INTERNATIONAL STANDARD

ISO/IEC 9579

Second edition
2000-02-15

Information technology — Remote database access for SQL with security enhancement

Technologies de l'information — Accès à la base de données à distance pour SQL avec sécurité accrue

Reference number
ISO/IEC 9579:2000(E)

PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 734 10 79
E-mail copyright@iso.ch
Web www.iso.ch

Printed in Switzerland

Contents

Contents iii

Tables viii

Figures ix

Foreword x

Introduction xi

1 Scope 1

2 Normative References 3
2.1 International Standards 3
2.2 Internet Engineering Task Force 3
2.3 Institute of Electrical and Electronics Engineers 4

3 Interoperability 5
3.1 Interoperability between implementations 5
3.2 Interoperability with conforming OSI implementations 5
3.3 Interoperability with future editions 5

4 Definitions, Conventions and Notations 6
4.1 Definitions 6
4.2 Conventions 7
4.2.1 Convention for Figures 7
4.2.2 Naming of Concepts 7
4.2.3 Naming of Parameters 7
4.2.4 Specification of RDA Protocol, RDA Operations and RDA encoding elements 7
4.2.5 Evaluation of Rules 7

4.3 Notations 9
4.3.1 SQL/CLI functions 9
4.3.2 Implicit encoding definitions 9
4.3.3 Encoding Attributes 9
4.3.4 Notation for encoding syntax 9

5 Model and Facilities 10

5.1 Model 10

5.2 The RDA-client environment 11
5.2.1 Service User 11
5.2.2 SQL-client Services 11
5.2.3 RDA-client Services 12
5.2.4 Transport Mapping 12
5.2.5 RDA-client 12
5.2.6 RDA Location Server 13

5.3 The RDA-server environment 14
5.3.1 Transport Mapping 14
5.3.2 RDA-server Services 14
5.3.3 RDA-server 15
5.3.4 SQL-server 15
5.3.5 RDA Support Server 15

5.4 RDA concepts and the mapping of SQL/CLI concepts 16
5.4.1 Application Communication Areas 16
5.4.1.1 Attributes 16
5.4.1.2 Diagnostics areas 16
5.4.1.3 Descriptor areas 16
5.4.2 SQL_TEXT 17
5.4.3 SQL-session and SQL-connection 17
5.4.4 SQL User Name and Password 17
5.4.5 Multi-site Transactions 17
5.4.6 SQL/CLI Handles 17
5.4.7 Connection Ident 18
5.4.8 Statement Ident 18
5.4.9 Request Ident 18
5.4.10 Encodings 18

5.5 RDA Model of Transport 19
5.5.1 Transport Provider 19
5.5.2 Transport Address 19
5.5.3 Destination SQL-server Name 19
5.5.4 Transport Connection 19
5.5.5 Transport Facilities 19

5.6 RDA Facilities for Transport Connections 21
5.6.1 RDA Suspend and Resume Facility 21
5.6.2 RDA Encoding Facility 21

5.7 RDA Facilities for Transaction Co-ordination 22
5.7.1 RDA Transaction Co-ordination Facility 22

5.8 RDA Facilities for Security 23
5.8.1 RDA Security Services 23
5.8.2 Use of Transport Provider security facilities 23
5.8.3 Use of Authentication in RDAConnect 24
5.8.4 Use of MessageAuthentication in RDAMessage 24

6 RDA Protocol 26

6.1 The RDA Protocol Exchange 26

6.2 RDAMessage 27
6.2.1 RDAMessage protocol element 27
6.2.2 MessageAuthentication encoding element 30

6.3 Invocation of RDA Operations 32
6.3.1 Invocation of the Request in the RDA-client environment 32
6.3.2 Evaluation of the Request in the RDA-server environment 33
6.3.3 Invocation of the Response in the RDA-server environment 34
6.3.4 Evaluation of the Response in the RDA-client environment 35
6.3.5 Transport Fail Indication 35

