ISO/IEC JTC 1/SC 32 N 0736
ISO/IEC JTC 1/SC 32/WG 4 SQL/MM:VIE-006
January, 2002

ISO

International Organization for Standardization

ISO/IEC JTC 1/SC 32
Data Management and Interchange
WG4 SQL/MM

Secretariat: USA (ANSI)

Title: Information technology — SQL Multimedia and Application Packages - Part 1: Framework FCD Text

Project: 1.32.04.02.01.00

Editor: Takaaki Shiratori

References:

1) WG4:VIE-007, SQL/MM Part-2: Full-Text Revised Text for CD, December 2001, by Mark Ashworth
2) WG4:VIE-008, SQL/MM Part-3: Spatial Revised Text for CD, December 2001, by Mark Ashworth
3) WG4:VIE-009, SQL/MM Part-5: Still Image Revised Text for CD, December 2001, by Mark Ashworth
4) WG4:VIE-010, SQL/MM Part-6: Data Mining FCD, May 2001, by Christoph Lingenfelder

VIE-006 contains the titled document (*Part1: Framework FCD Text*) that has been available for FCD ballot starting December 14, 2001, at the following URL:

http://www.jtc1sc32.org/sc32/jtc1sc32.nsf/f3b9a582bbf35d33852566210054191a/629ac8bc3e75011e88256b1300434ee0?OpenDocument

For FCD Ballot

ISO/IEC JTC 1/SC 32: N 0736

Date: 2001-11-28

ISO/IEC FCD 13249-1:2002 (E)

ISO/IEC JTC 1/SC 32/WG4

Secretariat: USA

Information Technology — Database Languages — SQL Multimedia and Application Packages — Part 1:Framework

Document type: International Standard
Document subtype: Not applicable
Document stage: (30) Committee
Document language: E

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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.

ISO/IEC 13249-1 was prepared by Joint Technical Committee ISO/IEC, JTC 1, *Information technology*, Subcommittee SC 32, *Data management and interchange*.

ISO/IEC 13249 consists of the following parts, under the general title: *Information technology — Database Languages — SQL Multimedia and Application Packages*:

— Part 1: Framework (SQL/MM Framework)

— Part 2: Full-Text (SQL/MM Full-Text)

— Part 3: Spatial (SQL/MM Spatial)

— Part 5: Still Image (SQL/MM Still Image)

Parts other than this part specify requirements, and all are dependent on various parts of ISO/IEC 9075 and also on this part of ISO/IEC 13249.

Introduction

The organization of this part of ISO/IEC 13249 is as follows:

1) Clause 1, "Scope", specifies the scope of this part of ISO/IEC 13249.

2) Clause 2, "Normative references", identifies additional standards that, through reference in ISO/IEC 13249, constitute provisions of this part of ISO/IEC 13249, and hence to all parts of ISO/IEC 13249.

3) Clause 3, "Terms and definitions", specifies terms and definitions used in ISO/IEC 13249.

4) Clause 4, "Concepts", describes the concepts used in ISO/IEC 13249.

5) Clause 5, "Parts of ISO/IEC 13249", summarises the content of each of the parts of ISO/IEC 13249.

6) Clause 6, "Notation and conventions used in other parts", defines the notation and conventions used in other parts of ISO/IEC 13249.

7) Clause 7, "Implementation requirements", describes the requirements relating to the implementation of ISO/IEC 13249.

8) Clause 8, "Conformance", specifies the conformance requirements for all or some of the parts of ISO/IEC 13249.

9) Annex A is an informative Annex. It describes the formal procedures for maintenance and interpretation of ISO/IEC 13249.

Information Technology — Database Languages — SQL Multimedia and Application Packages — Part 1:Framework

1 Scope

ISO/IEC 13249 defines a number of packages of generic data types common to various kinds of data used in multimedia and other subject areas, to enable that data to be stored and manipulated in an SQL database. Each package is defined as a part of ISO/IEC 13249.

ISO/IEC 13249-1 defines those concepts, notations and conventions that are common to two or more other parts of ISO/IEC 13249. In particular it describes the way ISO/IEC 9075 is used in other parts to define the user-defined types and their behaviour appropriate to each subject area.

