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Douglas Mann, Secretariat, ISO/IEC JTC 1/SC 32

Pacific Northwest National Laboratory *, 901 D Street, SW., Suite 900, Washington, DC, 20024-2115, United States of America

Telephone: +1 703 575 2114; Facsimile; +1 703 681 9180; E-mail: MannD@battelle.org

available from the JTC 1/SC 32 WebSite www.jtc1sc32.org

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Position Paper
from
Spatial Standardization Study Group
Menlo Park, California February 14-16, 2000

1. Purpose

The purpose of the Spatial Standardization Study Group meeting is recorded in Resolution 29 from the plenary meeting of ISO/IEC JTC1 held in Korea, November 1999, "The purpose of the [Special JTC 1] meetings [On Planning Spatial Standardization & Related Interoperability] is to develop a mutually agreed plan between the interested parties setting out the responsibilities for work in spatial standardization and its related interoperability. The main aim is to achieve minimal overlap and optimum collaboration."

The purpose of the paper is to communicate the position and general direction of the participants after the first meeting. The paper includes supporting background information and suggests areas of cooperation in fulfillment of Resolution 29. It proposes a way ahead to achieve minimal overlap and optimal collaboration.

2. Organizations represented

2.1 ISO/IEC JTC 1/SC 24 Computer Graphics and Image Processing

ISO/IEC JTC 1/SC 24 is responsible for the development of international standards in the areas of computer graphics, image processing, and visual information presentation. These standards involve both presentation aspects and interaction aspects. Over the past 20 years, SC24 has published 59 international standards comprising over 8000 pages. Many of their standards have become widely used in their own right as well as being used within international standards from other committees. SC24 continually seeks to work in collaboration not only with other ISO and IEC committees but also with industry consortia to expeditiously complete standards in areas of interest throughout the world.

Many of the standards produced by SC 24 are used for representing geospatial data. Geospatial information is an inherent part of a broader environmental representation being standardized as part of the SEDRIS projects.

SC 24 has a long history of collaboration with other standards bodies and industry consortia. It was the innovator of the technique of using Collaborative Working Agreements as a means of working productively with industry consortia. This technique has been remarkably successful in quickly producing international standards from recognized de facto industry standards.

Additional information can be found at http://www.bsi.org.uk/sc24/ .

2.2 ISO/IEC JTC 1/SC 31 Automatic Data Capture

ISO/IEC JTC 1 SC31 (Automatic Identification and Data Capture) consists of four working groups generally concerned with data carrier, data structure and radio frequency identification for item management across the global commercial and retail supply chains. These standards are used by the Uniform Code Council (UCC) and the European Article Numbering organization (EAN) to manage a Global Location Number (GLN) system that is widely used on a daily basis by more than 200,000 companies involved in a variety of business activities, including chemicals, electronics, banking, healthcare, retailing and do-it-yourself (DIY) sectors. The EAN/UCC location number is recognized by the United Nations working party responsible for UN/EDIFACT.

EAN/UCC location numbers, a key concept in EDI, are guaranteed to be globally unique within the EAN/UCC system and are typically represented today as bar codes physically marked onto trade units to identify the parties involved in the transaction (buyer, supplier); transport units (consignor, consignee); and physical locations (place of delivery, place of departure). Future extensions of this system will likely take advantage of spatial standards developed by ISO/IEC JTC 1.

Additional information can be found at http://www.uc-council.org/sc31/home.htm.

2.3 ISO/IEC JTC 1/SC 32 Data Management and Interchange

The management of spatial data using SQL is standardized by Working Group 4, SQL/Multimedia and Application Packages. WG 4 has expertise in databases and SQL as well as in spatial information. Because of its close ties to WG 3 (Database Languages), it has the ability to effect change in the SQL standard upon which SQL/MM is constructed. WG 4 contributes to spatial standardization by combining the power of SQL with an evolving common spatial schema to develop SQL implementations. WG 4 is also able to contribute to the common spatial schema in areas not addressed by other spatial standards organizations. WG 4 currently has liaison agreements with OGC, ISO/TC 211, and ISO/TC 204. WG 2 of SC 32 deals with metadata standardization.

