Standards Compliance 15

Introduction

Standardization is a growing presence in the Information Technology (IT) industry. This chapter examines some of the issues related to standardization and tries to draw some general rules on when and how standardization can be accomplished.

Why Standardization

Standardization should be viewed as one of the things for which end users of a system will ask when it is appropriate to their business needs. If standardization is seen as a product attribute, such as price, performance, safety, or any of the many other things that cause customers to buy, then it is correctly positioned. There are times that it may not appeal to some customers at some level, and then there are times when it is nearly almost always mandatory, depending upon the nature and intent of the end user. End users may not care about the collision detection schema used in their LAN (ISO/IEEE 8802-3), but they may be very interested as to whether or not the keyboard has a QWERTY (ANSI X3) layout. Conversely, a software designer needs to know things such as when to use a standardized interface for shell and utilities (IEEE 1003.2) or if a standardized C++ is needed (X3Jl6).

In any case involving voluntary standards, there is the option of not adhering to a standard. Voluntary standards are a price of doing business; if a customer demands them and you do not have them, you do not sell your product. In some cases, you can convince a buyer that the nonstandard solution that you offer is significantly better, but it must be better by a margin large enough to justify the extra expense of ignoring a standard. Ultimately, standardization comes down to a matter of economics.

End users require standards because they believe standards promote inter-working and interconnection. Governments specify standardization so that they can compare two or more dissimilar products and make a business decision. Many governments are required by law to specify standards in their procurements for exactly this reason. Providers use standardization to provide a base from which to expand capabilities or to provide expandability of a system into areas into which they have little expertise. The use of the SCSI port for disk drives is an example, as is the use of TCP/IP for communications.

The key thing to remember as you read this chapter is that standards are a business tool, and should be used for business reasons. Standards are an enabler; if you do not have the standards that a user wants, then you will not even have a chance to sell a product, no matter how good or advanced it is. On the other hand, if you have standards in your product, and the product is inferior, you probably will also not win too many sales. Standards do not sell products; they merely make it possible for you to enter the market to try to sell your efforts.

Note – Regulatory standards are a different matter. They deal with safety, telephonic network interconnect, and environmental concerns, and are usually required by law. If you sell product without meeting these standards, you are illegal. Regulatory standards are considered to be mandatory and are not dealt with in this chapter.

This chapter will describe some of the more important standardization organizations and their products.

Sources of Standards

Standards come in different types and are created by a variety of organizations. This section discusses the derivation of standards.

Types of Standards

There are two distinct types of standards that exist: *de jure* standards and *de facto* standards. *De jure* standards are created by *Standards Developing Organizations* (SDOs), which are organizations that operate under specific rules to create standards. No consortium produces *de jure* standards, because consortia limit participation in their specification producing processes.

De facto standards are volume standards—that is, a true *de facto* standard is a product that leads in market share, in the industry, and from this gains standing as the "industry standard." Consortia try to develop *de facto* standards from their specification by having large numbers of users and providers adopt their specifications. Ultimately, most consortia wish to have their specifications made into standards by submitting them to an SDO and gaining a national and international seal of approval.

For purposes of this chapter, *standards* will refer to technical descriptions formally accepted and endorsed by an SDO. *Specification* will refer to a consortium document, and the term *de facto standard* will be used to indicate a product that is a dominant market leader.

Standards Developing Organizations (SDOs)

The following organizations develop industry-wide standards.

The International Organization for Standardization (ISO)

ISO is the premier standardization organization in the world. Based in Geneva, ISO standardizes everything from screw threads to mica to humane animal traps. It has, in conjunction with the *International Electrotechnical Committee* (IEC), one joint technical committee, imaginatively called *ISO/IEC Joint Technical Committee* l (JTC l), which is charged with information technology standardization. JTC l is also the largest and most productive standards committee in existence. It has 22 Primary (or voting) members and 19 Observer (nonvoting but contributing) members, with 2500 standards documents and over 3500 volunteers in 41 nations.