2 Normative references

The following standards contain provisions that, through reference in this part of this text, constitute provisions in this part of ISO/IEC 13249. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on ISO/IEC 13249 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid international standards.

ISO/IEC 9075-1:1999*, Information technology - Database languages - SQL - Part 1: Framework.*

ISO/IEC 9075-2:1999*, Information technology - Database languages - SQL - Part 2: Foundation.*

ISO/IEC 9075-4:1999*, Information technology - Database languages - SQL - Part 4: Persistent stored modules.*

3 Terms and definitions

Editor's Note 4

The following possible problem has been identified (source Mark Ashworth):

SQL/MM Part 2:Full-Text, SQL/MM Part 3: Spatial and SQL/MM Part 5:Still Image have an Informational Schema and Definitional Schema. Add some description of the Information Schema and Definitional Schema that is common across these parts.

3.1 Definitions taken from ISO/IEC 9075

The following terms defined in ISO/IEC 9075 are used either in this part of ISO/IEC 13249 or in other parts of ISO/IEC 13249.

(a) assignment

(b) attribute

(c) cardinality

(d) column

(e) compilation unit

(f) constructor function

(g) data type

(h) declared type

(i) descriptor

(j) external routine

(k) identifier

(l) implementation-defined

(m) implementation-dependent

(n) instance (of a value)

(o) interface (of a structured type)

(p) mutator function

(q) null value

(r) observer function

(s) row

(t) sequence

(u) signature (of an SQL-invoked routine)

(v) SQL-environment

(w) SQL-implementation

(x) SQL-invoked routine

(y) SQL routine

(z) subtype

(aa) supertype

(bb) table

(cc) type-preserving function

(dd) user-defined type

(ee) white space

3.2 Definitions provided in this part of ISO/IEC 13249

For the purposes of this part of ISO/IEC 13249, the following definitions apply.

3.2.1
generic data type
a generic data type is a kind of data not already defined in ISO/IEC 9075 that is used in a wider context than a single enterprise and for which there are advantages in standardizing the way it is represented

3.2.2
meta-variable
a meta-variable is a variable which is used to define implementation-dependent or implementation-defined constants

3.2.3
multimedia
multimedia is any kind of data other than conventional data, examples being graphic, audio and visual data

3.3 Definitions provided in other parts of ISO/IEC 13249

The terms and associated definitions relating to the subject areas of ISO/IEC 13249 are provided by the part of ISO/IEC 13249 that defines the user-defined types for that subject area.

4 Concepts

4.1 Concepts taken from ISO/IEC 9075

The following concepts defined in ISO/IEC 9075 are used either in this part of ISO/IEC 13249 or in other parts of ISO/IEC 13249.

(a) array

(b) base table

(c) character set

(d) distinct type

(e) exception condition

(f) False

(g) function invocation

(h) host language

(i) method

(j) ordering function

(k) predefined data type

(l) privilege

(m) source type

(n) SQL-data

(o) SQL-statement

(p) structured type

(q) transformation functions

(r) True

(s) Unknown

(t) user-defined cast

(u) view

4.2 Requirements for generic kinds of data

ISO/IEC 9075 defines the Database Language SQL, which is a language used to define and manipulate SQL-data. For the purposes of this part of ISO/IEC 13249, the SQL-data in an SQL-environment is referred to as an SQL database.

Using the data definition facilities of ISO/IEC 9075, an enterprise may develop an SQL database based on the kinds of data chosen for some specific purpose determined by the particular requirements of the enterprise.

Editor's Note 1

The following possible problem has been identified (source Mike Newton):

The description of requirements for ISO/IEC 13249 in this clause is based on the storage and manipulation of generic kinds of application data for users, whereas the purpose of the user-defined types in Part 6: Data Mining is to support the processing of application data for users. This clause needs to allow for the requirements for Part 6.

Many kinds of data are used in a wider context than that of an individual enterprise, in which case there are benefits in being able to use a generic specification for the definition and manipulation of these kinds of data.

These benefits include the enabling of the following:

(a) shared understanding of this data;

(b) exchange of this data;

(c) provision of common manipulation facilities to process this data.

Recognition of these benefits has resulted in the development of international standards and of publicly available specifications for generic data types in a number of subject areas. These subject areas include text, spatial, graphic, audio and video data.

