 140-2 level 3 or equivalent to protect its private keys.
- The access to the CA system is limited only to the CA services.
- The access to the CA system is monitored.

## **6.8 Time-stamping**

No stipulation.

## 7 Certificate, CRL, and OCSP profiles

### 7.1 Certificate Profile

Certificates and CRLs issued by a Conforming CA SHALL follow the PKIX Certificate Profile as defined in RFC 5280 [RFC5280]. The following text further profiles the PKIX profile for use by RADIUS/TLS eduroam® service.

All Certificates SHALL be X.509 version 3.

End-entity Certificates SHALL contain the following extensions:

**a) Authority Key Identifier**

the identifier of the key of the issuer in the *keyIdentifier* field

**b) Subject Key Identifier**

the identifier of the certified key

**c) Basic Constrains**

false in the *cA* field

**d) Key Usage**

bits *digitalSignature* and *keyEncipherment* set

**e) Extended Key Usage**

*TLS server authentication, TLS client authentication*

**f) Certificate Policies**

This extension SHOULD contain only *policyIdentifiers*. Their value SHALL be:

- **1.3.6.1.4.1.25178.3.1.1** in Certificates issued to eduroam® Service Provider
- **1.3.6.1.4.1.25178.3.1.2** in Certificate issued to eduroam® Identity Provider
- the full OID of the TP applicable when issuing the Certificate, i.e. **1.3.6.1.4.1.27262.1.13.1.1.4**
- the OID of the base arc of this TP, i.e. **1.3.6.1.4.1.27262.1.13.1.1**
- the OID of the CP applied when issuing the Certificate

Further *policyIdentifiers* MAY be included.

**g) Subject Alternative Name**

- DNS name(s) of the RADIUS/TLS service in the *dNSName* field

- (optionally) IP address(es) of the RADIUS/TLS service in the *iPAddress* field
- (optionally) *email address(es)* of the RADIUS administrator(s) in the *rfc822Name* field

#### **h) CRL Distribution Point**

at least one HTTP URL where the current DER encoded CRL for the Certificate is published in the *URI* field

End-entity Certificates SHOULD contain the following extensions:

#### **a) Authority Information Access**

- at least one HTTP URL where the issuer's DER encoded Certificate is published in the *URI* field for the *cAIssuers* access method
- (optionally) the OCSP locator in the *URI* field for the *OCSP* access method

The Certificate extensions listed MAY contain other additional values at the discretion of the CA.

Certificates MAY contain other additional extensions at the discretion of the CA.

## **7.2 CRL Profile**

All CRLs SHALL conform to CRL version 2 as specified by the X.509 recommendation.

All CRLs SHOULD contain the following extensions:

#### **a) CRL Number**

a sequential number of the CRL

CRLs MAY contain other extensions at the discretion of the CA.

## **7.3 OCSP Profile**

No stipulation.

## **8 Compliance audit and other assessment**

A Conforming CA SHALL enable a compliance audit by an entity appointed by the eduPKI PMA.

## **9 Other business and legal matters**

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## References

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