

# INTERNATIONAL STANDARD



**Power systems management and associated information exchange – Data and communications security –  
Part 9: Cyber security key management for power system equipment**

IEC 62351-9:2017

<https://standards.iteh.ai/en/standards/iec/295c09c2-1fc0-415e-abcc-7dfa6561170a/iec-62351-9-2017>



## THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2017 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Central Office  
3, rue de Varembe  
CH-1211 Geneva 20  
Switzerland

Tel.: +41 22 919 02 11  
Fax: +41 22 919 03 00  
[info@iec.ch](mailto:info@iec.ch)  
[www.iec.ch](http://www.iec.ch)

### About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

### About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

#### IEC Catalogue - [webstore.iec.ch/catalogue](http://webstore.iec.ch/catalogue)

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

#### IEC publications search - [www.iec.ch/searchpub](http://www.iec.ch/searchpub)

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

#### IEC Just Published - [webstore.iec.ch/justpublished](http://webstore.iec.ch/justpublished)

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

#### Electropedia - [www.electropedia.org](http://www.electropedia.org)

The world's leading online dictionary of electronic and electrical terms containing 20 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

#### IEC Glossary - [std.iec.ch/glossary](http://std.iec.ch/glossary)

65 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

#### IEC Customer Service Centre - [webstore.iec.ch/csc](http://webstore.iec.ch/csc)

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: [csc@iec.ch](mailto:csc@iec.ch).

IEC 62351-9:2017

<https://standards.iteh.ai/en/standards/iec/295c09c2-1fc0-415e-abcc-7dfa6561170a/iec-62351-9-2017>

# INTERNATIONAL STANDARD



**Power systems management and associated information exchange – Data and communications security –  
Part 9: Cyber security key management for power system equipment**

<https://standards.iteh.ai/catalog/standards/iec/295c09c2-1fc0-415e-abcc-7dfa6561170a/iec-62351-9-2017>

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

ICS 33.200

ISBN 978-2-8322-4220-9

**Warning! Make sure that you obtained this publication from an authorized distributor.**

## CONTENTS

FOREWORD.....	6
1 Scope.....	8
2 Normative references .....	8
3 Terms and definitions .....	9
4 Abbreviations and acronyms.....	14
5 Cryptographic applications for power system implementations.....	15
5.1 Cryptography, cryptographic keys, and security objectives.....	15
5.2 Types of cryptography .....	16
5.3 Uses of cryptography .....	16
5.3.1 Goals of cyber security .....	16
5.3.2 Confidentiality.....	17
5.3.3 Data integrity.....	17
5.3.4 Authentication.....	18
5.3.5 Non-repudiation.....	18
5.3.6 Trust.....	18
6 Key management concepts and methods in power system operations .....	19
6.1 Key management system security policy.....	19
6.2 Key management design principles for power system operations .....	19
6.3 Use of Transport Layer Security (TLS).....	19
6.4 Cryptographic key usages.....	19
6.5 Trust using a public-key infrastructure (PKI).....	20
6.5.1 Registration authorities (RA).....	20
6.5.2 Certification authority (CA).....	20
6.5.3 Public-key certificates.....	20
6.5.4 Attribute certificates.....	21
6.5.5 Public-key certificate and attribute certificate extensions .....	21
6.6 Trust via non-PKI self-signed certificates .....	22
6.7 Authorization and validation lists.....	22
6.7.1 General .....	22
6.7.2 AVLs in non-constrained environments .....	23
6.7.3 AVLs in constrained environments.....	23
6.7.4 Use of self-signed public-key certificates in AVLs .....	23
6.8 Trust via pre-shared keys.....	23
6.9 Session keys .....	24
6.10 Protocols used in trust establishment.....	24
6.10.1 Certification request .....	24
6.10.2 Trust Anchor Management Protocol (TAMP) .....	24
6.10.3 Simple Certificate Enrolment Protocol (SCEP).....	24
6.10.4 Internet X.509 PKI Certificate Management Protocol (CMP).....	24
6.10.5 Certificate Management over CMS (CMC) .....	25
6.10.6 Enrolment over Secure Transport (EST) .....	25
6.10.7 Summary view on the different protocols .....	25
6.11 Group keys .....	26
6.11.1 Purpose of group keys.....	26
6.11.2 Group Domain of Interpretation (GDOI) .....	26
6.12 Key management lifecycle .....	31