JTC 1 is composed of subcommittees (SCs) that deal with the technical areas listed on Table 15-1. JTC l currently has eighteen SCs. (Note that subcommittee numbers, once used, are not reused when the committee goes out of existence to ensure that duplicate documents are not created.)

Table 15-1 ISO/JTC 1 Standards Subcommittees

SC	Name	Country
SC l	Vocabulary	France
SC 2	Character Sets and Information Coding	France
SC 6	Data Communications	USA
SC 7	Design and Documentation	Canada
SC 11	Flexible Magnetic Media	USA
SC 14	Representation of Data Elements	Sweden
SC 15	Labeling and File Structure	Switzerland
SC 17	Identification and Credit Cards	Switzerland
SC 18	Text and Office Systems	USA
SC 21	Open Systems Support Services	USA
SC 22	Languages	Canada
SC 23	Optical Digital Data Disks	Japan
SC 24	Graphics	Germany
SC 25	Interconnection and Information Technology	Germany
SC 26	Microprocessor Systems	Japan
SC 27	Security Techniques	Germany
SC 28	Office Machinery and Stand Alone Printers	Japan
SC 29	Coded Representation for Hypermedia	France

These subcommittees and their subordinate Working Groups (WGs) create JTC 1 standards. It is in these committees that drafts are written, reviews are accomplished, and technical agreements are reached. After a complex balloting process, the document becomes an International Standard.

The standards produced by ISO/IEC JTC l are the dominant information technology standards in the world, and are usually the standards to which government and private procurements point. The U.S. position in ISO/IEC/JTC 1 is voted by ANSI with advice from the U.S. Technical Advisory Group (TAG) to JTC 1.

American National Standards Institute (ANSI)

Most nations have a single SDO that oversees national standards activities. In the United States, the American National Standards Institute (ANSI) is the umbrella organization for standards. ANSI makes the rules by which standards are written, and accredits organizations that follow its rules.

These rules serve two purposes:

- to allow free and open participation to any concerned party
- to achieve consensus in the creation of a standard. (Concensus is defined as a state achieved when all parties reach a substantial agreement. This indicates more than majority, but does not mean unanimity. Rather, it indicates that all arguments have been heard and addressed, and dealt with in a constructive fashion.)

All U.S. formal SDOs must follow the rules of ANSI in the creation of standards.

There are over 200 SDOs accredited by ANSI. The most important in IT standardization is ASC X3. X3 produces approximately 90% of the IT standards in the U.S. and contributes to nearly all other worldwide IT standards. The IEEE produces the majority of the remainder of the IT standards in the U.S., but has little impact on the course of international standardization except in the areas of POSIX and LANs.

Accredited Standards Committee X3 (ASC X3)

ASC X3 consists of a general committee of the whole (which meets approximately three times a year), three management committees, and seven general Technical Committees. Members of X3 belong to the JTC 1 TAG and advise ANSI on how to vote on international standards matters.

X3 tries to maintain a balance in X3 membership between producers, users, and general interest groups to prevent the domination of the process by any one group. Membership is open to any interested organization and requires payment of nominal dues. Voting is by organization to preclude any interest group flooding a committee thereby gaining a disproportionate advantage in standards creation. ASC X3 sets broad policy, general direction, and votes on each proposed standard presented to it by the Technical Committees.