Additional information can be found at http://bwonotes5.wdc.pnl.gov/SC32/JTC1SC32.nsf .

2.4 ISO/TC 211 Geographic information/Geomatics

ISO/TC 211 Geographic information/Geomatics is the ISO technical committeee responsible for standardization in the field of geographic information and geomatics.

ISO/TC 211 is establishing a series of standards for information concerning objects or phenomena that are directly or indirectly associated with a spatial location. The current work includes the fundamental standards in the field, including standards for conceptual schemas, methods, tools and services for data management, acquiring, processing, accessing, presenting and transferring such data in an interoperable way between different users, components and systems. The impact of this technology on human resources is a concern that is studied within one of the projects. Twenty-five work items have been approved so far and most of them are now at late CD stages and will become DIS within a short time. New work items are under ballot.

The work of ISO/TC 211 has a very broad international representation with 50 national member bodies currently involved. The work is conducted in close relationship with a large set of external and internal liaison organizations that ensure the most widespread market input. ISO/TC 211 also works closely with

committees developing standards for information technology. Through a cooperative agreement with Open GIS Consortium, the leading industry organization for developing spatial interoperability implementation specifications, a close contact with important technology developers and heavy consumers of this technology is achieved. The cooperation has led to processing of mature OGC specifications as International Standards. On the other side, OGC takes ISO deliverables as the basis for their abstract specifications.

ISO/TC 211 has invested considerable resources in harmonization with complementary efforts both within and outside of ISO.

Additional information can be found at http://www.statkart.no/isotc211/ .

2.5 Open GIS Consortium (OGC)

The OGC is a not-for-profit membership trade association dedicated to the development of specifications that provide for open access to heterogeneous geodata and geoprocessing services transparently and in a single session even when components live across the web in different distributed computing environments. OGC is now 5 years old and has 210 members internationally. OGC has accepted several large suites of interfaces in fulfillment of its mission, including Simple Feature Access, Catalog Services, Gridded Coverages, Coordinate Transformation Services, Geographic Markup Language, and has about another dozen in various stages of maturity. OGC events usually include a meeting of the Coordination Group that is a Special WG of ISO/TC 211.

Additional information can be found at http://www.opengis.org.

2.6 Simulation Interoperability Standards Organization (SISO)

The Simulation Interoperability Standards Organization (SISO) focuses on facilitating simulation interoperability and component reuse across government and non-government applications worldwide. SISO seeks to provide a forum for the interchange of new ideas, concepts, and technology across the broad Modeling and Simulation (M&S) community; to disseminate these ideas; to educate M&S practitioners and sponsors regarding their implementation; and to support the development of standards products (standards, recommended practices, and guides) for use in various applications. The organization and operation of SISO are governed by several high level operating principles designed to ensure that the organization conducts its business in a manner that encourages organization, responsiveness, responsibility, quality, discipline, fairness, openness and consensus. In standards development, these operating principles also include generality, stability and supportability.

Additional information can be found at http://www.sisostds.org .

2.7 SEDRIS Organization

The SEDRIS [Synthetic Environment Data Representation and Interchange Specification] Organization was established to solve pre-runtime Modeling and Simulation (M&S) data interchange problems. The M&S community needs an environmental data representation and interchange mechanism that, not only satisfies the requirements of today's systems, but is also extendable to meet future data sharing needs. This mechanism allows for standard representation of, and access to, existing environmental databases. It supports databases containing integrated terrain, ocean, atmosphere, and space data that allows for a unified representation and transition between domains. Finally, it allows for the increased utility and

reuse of legacy environmental databases, while remaining sensitive to data representational needs of visual, sensor, and constructive simulation systems.