6.12.1	Key management in the life cycle of an entity .....	31
6.12.2	Cryptographic key lifecycle .....	32
6.13	Certificate management processes .....	34
6.13.1	Certificate management process .....	34
6.13.2	Initial certificate creation .....	34
6.13.3	Enrolment of an entity .....	34
6.13.4	Certificate signing request (CSR) process .....	36
6.13.5	Certificate revocation lists (CRLs) .....	37
6.13.6	Online certificate status protocol (OCSP) .....	38
6.13.7	Server-based certificate validation protocol (SCVP) .....	41
6.13.8	Short-lived certificates .....	41
6.13.9	Certificate renewal .....	42
6.14	Alternative process for asymmetric keys generated outside the entity .....	43
6.15	Key distribution for symmetric keys with different time frames .....	44
7	General key management requirements .....	44
7.1	Asymmetric and symmetric key management requirements .....	44
7.2	Required cryptographic materials .....	44
7.3	Public-Key certificates requirements .....	45
7.4	Cryptographic key protection .....	45
7.5	Use of existing security key management infrastructure .....	45
7.6	Use of object identifiers .....	45
8	Asymmetric key management .....	45
8.1	Certificate generation and installation .....	45
8.1.1	Private and public key generation and installation .....	45
8.1.2	Private and public key renewal .....	46
8.1.3	Random Number Generation .....	46
8.1.4	Certificate policy .....	46
8.1.5	Entity registration for identity establishment .....	46
8.1.6	Entity configuration .....	47
8.1.7	Entity enrolment .....	47
8.1.8	Trust anchor information update .....	48
8.2	Public-key certificate revocation .....	49
8.3	Certificate validity .....	49
8.3.1	Validity of certificates .....	49
8.3.2	Certificate revocation .....	50
8.3.3	Certificate revocation status checking .....	50
8.3.4	Handling of authorization and validation lists (AVLs) .....	50
8.4	Certificate expiration and renewal .....	55
8.5	Secured Time Synchronization .....	55
9	Symmetric key management .....	56
9.1	Group based key management (GDOI) .....	56
9.1.1	GDOI requirements .....	56
9.1.2	Internet Key Exchange Version 1 (IKEv1) .....	56
9.1.3	Phase 1 IKEv1 main mode exchange type 2 .....	57
9.1.4	Phase 1/2 ISAKMP informational exchange type 5 .....	60
9.1.5	Phase 2 GDOI GROUPKEY-PULL exchange type 32 .....	62
9.1.6	GROUPKEY-PULL group key download exchange .....	70
10	Connections to the IEC 62351 parts and other IEC documents .....	71