The Technical Committees (TCs) of X3 are divided into of eight major areas, with Technical Management Committees overseeing the TCs. These areas are shown in the following table:

Table 15-2 X3 Technical Committees

Technical Management Committee	Technical Committee Designation	Committee Descriptor
Recognition (X3A)	X3A1	OCR and MICR
Media (X3B)	X3B5	Digital Magnetic Media
	X3B6	Instrumentation Tape
	X3B7	Magnetic Disks
	X3B8	Flexible Disk Cartridges
	X3B9	Paper Forms/Layouts
	X3B10	Credit/ID Cards
	X3B11	Optical Digital Data Disks
Languages (X3H&J)	X3H2	Database
	X3H3	Computer Graphics
	X3H4	Information Resource and Dictionary (IRDS)
	X3H5	Parallel processing Constructs for High-Level Programming Languages
	X3H6	Case Tool Integration Models
	X3H7	Object Information Management
	X3J1	PL/1
	X3J2	BASIC
	X3J3	FORTRAN
	X3J4	COBOL
	X3J7	APT
	X3J9	Pascal
	X3J10	APL
	X3J11	C language
	X3J12	DIBOL
	X3J13	Common Lisp
	X3J14	Forth
	X3J15	Databus
	X3J16	C++
	X3J17	Prolog
	X3J18	Rexx

Table 15-2 X3 Technical Committees

Technical Management Committee	Technical Committee Designation	Committee Descriptor
Documentation (X3K)	X3K5	Vocabulary for Information Processing Standards
Data Representation (X3L)	X3L2	Codes and Character Sets
	X3L3	Audio/Picture Coding
	X3L8	Data Representation
Communication (X3S)	X3S3	Data Communication
Systems Technology (X3T, V, & W)	X3T2	Data Interchange
	X3T3	Open Distributed Processing
	X3T4	Security Techniques
	X3T5	Open Systems Interconnection (OSI)
	X3T6	Non-Contact Information Systems Interfaces
	X3T7	Internationalization
	X3T9	I/O Interface
	X3Vl	Text and Office Publishing Systems
	X3W1	Office Machines

The major reason for the continued existence of these committees is to ensure that future developments in their standard are tied to changes in other standards. For example, the FORTRAN committee must be aware of what is happening in objects, communications, and I18N to ensure that FORTRAN is not obsoleted and that it can make use of newer technologies.

The Institute of Electrical and Electronics Engineers (IEEE)

The IEEE is an organization devoted to education and continued professional training of electrical engineers, but publishes standards as an offshoot of this educational activity. The IEEE has multiple Societies representing multiple disciplines. The Society of greatest interest to Solaris 2.x is the IEEE Computer Society.

The IEEE operates in much the same way as ASC X3, because it adheres to ANSI rules on consensus. Its voting members are individuals, rather than organizations. Organizations, such as SPARC International, may be represented and may vote, but basically, each participant represents as individual and votes as an individual.

The Computer Society of the IEEE

The Computer Society is best known for its standards activities in the area of the ISO/IEC 8802-x series of LANs and the Portable Operating System Interface (POSIX). The LANs will not be covered here, but are the basic low speed LANs (as differentiated from the FDDI and HPPI of X3T9). The Technical Committee on Operating Systems (TCOS) sponsors POSIX. Table 15-3 summarizes the major POSIX committees (1003):

Table 15-3 POSIX Projects

P1003.0	Guide to POSIX-based Open System Architecture
P1003.1	ISO 9945-1:1990 System Application Program Interface (POSIX Part 1)
P1003.2	IEEE/ANSI Std. 1003.2-1992 Shell and Utility Application Interface
P1003.3	IEEE/ANSI Std. 1003. 3-1991 Test Methods for Insuring Conformance to POSIX
P1003.4	Real Time POSIX Extensions
P1003.5	ADA Language Binding for POSIX
Pl003.6	Security Interface Standards for POSIX
P1003.7	System Administration Interface
Pl003.8	Network Services for Portable Application
Pl003.9	Standard FORTRAN Language Bindings to POSIX
P1003.10	Supercomputing Applications
Pl003.l1	Transaction Processing Applications
P1003.12	Part 1: API Network Process-to-Process Communication
Pl003.13	POSIX Real Time Application Support
Pl003.14	POSIX Multiprocessing Application Support
P1003.15	POSIX Batch Environment Amendments
P1003.16	POSIX Language Bindings - C Language to System API
P1003.l7	POSIX Part l: Directory Services API
P1003.18	POSIX Platform

As can be seen, there are currently 18 POSIX working groups. Of these groups, three have become (as of 1992) national or international standards. The drive in the IEEE Computer Society is to have all of the POSIX standards become international, which will allow porting of applications across both platforms and international borders.