7 RDA Operations 37

7.1 RDA request operations 37
7.1.1 RDAConnect Operation 37
7.1.2 RDADisconnect Operation 40
7.1.3 RDAEndTran Operation 41
7.1.4 RDAClientAttribute Operation 43
7.1.5 RDAStatementPrepare Operation 44
7.1.6 RDAStatementDeallocate Operation 45
7.1.7 RDAStatementExecute Operation 46
7.1.8 RDAStatementExecDirect Operation 49
7.1.9 RDAStatementFetchRows Operation 50
7.1.10 RDAStatementCloseCursor Operation 52
7.1.11 RDAStatementCancel Operation 53
7.1.12 RDASetCursorName Operation 54
7.1.13 RDAGetCursorName Operation 55
7.1.14 RDAGetInfo Operation 56
7.1.15 RDAGetTypeInfo Operation 57

7.2 RDA response encoding element 58

7.3 Encoding components 62
7.3.1 RDAAttribute encoding element 62
7.3.2 RDADiagnostic and RDADiagnosticStatus encoding elements 65
7.3.3 RDAItemDescriptor encoding element 66
7.3.4 RDARow and RDAValue encoding elements 68

8 Exceptions 69

8.1 Exception codes for RDA-specific Conditions 69

8.2 Exception Behaviour 70

9 Encodings 71

9.1 The Base Encoding 72

9.2 The ASN.1 PER Encoding 73

10 Transport Mappings 74

10.1 Mapping to TCP/IP 75
10.1.1 Transport Address 75
10.1.2 Mapping of Transport Connect 75
10.1.3 Mapping of Transport Disconnect 75
10.1.4 Mapping of Transport Fail 75
10.1.5 Mapping of Transport Send 75
10.1.6 Mapping of Transport Receive 75
10.1.7 Mapping of Transport Errors 75
10.1.8 Default Encoding 75

10.2 Mapping to TLS 76
10.2.1 Mapping of Transport Connect 76
10.2.2 Mapping of encodings 76
10.2.3 Mapping of Transport Errors 76
10.2.4 Provision of mandatory security facilities 76
10.2.5 Provision of optional security facilities 76

11 Conformance 77

11.1 RDA-client Conformance 77

11.2 RDA-server Conformance 77

11.3 Claims of Conformance 77

Annex A Conformance Proforma 79

A.1. Identification 79

A.2. Supplier Details 79

A.3. Implementation Details 80

A.4. RDA Support 80

A.5. Optional facilities for RDA-clients only 81

A.6. Optional facilities for RDA-servers only 82

Annex B RDA Programming Interface 83

B.1. Notation for defining RDA/API functions 84

B.2. Mapping RDA/API to a programming language 84

B.3. Transport Handles 84

B.4. Transport Mapping Codes 84
B.5. Transport Connection Management 85
B.6. RDA/API functions 85
B.7. RDA/API function invocation 85
B.8. RDA/API function parameters 86

Annex C Mapping of SQL/CLI 93
C.1. SQLDisconnect 94
C.2. SQLEndTran 94
C.3. SQLSetConnectAttr, SQLSetStmtAttr and SQLSetEnvAttr 94
C.4. <set transaction statement> 95

Annex D RDA Location Server 97
D.1. RDA Location Server name and schema 97
D.2. Server Location Table 98

Annex E RDA Support Server 99
E.1. RDA Support Server name and schema 99
E.2. Server Information Table 99
E.3. Request Log Table 101

Annex F Security Service Requirements 103
F.1. Potential Vulnerabilities 103
F.2. Authentication 104
F.3. Access Control 105
F.4. Transfer Integrity 106
F.5. Transfer Confidentiality 106
F.6. Storage Integrity 106
F.7. Storage Confidentiality 107
F.8. Non-repudiation 107