Annex A (normative) Protocol Implementation Conformance Statement (PICS).....	73
Annex B (informative) Random Number Generation (RNG) .....	74
B.1 Random number generation types.....	74
B.2 Deterministic random bit generators.....	74
B.3 Non-deterministic random number generation .....	75
B.4 Entropy sources .....	75
Annex C (informative) Certificate enrolment and renewal flowcharts .....	76
C.1 Certificate enrolment.....	76
C.2 Certificate renewal.....	76
Annex D (informative) Examples of certificate profiles.....	78
Bibliography.....	82
Figure 1 – Relationship between public-key certificates and attribute certificates.....	21
Figure 2 – Group key management distribution .....	26
Figure 3 – GDOI IKE Phase 1 – Authentication and securing communication channel.....	27
Figure 4 – GDOI Pull Phase 2.....	28
Figure 5 – Key renewal triggered by the entities.....	30
Figure 6 – Key management in product life cycle.....	31
Figure 7 – Simplified certificate life cycle .....	32
Figure 8 – Cryptographic key life cycle .....	33
Figure 9 – Example of the SCEP entity enrolment and CSR process.....	35
Figure 10 – Example of the EST entity enrolment and CSR process .....	36
Figure 11 – CSR processing .....	37
Figure 12 – Certificate revocation list.....	38
Figure 13 – Overview of the online certificate status protocol (OCSP).....	39
Figure 14 – Diagram using a combination of CRL and OCSP processes .....	40
Figure 15 – Call Flows for the Online Certificate Status Protocol (OCSP).....	41
Figure 16 – Overview Server-Based Certificate Validation Protocol using OCSP Backend .....	41
Figure 17 – SCEP certificate renewal.....	42
Figure 18 – EST certificate renewal/rekeying .....	43
Figure 19 – Central certificate generation .....	44
Figure 20 – IKEv1 (RFC 2409) main mode exchange with RSA digital signatures .....	57
Figure 21 – IKEv1 main mode exchange and security association messages .....	58
Figure 22 – IKEv1 main mode exchange: key exchange messages .....	59
Figure 23 – IKEv1 Main Mode Exchange: ID authentication messages.....	59
Figure 24 – IKEv1 HASH_I calculation .....	60
Figure 25 – Phase 1 Informational Exchange .....	61
Figure 26 – GD004FI GROUPKEY-PULL as define in RFC 6407 .....	62
Figure 27 – GROUPKEY-PULL hash computations .....	63
Figure 28 – GROUPKEY-PULL initial SA request exchange .....	64
Figure 29 – RFC 6407 Identification Payload .....	64
Figure 30 – ID_OID Identification Data.....	65
Figure 31 – 61850_UDP_ADDR_GOOSE/SV ASN.1 BNF .....	66

Figure 32 – IPADDRESS ASN.1 BNF .....	66
Figure 33 – Example IecUdpAddrPayload ASN.1 Data with DER Encoding .....	67
Figure 34 – 61850_UDP_TUNNEL Payload ASN.1 BNF .....	67
Figure 35 – 61850_ETHERNET_GOOSE/SV Payload ASN.1 BNF .....	67
Figure 36 – RFC 6407 SA TEK Payload .....	68
Figure 37 – IEC-61850 SA TEK Payload .....	69
Figure 38 – GROUPKEY-PULL Key Download Exchange .....	70
Figure 39 – IEC 62351 Part 9 relationship to other IEC 62351 parts .....	71
Figure C.1 – Certificate enrolment .....	76
Figure C.2 – Certificate renewal state machine .....	77
Table 1 – KDC IKEv1 Requirements .....	56
Table 2 – IEC 61850 Object IDs: Mandatory (m) and Optional (o) .....	65
Table D.1 – Examples of operator public-key certificates .....	79
Table D.2 – Examples of OEM certificates .....	80
Table D.3 – Example of OCSP certificate .....	81

iTech Standards  
(<https://standards.iteh.ai>)  
Document Preview

IEC 62351-9:2017

<https://standards.iteh.ai/catalog/standards/iec/295c09c2-1fc0-415e-abcc-7dfa6561170a/iec-62351-9-2017>

WITHOLDING

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**POWER SYSTEMS MANAGEMENT AND  
ASSOCIATED INFORMATION EXCHANGE –  
DATA AND COMMUNICATIONS SECURITY –**

**Part 9: Cyber security key management for power system equipment**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62351-9 has been prepared by IEC technical committee 57: Power systems management and associated information exchange.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
57/1838/FDIS	57/1853/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.



A list of all parts in the IEC 62351 series, published under the general title *Power systems management and associated information exchange – Data and communications security*, can be found on the IEC website.

In this standard, the following print types are used:

- ASN.1 notions is presented in bold Courier New typeface;
- when ASN.1 types and values are referenced in normal text, they are differentiated from normal text by presenting them in bold Courier New typeface.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

**IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.**

# POWER SYSTEMS MANAGEMENT AND ASSOCIATED INFORMATION EXCHANGE – DATA AND COMMUNICATIONS SECURITY –

## Part 9: Cyber security key management for power system equipment

### 1 Scope

This part of IEC 62351 specifies cryptographic key management, namely how to generate, distribute, revoke, and handle public-key certificates and cryptographic keys to protect digital data and its communication. Included in the scope is the handling of asymmetric keys (e.g. private keys and public-key certificates), as well as symmetric keys for groups (GDOI).