Standardization Consortia

Standardization consortia are usually vendor-funded interest groups interested in expediting the market acceptance of a particular interface specification. As previously noted, they do not produce standards, but rather provide specifications which they hope will become either *de facto* standards or *de jure* standards.

Some consortia, however, have a different function. Because most software and systems standards contain options, there needs to be a group, usually outside the standards process, that selects implementable subsets of the options contained in the standard. As an example of a successful consortium, the SQL Access Group (SAG) has taken the SQL standard and provided implementation guidelines for the standard, indicating what options work together to accomplish a task at hand. Additionally, some consortia provide testing and conformance validation, find holes or oversights in standards, and also find problems and bugs with the standard. They normally work in close conjunction with the SDOs and are useful adjuncts to the work of SDOs.

Other consortia are *proof-of-concept* consortia, in that they take a new technology and determine if it is a practicable technology to attempt to standardize. The Object Management Group (OMG) has done this with the concept of objects. They took a technology, gained industry acceptance of the concept, forced a direction on the industry, and then became involved with the object standardization process.

Major Consortia

X/Open Company, Limited is a consortium best known for its *Common Applications Environment* (CAE), a multivendor open systems environment based upon both *de jure* and *de facto* standards. It hopes, through the use of this CAE, to increase the implementation of open systems.

The most notable output of this consortium is the set of specifications that X/Open believes will produce interoperable systems. These specifications, when bundled together, are called the X/Open Portability Guide (XPG). To ensure that there is a way of determining who has met the requirements of the XPG specifications, X/Open offers a branding service that tests products against the XPG and then awards a brand if the products pass. XPG4 contains ISO/IEC standards as major components. XPG4 was approved in late 1992, and Sun products are beginning to be branded for XPG4 compliance as test suites are developed.

The Solaris 2.x system software conforms to XPG-3. The Solaris 2.x environment is XPG-3 BASE-branded.

The following SunOS/SVR4 products are XPG-3 BASE-branded:

Table 15-4 SunOS/SVR4 DTP XPG3 Brands

Product	Component
SunOS/SVR4 DTP	BASE
SunOS/SVR4 DTP	Internationalized System Calls and Libraries
SunOS/SVR4 DTP	Commands & Utilities
Sun C Compiler	C Language
OpenWindows 1.0 and higher	Windows Management
SunOS/SVR4 DTP	Terminal Interfaces
SunOS/SVR4 DTP	Interprocess Communication
SunOS/SVR4 DTP	Source Code Transfer

Object Management Group (OMG)

The OMG is a "proof of technology" consortium founded to stabilize and give critical mass to object oriented technologies. OMG is best known for its Object Request Broker, the OMG interface between object services and application objects/common facilities.

OMG works closely with other consortia and SDOs to ensure that the definition of object management – from technology creation through implementation is main streamed in the IT arena. Its major methodology of doing this is to provide a reference architecture with terms and definitions upon which all adopted specifications are based. Members are given the right to receive implementations of these specifications for their use.

OMG attempts to coordinate the activities of over 10 SDOs, along with several user and vendor consortia currently involved in standardization of objects.

The Unicode Consortium

The Unicode Consortium is an implementation consortium that was created in 1991 to encourage the use of Unicode as a *de facto* industry standard. The creation of Unicode was in response to the creation by the ISO/IEC JT C 1/SC2/WG2 of the draft ISO standard 10646, which developed a *multi-octet* (4x8 bit octet) *character* set (MOC). After many discussions, Unicode was included in ISO 10646 as a subset of the MOC. The MOC (full ISO 10646) is variable length (1 to 4 octets can be used), and has up to 32,000 planes that can be used to describe a national language. The Unicode base plane has a 16 bit fixed length. With over 65,000 character descriptions available, Unicode is acceptable for most current applications.