SEDRIS technology is developed by a government and industry team participating in a SEDRIS Associates arrangement within the SEDRIS Organization. Associates represent the major data providers supporting the M&S Community. There are presently twenty-two U.S. and seven international participants. This development atmosphere has ensured commercial support for SEDRIS Technology based on best commercial practices. Each associate has developed an interface to SEDRIS for their proprietary applications or an assigned data format supporting M&S use.

Additional information can be found at http://www.sedris.org .

2.8 Digital Geographic Information Working Group (DGIWG)

The Digital Geographic Information Working Group is composed primarily of representatives of the military mapping agencies of most of the NATO nations. DGIWG produced the first version of the Digital Geographic Information Exchange Standard (DIGEST) in 1989. Version 2.0 was published in 1998. The DIGEST includes a conceptual schema for describing geographic features, and the Feature Attribute Coding Catalog (FACC). It also specifies several formats for the transfer of geographic information in either vector or raster form. DGIWG hopes to develop DIGEST version 3 as a profile of the ISO standards developed by ISO/TC 211.

Additional information can be found at http://www.digest.org .

2.9 Object Management Group (OMG)

The Object Management Group (OMG) was founded in April 1989 by eleven companies, including 3Com Corporation, American Airlines, Canon Inc., Data General, Hewlett-Packard, Philips Telecommunications N.V., Sun Microsystems and Unisys Corporation. In October 1989, the OMG began independent operations as a not-for-profit corporation. Through the OMG's commitment to developing technically excellent, commercially viable and vendor independent specifications for the software industry, the consortium now includes over 800 members. The OMG is moving forward in establishing CORBA as the "Middleware that's Everywhere" through its worldwide standard specifications: CORBA/IIOP, Object Services, Internet Facilities and Domain Interface specifications.

The OMG was formed to create a component-based software marketplace by hastening the introduction of standardized object software. The organization's charter includes the establishment of industry guidelines and detailed object management specifications to provide a common framework for application development. Conformance to these specifications will make it possible to develop a heterogeneous computing environment across all major hardware platforms and operating systems. Implementations of OMG specifications can be found on many operating systems across the world today. OMG's series of specifications detail the necessary standard interfaces for Distributed Object Computing. Its widely popular Internet protocol IIOP (Internet Inter-ORB Protocol) is being used as the infrastructure for technology companies like Netscape, Oracle, Sun, IBM and hundreds of others. These specifications are used worldwide to develop and deploy distributed applications for vertical markets, including Manufacturing, Finance, Telecoms, Electronic Commerce, Realtime systems and Health Care. OMG defines object management as software development that models the real world through representation of "objects." These objects are the encapsulation of the attributes, relationships and methods of software identifiable program components. A key benefit of an object-oriented system is its ability to expand in functionality by extending existing components and adding new objects to the system. Object

Additional information can be found at http://www.posc.org .

2.11 The Web3D Consortium

The Web3D Consortium (formerly the VRML Consortium) was established to provide standards for the representation, manipulation and animation of three-dimensional computer graphic models on the World Wide Web. The Virtual Reality Modeling Language (VRML97) currently holds the world speed record for the establishment of an ISO standard.

The GeoVRML Working Group was established within the Web3D Consortium in order to extend VRML for the representation and interchange of georeferenced 3D models. It uses the SEDRIS Spatial Reference Model to provide local spatial reference frames and modeling primitives suitable for rendering and manipulation on low-end graphics hardware. As of February 2000, the recommended practices document and an open-source sample implementation for GeoVRML 1.0 have been submitted to the Board of the Consortium and have been recommended for adoption by the Technical Advisory Board.

Additional information can be found at http://www.web3d.org .