Many enterprises have requirements to use such generic data types combined with their own enterprise-specific data types in an SQL database. These requirements include the manipulation of component elements of a generic data type, enabling both the construction and recording of user-defined types within an SQL database, and the use

of these components in selection and retrieval of data from an SQL database. ISO/IEC 13249 addresses these requirements.

4.3 Use of ISO/IEC 9075

ISO/IEC 9075 includes facilities for defining user-defined types. A user-defined type can be either a distinct type or a structured type. A distinct type is based on some predefined data type. A structured type has attributes specified as either SQL data types or other user-defined types. A structured type may be defined as a subtype of another structured type, with inheritance of its attributes. A column of an SQL table can be defined as a user-defined type.

A user-defined type can only be manipulated by associated routines.

An attribute has automatically an associated observer and mutator function to retrieve and change its value. Further routines may be defined in which the body of the routine, being the component that determines behaviour on invocation of the routine, is specified either by SQL statements or by reference to an external routine prepared in some other programming language.

Each part of ISO/IEC 13249 defines a number of user-defined types and associated routines, defined according to ISO/IEC 9075. The types and routines of each part are intended for use with data for a specific subject area. Each part constitutes a package that aims to satisfy the requirements for including generic data types for that subject area in an SQL database. It does not define how data from multiple subject areas may be combined.

Each user-defined type is fully defined using the SQL syntax of ISO/IEC 9075.

For each routine there is a specification of its signature, which includes its name and all parameters with their type. A routine body is specified either by SQL statements or by reference to a definition, which is given either in some formal language or as descriptive text.

The definition of a user-defined type in a part of ISO/IEC 13249 can include user-defined cast functions to convert between a value of the user-defined type and another data type.

The definition of a user-defined type in a part of ISO/IEC 13249 can include an ordering function to specify the order of two values of the user-defined type.

4.4 Implementation of ISO/IEC 13249

Conformance to any one other part of ISO/IEC 13249 may be claimed by an implementation, in which case it is required to provide its users with the capability of using the user-defined types according to the specifications of that part of ISO/IEC 13249.

An implementor of a part of ISO/IEC 13249 has the freedom to provide a routine in any way that has the same effect as the specification of its body in that part. In particular, a specification of a routine body using SQL does not have to be implemented exactly as given, but may be implemented by another set of SQL statements or by an external routine having the same effect.

4.5 Use of ISO/IEC 13249

The requirements described in Subclause 4.2, "Requirements for generic kinds of data", involve data for user-defined types being recorded and manipulated with other enterprise data in an SQL database. Data can be in an SQL database only when a column of a table is defined as an appropriate type to record it. The user-defined types defined in subsequent parts of ISO/IEC 13249 can be used for this purpose in at least three different ways:

(a) as the basis of a column in a table;

(b) as the basis of an attribute of a user-defined type;

(c) as the basis of a new derived subtype.

In the first way, a column's type is specified as one of the user-defined types of a part of ISO/IEC 13249. This use of a user-defined type of ISO/IEC 13249 requires the USAGE privilege for the user-defined type (see Subclause 7.2, "USAGE privileges on user-defined types"). The routines defined by ISO/IEC 13249 are used to manipulate values of the user-defined type. Invocation of these routines requires the EXECUTE privilege for the routines (see Subclause 7.4, "EXECUTE privileges on routines").

In the second way, a new user-defined type is defined with an attribute that is one of the user-defined types of ISO/IEC 13249. The new user-defined type may have additional attributes to satisfy specific enterprise requirements. This use of a user-defined type of ISO/IEC 13249 requires the USAGE privilege for the user-defined type (see Subclause 7.2, "USAGE privileges on user-defined types"). The new user-defined type can then be used as a column's type, as in the first way. New routines may be created for the new user-defined type. If these new routines incorporate routines defined by ISO/IEC 13249 to manipulate values of the attribute that is one of the user-defined types of ISO/IEC 13249, then the EXECUTE privilege is required for the incorporated routines in order to create the new routine (see Subclause 7.4, "EXECUTE privileges on routines").

