**3GPP TSG-SA3 Meeting #124 S3-253830-r1 (merging 381 and 489)**

**Wuhan, China, 13 – 17 October 2025**

**Source: Huawei, HiSilicon, Ericsson**

**Title: PQC migration for PKI certificates**

**Document for: Approval**

**Agenda item: 5.2.1**

**Spec: 3GPP TR 33.703**

**Version: 0.1.0**

**Work Item: FS\_CryptoPQC**

**Comments**

It is proposed to study the PQC migration scheme of the PKI certificates in 3GPP.

\* \* \* First Change \* \* \* \*

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[y2] IETF RFC 9763: "Related Certificates for Use in Multiple Authentications within a Protocol "

[y3] IETF RFC 9802: "Use of the HSS and XMSS Hash-Based Signature Algorithms in Internet X.509 Public Key Infrastructure"

[y4] IETF Draft (Standards Track): "Internet X.509 Public Key Infrastructure - Algorithm Identifiers for the Module-Lattice-Based Key-Encapsulation Mechanism (ML-KEM) ", https://datatracker.ietf.org/doc/draft-ietf-lamps-kyber-certificates/.

[y5] IETF Draft (Standards Track): "Internet X.509 Public Key Infrastructure: Algorithm Identifiers for SLH-DSA", <https://datatracker.ietf.org/doc/draft-ietf-lamps-x509-slhdsa/>.

[y6] IETF Draft (Standards Track): "Internet X.509 Public Key Infrastructure - Algorithm Identifiers for the Module-Lattice-Based Digital Signature Algorithm (ML-DSA)", <https://datatracker.ietf.org/doc/draft-ietf-lamps-dilithium-certificates/>.

[y7] IETF Draft (Standards Track): "Composite ML-KEM for use in X.509 Public Key Infrastructure", <https://datatracker.ietf.org/doc/draft-ietf-lamps-pq-composite-kem/>.

[y10] IETF Draft (Standards Track): "A Mechanism for X.509 Certificate Discovery", <https://datatracker.ietf.org/doc/draft-ietf-lamps-certdiscovery/>.

[y11] NIST FIPS 203: “Module-Lattice-Based Key-Encapsulation Mechanism Standard”.

[y12] NIST FIPS 204: “Module-Lattice-Based Digital Signature Standard”.

[y13] NIST FIPS 205: “Stateless Hash-Based Digital Signature Standard”.

\* \* \* Next Change \* \* \* \*

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

ECIES Elliptic Curve Integrated Encryption Scheme

MIKEY-SAKKE Multimedia Internet KEYing – Sakai-Kasahara Key Encryption

PQC Post Quantum Cryptography

SDO Standards Development Organizations

SECG Security Engineering & Consulting Group

SUCI Subscription Concealed Identifier

PKI Public Key Infrastructure

PKIX Public Key Infrastructure X.509

HBS Hash-Based Signature

HSS Hierarchical Signature System

XMSS eXtended Merkle Signature Scheme

CRL Certificate Revocation Lists

KEM key encapsulation mechanism

ML-KEM Module-Lattice-Based Key-Encapsulation Mechanism

ML-DSA Module-Lattice-Based Digital Signature

SLH-DSA Stateless Hash-Based Digital Signature

CA Certification Authority

\* \* \* Next Change \* \* \* \*

## 6.X Protocol #X：PKI certificate

6.X.1 General

The IETF LAMPS group has introduced multiple Drafts to enable a smooth transition to PQC in PKIX to provide quantum-resistant security for PKIX.

### 6.X.2 Current Work in IETF

#### 6.X.2.1 IETF RFCs

### **Introduction of PQC algorithms**

The IETF RFC 9802 [y3] has specified algorithm identifiers and ASN.1 encoding format for several stateful Hash-Based Signature (HBS) schemes: Hierarchical Signature System (HSS), eXtended Merkle Signature Scheme (XMSS), and a multi-tree variant of XMSS, XMSS^MT. These schemes are applicable to the Internet X.509 Public Key Infrastructure (PKI) when digital signatures are used to sign certificates and certificate revocation lists (CRLs).

### **Support for Hybrid Mechanisms**

The IETF RFC 9763 [y2] defines a method for requesting and issuing two X.509 end-entity certificates for the same entity, in order to perform two authentications using the two certificates where each certificate corresponds to a distinct digital signature.

#### 6.X.2.2 IETF Adopted Drafts

### **Introduction of PQC algorithms**

The IETF standards track draft “Internet X.509 Public Key Infrastructure - Algorithm Identifiers for the Module-Lattice-Based Key-Encapsulation Mechanism (ML-KEM)” [y4] proposes to use the ML-KEM [y11] in X.509 Public Key Infrastructure. The conventions for the subject public keys and private keys are specified.

The IETF standards track draft “Internet X.509 Public Key Infrastructure: Algorithm Identifiers for SLH-DSA” [y5] proposes to use the SLH-DSA [y13] in X.509 Public Key Infrastructure. The conventions for the associated signatures, subject public keys, and private keys are specified.

The IETF standards track draft “Internet X.509 Public Key Infrastructure - Algorithm Identifiers for the Module-Lattice-Based Digital Signature Algorithm (ML-DSA)” [y6] proposes to use the ML-DSA [y12] in X.509 Public Key Infrastructure. The conventions for the associated signatures, subject public keys, and private keys are specified.

### **Support for Hybrid Mechanisms**

The IETF standards track draft “Composite ML-KEM for use in X.509 Public Key Infrastructure” [y7] defines a specific instantiation of the PQ/T Hybrid paradigm called "composite" where multiple cryptographic algorithms (i.e. ML-KEM [y11] in hybrid with traditional algorithms RSA-OAEP, ECDH, X25519, and X448) are combined to form a single key encapsulation mechanism (KEM) presenting a single public key and ciphertext such that it can be treated as a single atomic algorithm at the protocol level.

### **Certificate Discovery**

The IETF standards track draft “A Mechanism for X.509 Certificate Discovery” [y10] specifies a method to discover a secondary X.509 certificate associated with an X.509 certificate to enable efficient multi-certificate handling in protocols.

6.X.3 3GPP Considerations\* \* \* End of Changes \* \* \* \*