Annex G Security Profiles 109

Annex H RDA Operations and Protocol in ASN.1 notation 111

Annex I Encoding of Multiple Rows 115

Tables

Table 1–Codes used to identify the protocol 27
Table 2–Codes used to identify the protocol version 27
Table 3–Codes used to identify an RDA message type 28
Table 4–Use of MessageAuthenticateParameters 31
Table 5–Extension to Table 14 of ISO/IEC 9075-3 41
Table 6–Codes used for attribute types 62
Table 7–Codes used for RDA defined Connection Attributes 62
Table 8–Prohibited attributes 63
Table 9–Extension to Table 19 of ISO/IEC 9075-3 63
Table 10–Values of Statement Ident 64
Table 11–RDADescriptorEntries required for SQL Data Types 66
Table 12–SQLSTATE class and subclass values for RDA-specific conditions 69
Table 13–RDAResponse Parameter settings for RDA generated conditions 70
Table 14–Codes used to identify TCP/IP encoding 71
Table 15–Transport Mappings 74
Table 16–Transport Mapping Codes 84
Table C.1–RDA Operations invoked when evaluating an SQL/CLI function 93
Table G.1–Security Profiles – Facilities Used 109
Table G.2–Security Profile – Services Provided 109

Figures

Figure 1–RDA model of SQL-environment 10
Figure 2–Model of the RDA-client environment 11
Figure 3–Model of the RDA server environment 14

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

International Standard ISO/IEC 9579 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 32, *Data management and interchange*.

This second edition cancels and replaces the first edition (ISO 9579:1999), which has been technically revised.

Annexes A to E and G form a normative part of this International Standard. Annexes F, H and I are for information only.

Introduction

Remote Database Access for SQL (RDA/SQL) International Standard is a member of a set of International Standards produced to facilitate the interworking of computer systems. This International Standard conforms to the model defined in ISO/IEC 10032, *Information technology – Reference Model of Data Management*.

Remote Database Access for SQL can be used to provide remote data access to a database management system conforming to ISO/IEC 9075 (Database Language SQL).

The goal of Remote Database Access for SQL is to allow, with a minimum of technical agreement outside this International Standard, the interconnection of applications and database systems:

- from different manufacturers,
- under different managements,
- of different levels of complexity,
- exploiting different technologies.

An application may itself be a database system and therefore this International Standard can be used to support multi-database system interworking.

Information technology — Remote database access for SQL with security enhancement

1 Scope

This International Standard, Remote Database Access for SQL (RDA), defines a model for the remote interaction of an SQL-client and one or more SQL-servers through communication media, and defines the encoding of messages, the semantics of messages and associated facilities for mediating the interaction between one SQL-client and one SQL-server.

This International Standard also defines a mapping of the RDA Protocol to the specific communication infrastructures TCP/IP and Transport Layer Security (TLS).

This International Standard relies upon the facilities provided by ISO/IEC 9075 (SQL) and ISO/IEC 9075-3 (SQL/CLI).

This International Standard also:

- identifies potential security vulnerabilities in remote database access using RDA,
- defines RDA facilities which protect against the potential vulnerabilities.

Normative annexes provide:

- a Conformance Proforma,
- an optional language independent Application Programming Interface defined in the notational conventions of ISO/IEC 9075-3 (SQL/CLI) for invoking RDA Operations,
- an optional mapping of ISO/IEC 9075-3 (SQL/CLI) functions to RDA Operations,
- definitions of optional SQL-servers, the RDA Location Server and the RDA Support Server, to facilitate interoperation and data distribution in a heterogeneous environment,
- a set of security profiles that identify which RDA facilities and other security facilities are required for different levels of protection against potential vulnerabilities.

Informative annexes provide:

- an analysis of security service requirements,
- an ASN.1 specification for the RDA Protocol,
- an ASN.1 specification for the encoding of multiple rows.

This International Standard does not constrain:

- conforming RDA-client environments to be implemented using any particular processor decomposition,
- conforming RDA-server environments to be implemented using any particular processor decomposition.

This International Standard refers to but does not define:

- protocols and security mechanisms for communication confidentiality, integrity and authentication of communicating peers,
- digital signature and authentication mechanisms supported by protocol elements of RDA.