In the third way, a new user-defined type is defined as a subtype of one of the user-defined types of a part of ISO/IEC 13249. The new user-defined type may have additional attributes to satisfy specific enterprise requirements. This use of a user-defined type of ISO/IEC 13249 requires the UNDER privilege for the user-defined type (see Subclause 7.3, "UNDER privileges on user-defined types"). The new user-defined type can then be used as a column's type, as in the first way. The routines defined by ISO/IEC 13249 can be used to manipulate the new user-defined type (though further routines may be needed). Invocation of these routines requires the EXECUTE privilege for the routines (see Subclause 7.4, "EXECUTE privileges on routines").

Whichever way is considered most appropriate for a specific enterprise context, any user-defined type can be used only in an SQL environment.

An SQL-agent consists of one or more compilation units that interact with an SQL-environment. An SQL-agent can interact only via predefined data types for which ISO/IEC 9075 defines a mapping for the host language or programming language used to create the SQL-agent.

The definition of a user-defined type in a part of ISO/IEC 13249 can include transform functions to convert between a value of the user-defined type and predefined types.

5 Parts of ISO/IEC 13249

The parts of ISO/IEC 13249 currently under development are as follows.

5.1 Part 1: Framework (SQL/MM Framework)

This part of ISO/IEC 13249 provides a specification of both the definitional mechanisms and the conventions used in all other parts.

5.2 Part 2: Full-Text (SQL/MM Full-Text)

ISO/IEC 13249-2 specifies user-defined types for full-text data and for a number of text search patterns. It also defines routines for searching full-text data according to a given search pattern. In addition, it defines routines for casting character strings to and from these user-defined types.

5.3 Part 3: Spatial (SQL/MM Spatial)

ISO/IEC 13249-3 specifies user-defined types for spatial data, specifically points, curves, surfaces and collections of these. It also defines routines for manipulating, searching and ordering spatial data. In addition, it defines transform functions for converting the user-defined types to and from character and binary representations.

5.4 Part 5: Still Image (SQL/MM Still Image)

ISO/IEC 13249-5 specifies user-defined types for image data, organised according to some image format, such as ISO/IEC 10918, JPEG, and for image search mechanisms. It also defines routines for manipulating and for searching image data using different mechanisms. In addition, it defines transform functions for converting the user-defined types to and from binary representations.

Editor's Note 2

A description of Part 6: Data Mining is required.

6 Notations and conventions used in other parts

6.1 Notation

The notation used in the specification of user-defined types and associated routines is, wherever possible, the database language SQL as defined in ISO/IEC 9075.

6.2 Conventions

6.2.1 Clause structure

Within each part, the specification of user-defined types having a common purpose is contained within a single clause of that part of ISO/IEC 13249. For each user-defined type there is a subclause, which contains further subclauses giving the definition of the type and each of its associated routines.

6.2.2 Organization of specifications

A subclause that defines a user-defined type or routine has the following unnumbered sections.

1) **Purpose**: This section shall contain a brief description of the purpose of the user-defined type or routine.

2) **Definition**: This section shall contain the ISO/IEC 9075 syntax used to define the type or routine. In order to distinguish SQL syntax from other text in ISO/IEC 13249, SQL syntax is specified in a non-proportional type font. <key word>s, as defined in ISO/IEC 9075, are in uppercase. Parameter and variable identifiers are in lower case or mixed case. Data type, attribute and SQL-invoked routine identifiers are specified as prescribed in Subclause 6.2.3, “Data type, attribute and SQL-invoked routine identifiers”. If this section is empty, the section heading shall be omitted.

3) **Definitional Rules**: This section shall contain an enumerated list of rules to be applied when defining the type or routine. If this section is empty, the section heading shall be omitted.

4) **Description**: This section shall contain an enumerated list of rules describing the type or routine. For a type, the first item shall contain a statement indicating the attributes and routines that are part of the public specification. For a routine, the first item shall contain the definition of the routine's parameters. If this section is empty, the section heading shall be omitted.

If there is any discrepancy between the interpretation of a given Definition and its associated Description, then any SQL specification shall take precedence.

6.2.3 Data type, attribute and SQL-invoked routine identifiers

Within the specification of a user-defined type or routine, data type identifiers, attribute identifiers and routine identifiers shall obey the following rules:

1) two capital letters and an underscore shall be used as a prefix; for example, Full-Text uses FT_;

2) underscore character shall not be used except in the prefix (i.e. only alphanumeric characters [a-z,A-Z,0-9]);

3) each word used in the identifier shall have an initial capital letter; for example, FT_Primary;

4) italic type font shall be used in a Definitional Rules section and in a Description section.