This part of IEC 62351 assumes that other standards have already chosen the type of keys and cryptography that will be utilized, since the cryptography algorithms and key materials chosen will be typically mandated by an organization's own local security policies and by the need to be compliant with other international standards. This document therefore specifies only the management techniques for these selected key and cryptography infrastructures. The objective is to define requirements and technologies to achieve interoperability of key management.

The purpose of this part of IEC 62351 is to guarantee interoperability among different vendors by specifying or limiting key management options to be used. This document assumes that the reader understands cryptography and PKI principles.

### 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC TS 62351-2, *Power systems management and associated information exchange – Data and communications security – Part 2: Glossary of terms*

ISO/IEC 9594-8:2017 | Rec. ITU-T X.509 (2016), *Information technology – Open systems interconnection – The Directory: Public-key and attribute certificate frameworks*

ISO/IEC 9834-1:2012 | Rec. ITU-T X.660 (2011), *Information technology – Procedures for the operation of object identifier registration authorities: General procedures and top arcs of the international object identifier tree*

SCEP IETF Draft, *Simple Certificate Enrolment Protocol, draft-gutmann-scep-04.txt*

RFC 5246, *The Transport Layer Security (TLS) Protocol Version 1.2*

RFC 5272, *Certificate Management over CMS (CMC)*

RFC 5934, *Trust Anchor Management Protocol (TAMP)*

RFC 6407, *The Group Domain of Interpretation*

RFC 6960, *X.509 Internet Public Key Infrastructure Online Certificate Status Protocol – OCSP*

RFC 7030, *Enrolment over Secure Transport*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC TS 62351-2 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

#### 3.1

##### **asymmetric keys**

two related keys, a public key and a private key, that are used to perform complementary operations, such as encryption and decryption or signature generation and signature verification

#### 3.2

##### **authorization and validation list**

##### **AVL**

signed list containing information to an AVL entity about potential communications entities and possible restrictions on the communications with such entities

[SOURCE: ISO/IEC 9594-8:2017 | Rec. ITU-T X.509 (2016), 3.5.9]

#### 3.3

##### **authorization and validation list entity**

##### **AVL entity**

entity, when acting as a relying party, which is dependent on an AVL issued by a designated authorizer

[SOURCE: ISO/IEC 9594-8:2017 | Rec. ITU-T X.509 (2016), 3.5.10]

#### 3.4

##### **authorizer**

entity trusted by one or more entities operating as AVL entities to create, maintain and sign authorization and validation lists

[SOURCE: ISO/IEC 9594-8:2017 | Rec. ITU-T X.509 (2016), 3.5.11]

#### 3.5

##### **certification path**

ordered list of one or more public-key certificates, starting with a public-key certificate signed by the trust anchor, and ending with the end-entity public-key certificate to be validated

Note 1 to entry: All intermediate public-key certificates, if any, are CA certificates in which the subject of the preceding public-key certificate is the issuer of the following public-key certificate.

[SOURCE: ISO/IEC 9594-8:2017, 3.5.18 | Rec. ITU-T X.509 (2016), 3.5.21]

**3.6**  
**certificate signing request**  
**CSR**

request issued when a new certificate or renewal of a certificate is required

Note 1 to entry: When the generated CSR is submitted to a CA, the CA signs the CSR using its private key and the CSR becomes the certificate.

[SOURCE: RFC 2986]

**3.7**  
**controllership**

intersection of legal ownership, physical control, and logical control over a device or system, in which the nature of any contractual agreements between ownership and control of the device or system is not important in the context

**3.8**  
**cryptographic binding**

use of one or more cryptographic techniques by a CKMS to establish a trusted association between a key and selected metadata elements

[SOURCE: NIST SP 800-130]

**3.9**  
**cryptographic key management system**  
**CKMS**

system for the management (e.g., generation, distribution, storage, backup, archive, recovery, use, revocation, and destruction) of cryptographic keys and their metadata

[SOURCE: NIST SP 800-130]

**3.10**  
**dataset**

collection of data

**3.11**  
**digital signature**

result of a cryptographic transformation of data that, when properly implemented, provides a mechanism for verifying origin authentication, data integrity, and signatory non-repudiation