2.12Other organizations

The following organizations were invited but were unable to attend:

- ISO/TC 184 Information may be found at http://www.nist.gov/sc4/
- ISO/TC 204 Information may be found at http://sae.org/technicalcommittees/204.htm

3. Goals

3.1 Interoperability

Participants at the meeting agreed that the primary goal of the meeting was to maximize interoperability among systems that produce and use spatial data. This requires consistent standards for data, data processing, and data transfer. It is recognized that various aspects of spatial data may continue to differ in order to support different applications, but such differences should be minimized and gratuitous differences eliminated to the extent possible. Elements common to multiple applications should be specified consistently, and in the same way, where possible. Consistency of standards will reduce the need to compile similar data redundantly for use by different applications.

3.2 Coordination

Achievement of standards consistency will require the various spatial standards organizations to put more effort into coordinating the work of standards development and harmonizing the results. However, closer coordination of the work should lead to more efficient use of the available resources as redundant (but dissimilar) standardization of the same spatial concepts is avoided.

The formal standards bodies, the public sector, consortia, and other interested parties need to actively seek partnerships to develop frameworks (architectures) for cooperation on several levels: agreements, processes, technology, resources, and others.

3.3 Market orientation

Those organisations that are developing standards need to continue to be driven by business imperatives and by markets. The goal includes enablement of better business climates and outcomes through standards that support effective business workflows including e-business and information exchange.

The spatial consensus community will continue to focus on the immediate needs of the users while also protecting the long term plan working towards a common vision of the spatially enabled information society. Development of a common vision based on the needs and ‘use case’ scenarios of the organizations involved in spatial co-operation will lead to a better understanding of where the eventual standards need to depend on (that is, normatively reference) each other and where a higher order of conformance testing could be required.

The barriers to market insertion and exploitation need to be removed by a combination of technology, new business model, partnership and marketing actions.

3.4 Conformance

Collaboration is needed to institute and identify conformance criteria, conformance requirements, and conformance testing agents.

4. Interaction and cooperation

4.1 Needs of the marketplace

All businesses that produce, distribute, or utilize spatial information alone or in conjunction with non-spatial information will benefit from spatial standards. Environments supported include geographic information, decision support, data mining, data warehousing, modeling and simulation. Application areas include but are not limited to automated mapping, geo-engineering, computer aided drafting and design, entertainment, modeling, and simulation. These span the planning, design, construction, operation, and maintenance of facilities and their supporting infrastructure such as communications, transportation, and utilities.

There are many places in the marketplace that will benefit significantly from *interoperable* access to spatial information and services. Industry sectors include such areas as the travel and tourism industries, the mapping and routing industries, communications, utilities, transportation, national defence, agriculture, disaster management and public safety, location services, inventory management, real and synthetic environmental modeling and gaming, and the emerging needs of electronic commerce for spatial information.

4.2 Specific technology

Initial candidates for technological collaboration are those subject areas listed below:

- Terminology
- Catalogues
- Geometry
- Location
- Topology
- Rendering
- Imaging
- Temporal
- Reference System
- Metadata
- XML

4.3 Customer participation

There are several aspects of interaction and cooperation that involve customer participation. These include testbeds, pilot projects, testing and other guarantors of conformance.

Testbeds are pre-specification efforts designed to bring quick consensus on a limited number of low-risk developments. Testbeds are sponsored by organizations whose business is constrained by the lack of interoperable spatial technology.

Pilot projects are post-specification efforts designed to assess the suitability of new technologies for acceptance into an enterprise. Successful pilot projects lead to training and operational insertion into production environments and provide feedback into the standards development process.

Conformance testing is a post-specification activity used to formally validate conformance to the relevant standards.

The cooperation will need to extend into the area of customer participation.

5. Approaches to cooperation

5.1 Provide mechanism for joint communication

5.1.1 Introduction

Multi-lateral communication among organizations is necessary for maximizing interoperability. Several mechanisms are suggested for improving such communication.

5.1.2 Develop common terminology

Attendees recognized the need to reconcile technical terminology differences to enable effective multi-lateral communications. Several basic terms initially need to be defined for a better understanding of the domain and market perspective differences. Included are such terms as spatial, interoperability, integrated environment, data model versus data representation model, geometry, multi-dimension topology, catalogue, and schema.