6.2.4 Parameter identifiers

Parameter identifiers shall be in lowercase. To distinguish parameters from other identifiers used in these sections, parameters shall be in an italic type font when used in the Definitional Rules and the Description sections.

6.2.5 Meta-variables

Meta-variables used to define implementation-dependent or implementation-defined constants shall follow the conventions of Subclause 6.2.3, "Data type, attribute and SQL-invoked routine identifiers".

6.2.6 Symbols

Definitional Rules and Description sections contain symbols that are distinguished from other identifiers by being in an uppercase italics type font.

6.2.7 Exceptions

Except where otherwise specified, the phrase "an exception condition is raised:", followed by the name of a condition, shall be used in a Definitional Rules section or in a Description section to indicate one of the following:

The execution of a routine is unsuccessful.

Application of Definitional Rules or Description items may be terminated.

The effect of an SQL-statement that terminates with an exception condition (unless this condition is explicitly defined in ISO/IEC 9075) is implementation-dependent.

The phrase "a completion condition is raised:", followed by the name of a condition, shall be used in a Definitional Rules section or in a Description section to indicate that application of Definitional Rules or Description items is not terminated. In such a case, diagnostic information is to be made available; unless an exception condition is raised, the execution of the SQL-statement is successful.

6.2.8 Status codes

ISO/IEC 9075 specifies that a parameter, SQLSTATE, shall be used for the purpose of indicating any exception or completion conditions by means of a five-character status code. This parameter shall also be used in each part of ISO/IEC 13249; each part shall contain a clause giving the values of SQLSTATE for the routines defined by that part.

7 Implementation requirements

In addition to the provisions given for each part of ISO/IEC 13249, an implementation of any part shall satisfy the following requirements.

7.1 Schemas

ISO/IEC 9075 specifies that an object such as an SQL-invoked routine, a user-defined type, a domain, a table, a view, or a privilege shall be part of exactly one schema.

ISO/IEC 13249 does not include a statement for creating a schema. For an implementation of any part of ISO/IEC 13249, an implementation-defined set of <schema definition> statements shall be effectively executed such that each <schema definition> statement that contains a <schema element> for a schema object defined in that part shall contain exactly one <schema element> for each object defined by that part. The number of such schemas and their names is implementation-defined.

It is assumed that the default character set of the SQL-schema in which an SQL-invoked routine specified in ISO/IEC 13249 is created includes the characters used in all character string literals contained in the body of that routine and a space character denoted by a blank space in such literals.

7.2 USAGE privileges on user-defined types

ISO/IEC 9075 specifies that a user shall have the USAGE privilege on a user-defined type before the user can refer to it for the purpose of defining other objects such as SQL-invoked routines, tables, views or user-defined types.

The parts of ISO/IEC 13249 do not include a GRANT USAGE statement for the user-defined types defined in that part. For an implementation of any part of ISO/IEC 13249, a GRANT statement granting USAGE privilege for each object defined by that part to an implementation-defined set of grantees shall be effectively executed when these user-defined types are created (except when explicitly noted in a Definitional Rule in that part). Whether or not the GRANT statement includes WITH GRANT OPTION is implemention-defined.

7.3 UNDER privileges on user-defined types

ISO/IEC 9075 specifies that a user shall have the UNDER privilege on a user-defined type A before the user can use it for defining subtypes of A.

Each part of ISO/IEC 13249 does not include a GRANT UNDER statement for the user-defined types defined in that part. For an implementation of any part of ISO/IEC 13249, a GRANT statement granting UNDER privilege for each object defined by that part to an implementation-defined set of grantees shall be effectively executed when these user-defined types are created (except when explicitly noted in a Definitional Rule in that part). Whether or not the GRANT statement includes a WITH GRANT OPTION is implemention-defined.

7.4 EXECUTE privileges on routines

ISO/IEC 9075 specifies that a user shall have the EXECUTE privilege on a routine before that user can execute the routine.