[SOURCE: FIPS 186]

**3.12**  
**entity**

generic term that covers human users, automation systems, software applications, communication nodes, field devices, and other types of assets

**3.13**  
**group controller/key server**  
**GCKS**

device that defines group policy and distributes keys for that policy

[SOURCE: RFC 3740]

**3.14****group domain of interpretation****GDOI**

domain that manages group security associations, which are used by IPsec and potentially other data security protocols

Note 1 to entry: These security associations protect one or more key-encrypting keys (KEK), traffic-encrypting keys (TEK), or data shared by group members. GDOI uses the notion of a group controller, which is used to support the establishment of security associations between members of a group.

[SOURCE: RFC 6407]

**3.15****group member****GM**

authorized member of a secure group, sending and/or receiving IP packets related to the group

**3.16****hash function**

(mathematical) function which maps data of arbitrary size into data of a fixed size called a digest

Note 1 to entry: Approved hash functions satisfy the following properties.

- 1) One-Way. It is computationally infeasible to find any input that maps to any pre-specified output.
- 2) Collision Resistant. It is computationally infeasible to find any two distinct inputs that map to the same output.

[SOURCE: ISO/IEC 9598-8:2017 | Rec. ITU-T X.509 (2016), 3.5.36]

**3.17****hash message authentication code****HMAC**

cryptographic code used for authentication with symmetric keys and for data integrity

[SOURCE: RFC 2104]

**3.18****key distribution centre****KDC**

centre which, in an IEC 62351-9 context, provides a network service that supplies temporary (symmetrical) session keys to predefined set of peers after successful authentication

Note 1 to entry: This is also known as Group Controller/Key Server (GCKS) (See GDOI).

**3.19****message authentication code****MAC**

cryptographic checksum on data that uses a symmetric key to detect both accidental and intentional modification of the data

[SOURCE: SP 800-63; FIPS 201]

**3.20****object identifier**

ordered list of primary integer values from the root of the international object identifier tree to a node, which unambiguously identifies that node

[SOURCE: ISO/IEC 9834-1:2012 | Rec. ITU-T X.660 (2011), 3.5.11]

### **3.21 online certificate status protocol OCSP**

protocol that enables applications to determine the (revocation) state of an identified certificate

Note 1 to entry: OCSP may be used to satisfy some of the operational requirements of providing more timely revocation information than is possible with CRLs and may be used to obtain additional status information. An OCSP client issues a status request to an OCSP responder and suspends acceptance of the certificate in question until the responder provides a response.

[SOURCE: RFC 6960]

### **3.22 pre-shared key PSK**

secret which is shared in advanced between the two entities, such as software applications or devices, to be able to authenticate themselves after establishing a secure connection

### **3.23 private key**

(in a public-key cryptosystem) that key of an entity's key pair which is known only by that entity

[SOURCE: ISO/IEC 9594-8:2017 | Rec. ITU-T X.509 (2016), 3.5.49]

### **3.24 public-key certificate**

public key of an entity, together with some other information, rendered unforgeable by digital signature with the private key of the CA which issued it

Note 1 to entry: A public-key certificate is often called an X.509 certificate or a digital certificate. However, such terms are ambiguous, as they could also mean attribute certificates, which are also defined by ISO/IEC 9594-8:2017 | Rec. ITU-T X.509 (2016).

[SOURCE: ISO/IEC 9594-8:2017 | Rec. ITU-T X.509 (2016), 3.5.57]

### **3.25 public-key cryptography standards PKCS**

specifications produced by RSA Laboratories in cooperation with secure systems developers worldwide for the purpose of accelerating the deployment of public-key cryptography

[SOURCE: www.rsa.com]

### **3.26 random number generation RNG**

process used to generate an unpredictable series of numbers

Note 1 to entry: Each individual value is called random if each of the values in the total population of values has an equal probability of being selected.

[SOURCE: NIST SP 800-57]

### **3.27 registration authority**

those aspects of the responsibilities of a certification authority that are related to identification and authentication of the subject of a public-key certificate to be issued by that certification authority