5.1.3 E-Mail lists

A common E-mail address list should be used for announcements of meetings, announcements of document availability, and distribution of other information of common interest. The number and type of e-mail lists will depend on the requirements of the overall industries, organizations, and each individual project.

5.1.4 Web sites

Web access should be provided. Further, each organization should provide a link to the web sites of each of the other organizations recognizing that Web access may be restricted as necessary to authorized individuals. An interim list will be provided at http://www.gistandards.org.uk/spatialsummit/ . However, each organization needs to review the access provisions afforded to other collaborating spatial standards organizaions.

5.1.5 Exchange of documents

Agreements need to be developed between the spatial standards organizations to release significant documents to each other as appropriate. Each organization should make copies of its documents available to members of the other organizations. Since those organizations that do not belong to ISO or ISO/IEC JTC1 have different working procedures, and classify their documents in different ways, it is difficult to provide a concise list of the types of documents that should be exchanged.

In the ISO context, the types of documents should certainly include new work item proposals (NP), Committee Drafts (CD), Draft International Standards (DIS), and Final Draft International Standards (FDIS). ISO Technical Committees and ISO/IEC JTC1 Subcommittees should also consider exchanging significant working drafts (WD), especially those that are distributed for review by the Technical Committee or Subcommittee. Non-ISO organizations should exchange documents equivalent to these ISO documents.

5.2 Operations

5.2.1 Liaisons (both formal and informal)

Several liaisons have already been established between the organizations represented at the meeting. However, these liaison activities can be made more effective in communicating significant information between organizations, and in initiating meaningful cooperation between organizations. Challenges which can be addressed include workload conflicts, scheduling conflicts, and costs of travel, all of which make it difficult for a liaison representative to attend meetings of two organizations on a regular basis.

Steps which can be taken to improve the effectiveness of liaison include:

- Completing the network of active liaisons between the spatial standards organizations;
- Identifying multiple representatives (including alternates) for each liaison;
- Providing assistance to liaison representatives in drafting liaison reports;
- Identifying the need for joint meetings.

5.2.2 Joint meetings

Joint meetings at the working group level offer an effective means for coordination of standards development work and harmonization of the results. An example is the meeting held in June 1998 between ISO/IEC JTC1/SC32 WG 4, ISO/TC 184 SC4, ISO/TC 211 WG2, DGIWG, and the OGC Geometry SIG that resulted in harmonization of geometry models across the five groups.

There is a need to develop a mechanism for determining the requirements for such meetings as a regular activity. The ongoing meeting requirements should be the main agenda item of a second meeting, already authorized by ISO/IEC JTC 1 to be held between April and June 2000.

5.2.3 Common membership

ISO/IEC Directives, Part 1 allow representatives of approved liaison organizations to participate (but not to vote) in meetings (including working group meetings) of the ISO or IEC Committees or Subcommittees to which they are liaison representatives. Other organizations may allow representatives of liaison organizations to participate in working group meetings on the same basis. Another way to

establish common membership depends upon the national bodies represented in ISO: these have the option to appoint the selected experts to multiple committees or subcommittees.

5.2.4 Multi-standard profiles

The use of profiles should be considered as a means of reducing duplication of standards development.

5.2.5 Formal Cooperative Working Agreements

An effective means of sharing the responsibility for standards development is through formal joint relationships between industry organizations and formal standards organizations. Formal cooperative working agreements insure a smooth working relationship between the organizations by explicitly stating the rights and responsibilities of each organization. Such agreements should be coupled with formal liaison relationships to ensure that each organization is able to fully participate in the activities of the other.

A prime example of success in this area is the relationship between the Web3D Consortium and ISO/IEC JTC1 created to standardize the Virtual Reality Modelling Language (VRML). This relationship states that early development takes place using the procedures of the Consortium where speedy processing is essential. When a specification is ready for standardization it is handed to the formal standards committee (in this case SC 24) for official review. The subsequent stages of standards development take place within the standards committee using its procedures but with participation of the Consortium. Another example is the cooperative agreement between OGC and ISO/TC 211.

