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## **Clarifications for Ed25519, Ed448, X25519, and X448 Algorithm Identifiers**

### **Abstract**

This document updates RFC 8410 to clarify existing and specify missing semantics for key usage bits when used in certificates that support the Ed25519, Ed448, X25519, and X448 Elliptic Curve Cryptography algorithms.

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### 1. Introduction

[[RFC8410](#)] specifies the syntax and semantics for the Subject Public Key Information field in certificates that support Ed25519, Ed448, X25519, and X448 Elliptic Curve Cryptography (ECC) algorithms. As part of these semantics, it defines what combinations are permissible for the values of the key usage extension [[RFC5280](#)]. [[RFC8410](#)] did not define what values are not permissible nor did it refer to keyEncipherment or dataEncipherment. [[ERRATA](#)] has also been submitted to clarify that keyCertSign is always set in certification authority certificates. To address these changes, this document replaces Section 5 of [[RFC8410](#)] with [Section 3](#).

### 2. Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 [[RFC2119](#)] [[RFC8174](#)] when, and only when, they appear in all capitals, as shown here.

### 3. New Section 5 for RFC 8410

The intended application for the key is indicated in the keyUsage certificate extension.

If the keyUsage extension is present in a certificate that indicates id-X25519 or id-X448 in SubjectPublicKeyInfo, then the following **MUST** be present:

keyAgreement;

one of the following **MAY** also be present:

encipherOnly; or  
decipherOnly;

and the following **MUST NOT** be present:

digitalSignature;  
nonRepudiation;  
keyEncipherment;  
dataEncipherment;  
keyCertSign; and  
cRLSign.

If the keyUsage extension is present in an end-entity certificate that indicates id-Ed25519 or id-Ed448 in SubjectPublicKeyInfo, then the keyUsage extension **MUST** contain one or both of the following:

nonRepudiation; and  
digitalSignature;

the following **MAY** also be present:

cRLSign;

and the following **MUST NOT** be present:

keyEncipherment;  
dataEncipherment;  
keyAgreement;  
keyCertSign;  
encipherOnly; and  
decipherOnly.

If the keyUsage extension is present in a certification authority certificate that indicates id-Ed25519 or id-Ed448 in SubjectPublicKeyInfo, then the keyUsage extension **MUST** contain keyCertSign, and zero, or more of the following:

nonRepudiation;  
digitalSignature; and  
cRLSign;

and the following **MUST NOT** be present:

keyEncipherment;  
dataEncipherment;  
keyAgreement;  
encipherOnly; and  
decipherOnly.

#### 4. Security Considerations

This document introduces no new security considerations beyond those found in [RFC8410].

#### 5. IANA Considerations

This document has no IANA actions.

#### 6. References

##### 6.1. Normative References

- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, DOI 10.17487/RFC2119, March 1997, <<https://www.rfc-editor.org/rfc/rfc2119>>.
- [RFC5280] Cooper, D., Santesson, S., Farrell, S., Boeyen, S., Housley, R., and W. Polk, "Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile", RFC 5280, DOI 10.17487/RFC5280, May 2008, <<https://www.rfc-editor.org/rfc/rfc5280>>.
- [RFC8174] Leiba, B., "Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words", BCP 14, RFC 8174, DOI 10.17487/RFC8174, May 2017, <<https://www.rfc-editor.org/rfc/rfc8174>>.
- [RFC8410] Josefsson, S. and J. Schaad, "Algorithm Identifiers for Ed25519, Ed448, X25519, and X448 for Use in the Internet X.509 Public Key Infrastructure", RFC 8410, DOI 10.17487/RFC8410, August 2018, <<https://www.rfc-editor.org/rfc/rfc8410>>.

##### 6.2. Informative References

- [ERRATA] Liao, L., "Errata 5696", 17 April 2019, <<https://www.rfc-editor.org/errata/eid5696>>.

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TODO acknowledge.

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