Each part of ISO/IEC 13249 does not include a GRANT EXECUTE statement for the routines defined in that part. For an implementation of any part of ISO/IEC 13249, a GRANT statement granting EXECUTE privilege for each routine defined by that part to an implementation-defined set of grantees shall be effectively executed when the routine is created (except when explicitly noted in a Definitional Rule in that part). Whether or not the GRANT statement includes a WITH GRANT OPTION is implementation-defined.

8 Conformance

8.1 Implementations

Each other part of ISO/IEC 13249 shall provide a specification to which an implementation may claim conformance, independently of any other part.

Editor'sNote 3

The following possible problem has been identified (source Mark Ashworth):

Both SQL/MM Part 5: Still Image and SQL/MM Part 6: Data Mining have conformance clauses that specify a function-only implementation. However Framework is written to require an implementation to provide the type and routine definitions as found in the Definition sections of the part. This includes the method definition. Framework needs to be changed to accommodate Parts 5 and 6.

A conforming implementation of a part of ISO/IEC 13249 shall support the mandatory public user-defined types and routines for that part. All mandatory and optional user-defined types and routines shall be supported as specified in the Definitional Rules sections and Description sections for that part.

A conforming implementation of a part of ISO/IEC 13249 shall supply <SQL-invoked routine>s whose <routine body> is either an <SQL routine body> or an <external body reference> that specifies PARAMETER STYLE SQL as defined in Subclause 11.49, "<SQL-invoked routine>", of ISO 9075-2. The implementation is not required to:

- perform the exact sequence of actions defined in a Description section or an <SQL routine body> contained in that part, but the implementation shall achieve the same effect as that sequence, with the following permitted deviations:

  an exception or warning condition specified by ISO/IEC 9075 for an SQL-statement other than <signal statement> or <resignal statement> is not required to be reproduced;

  the effects on the SQL diagnostics area resulting from an SQL <signal statement> or <resignal statement> are not required to be as specified in ISO/IEC 9075, apart from the RETURNED_SQLSTATE value;

- conform to a specified <language clause> of LANGUAGE SQL;

- conform to a specified <deterministic characteristic> of NOT DETERMINISTIC;

- conform to a specified <deterministic characteristic> of DETERMINISTIC so long as the result is implementation-dependent;

- conform to a specified <SQL-data access indication> so long as a more restrictive <SQL-data access indication> is used.

A conforming implementation of a part of ISO/IEC 13249 that uses an <external body reference> for a routine shall specify an implementation-dependent <transform group specification>, when defining the routine, to permit values of user-defined types to be transferred between the SQL-environment and the external routine.

In addition, a conforming implementation of a part of ISO/IEC 13249 shall support the implementation requirements specified in Clause 7, "Implementation requirements".

8.2 Relationship to other International Standards

A conforming implementation of a part of ISO/IEC 13249 shall support Core SQL as specified in ISO/IEC 9075 and any additional Features of ISO/IEC 9075 specified as required in that part of ISO/IEC 13249.

8.3 Claim of conformance

A claim of conformance to ISO/IEC 13249 shall state the part or parts to which conformance is claimed.

In addition, a claim for conformance shall include definitions for all elements and actions that the part, or parts, of ISO/IEC 13249 specifies as implementation-defined.

8.4 Extensions and options

A conforming implementation of a part of ISO/IEC 13249 may provide support for additional implementation-defined routines, defined using either the user-defined types for that part or implementation-defined user-defined types.

A conforming implementation of a part of ISO/IEC 13249 remains conforming even if it provides user options to process the defined routines in a non-conforming manner.

Annex A
(informative)

ISO/IEC JTC1 formal procedures

ISO/IEC JTC1 has formal procedures for revision, maintenance, and interpretation of JTC1 international standards. Clause 6.13 of the JTC1 Directives, "Maintenance/correction of defects in JTC1 Standards", specifies procedures for creating and processing "defect reports". Defect reports may result in technical corrigenda, amendments, interpretations, or other commentary on an existing International Standard.

In addition, SC32, the JTC1 subcommittee that developed ISO/IEC 13249, has procedures for raising new "questions" about topics related to existing SC32 projects. Questions may result in interpretations, new project proposals, or possibly new defect reports.

Potential new questions or new defect reports addressing the specifications of ISO/IEC 9075 should be communicated to:

Secretariat, ISO/IEC JTC1/SC32