Such relationships require that complete specifications be provided by the consortium in question so that they can be processed as Committee Drafts. From that time, it need only take 18 months to complete the standardization process including two rounds of committee draft processing.

6. Summary of Actions

The following short and long term actions are asserted in this report:

No.	Summary of action	Who by	Due date
1	Provide comments on this report	All	2000-03-17
2	Maximize interoperability among systems that produce and use spatial data (3.1)	All	Ongoing
3	Put more effort into coordinating standards development and harmonizing the results (3.2)	All	Ongoing
4	Avoid redundant (duplicate) standardization (3.2)	All	Ongoing
5	Seek partnerships to develop frameworks for cooperation on agreements, processes, technology, resources and others (3.2)	All	Ongoing
6	Continue to be driven by business imperatives, by markets (3.3)	All	Ongoing
7	Focus on the immediate needs of users while also protecting the long term plan (3.3)	All	Ongoing
8	Develop common 'use-case' scenarios (3.3)	All	Ongoing
9	Work towards removal of barriers to market insertion and exploitation (3.3)	All	Ongoing
10	Collaborate on conformance issues (3.4)	All	Ongoing
11	Develop technology cooperation for Terminology, Catalogues, Geometry, Location, Topology, Rendering, Imaging, Temporal, Reference System, Metadata, XML (4.2)	All	Ongoing
12	Extend cooperation into customer participation (4.3)	All	Ongoing
13	Develop common terminology (5.1.2)	All	Ongoing
14	Create e-mail lists (5.1.3)	MF	2000-03-03
15	Link web sites to meet collaboration needs (5.1.4)	MF All	2000-02-29 2000-03-03
16	Develop document release agreements (5.1.5)	All	Ongoing
17	Improve the effectiveness of the liaison process (5.2.1)	All	Ongoing
18	Develop mechanism for determining ongoing meeting requirements (5.2.2)	All	Next meeting
19	Call a second meeting between April and June 2000 (5.2.2)	MF	2000-03-10
20	Develop common membership concepts (5.2..3)	All	Ongoing
21	Consider profiles as a method to avoid duplication (5.2.4)	All	Ongoing
22	Develop (more) formal cooperation agreements (5.2.5)	All	Ongoing

In the above, MF = Mr Martin Ford, 'All' means those organizations participating in the Study Group.

Working Modes of Cooperation (from ISO/IEC Directives, Part 1, Annex A)

Mode 1 – Informative relation

One organization is fully entrusted with a specific work area and keeps the other fully informed of all progress.

Mode 2 – Contributive relation

One organization should take the lead of the work and the other should make written contributions where considered appropriate during the progress of this work. This relation also includes the exchange of full information.

Mode 3 – Subcontracting relation

One organization is fully entrusted with the realization of the work on an identified item, but due to specialization of the other, a part of the work is subcontracted and that part is prepared under the responsibility of the second organization. Necessary arrangements must be made to guarantee the correct integration of the resulting subcontracted work into the main part of the programme. To this end, the enquiry and approval stages are handled by the organization being the main contractor for the standardization task.

Mode 4 – Collaborative relation

One organization takes the lead in the activities, but the work sessions and meetings receive delegates from the other who have observer status and who ensure the technical liaison with the other organization. Such observers should have the right to intervene in the debate but have no right to vote. The full flow of information is oriented through this liaison.

Mode 5 – Integrated liaison

Joint Working Groups and Joint Technical Committees ensure integrated meetings for handling together the realization of standards under a principle of total equality of participation.

Joint Working Groups between technical committees of the two organizations shall operate in accordance with the ISO/IEC Directives, Part 1, 1.10.4.

For Joint Technical Committees this idea cannot be implemented until procedures consistent with the principles of collaboration between IEC and ISO are mutually agreed. In the meantime work results would be handled by mutual agreement by one or the other party.