ISO 10646 now includes the fixed 16-bit version of Unicode as the basic plane of the internationalized character set. Unicode has also upgraded its specification to Unicode 1.1, which is now in conformance with the international standard.

It is important to remember that the use of the Unicode Base Plan does not meet full ISO 10646 requirements. Unicode is a subset of full 10646 capabilities; if a request for full compliance with multi-planar 10646 is received, it should be handled differently from Unicode.

The specification of this consortium is Unicode 1.1, The Unicode Standard.

UNIX International (UI)

UNIX International (UI) is a consortium focused upon directing the controlled evolution of open systems based on UNIX® System V. UI acts as a filter for market needs to be delivered to UNIX Systems Laboratories (USL), which produces and licenses the operating system code.

The original intent of USL was to stop the proliferation of disparate types of UNIX systems that were flooding the market, and to join all of the major UNIX variants into a singular variant called UNIX System V, Release 4 (SVR4). This stable platform was to be the departure point for unifying the UNIX market and permitting it to advance on a common front.

The specification of this consortium is UNIX SVR4.

SPARC International (SI)

SPARC® International (SI) is a consortium that was started in 1987 when Sun Microsystems openly licensed its SPARC microprocessor architecture to a not-for-profit group to encourage the evolution and use of the architecture throughout the industry. The key to the success of this group is the *SPARC Compliance Definitions*, (SCD) which provides members of the consortium the ability to create a broad base of compatible SPARC/UNIX products that can be verified compliant through openly agreed-upon standards definitions. This compliance with the SCD will verify and offer market assurance of binary compatibility.

The product of this consortium is the SPARC Compliance Definition (SCD).

Governmental Agencies

The *National Institute for Standards and Technology* (NIST) replaced the old National Bureau of Standards (NBS) in 1989. The *Computer Systems Laboratory* (CSL) is the federal government's primary player in the standardization arena. Although it is a formally-chartered SDO in its own right, NIST rarely creates standards, preferring to rely upon the private process for standards. The most important role of NIST is the maintenance of the *Federal Information Processing Standards* (FIPS), which are those standards that the government will use in its procurement efforts. By adopting a set of standards such as FIPS, NIST can cause the market to move to that standard for federal procurement. In this way, NIST has significant clout in the economic policies of standardization.

Solaris Support for Standards

The following is a partial list of the standards supported by Solaris 2.x:

Sun Architecture

- IEEE 754-1985 Floating Point Standard
- ISO 9316, ANSI X3.131-1986, FIPS PUB 131; SCSI
- ANSI X3.22-1973, FIPS PUB 3-1; 800 CPI/NRZI tape
- ANSI X3.39-1973, FIPS PUB 25; 1600 CPI/Phase Encoded tape
- ANSI X3.54-1976, FIPS PUB 50; 6250 CPI/GCR tape
- ANSI X3.91M-1982, FIPS PUB 111; SMD
- ISO 9318-1, ANSI X3.129-1986, FIPS PUB 130; IPI 1(Physical Layer)
- ISO 9318-2, ANSI X3.130-1986, FIPS PUB 130; IPI 2 (Disk)
- ANSI X3.132-1987, FIPS PUB 130; IPI
- ANSI X3.147-1987, FIPS PUB 130; IPI
- ANSI X3.15-1976/R1983, FIPS PUB 16-1, Fed Std 1010; Bit sequencing

SunOS

- ISO 9660-1988; CD-ROM File Format
- Orange Book US DOD5200.28-STD C2 level security
- ISO 8859/1
- ISO 9945/1, IEEE 1003.1 - 1988, FIPS PUB 151-1; POSIX OS interface (SunOS 4.1 or higher)
- SVID Issue 2 Volumes 1 & 2 - ATT System V Release 3.2 Interface Definition
- X/Open Portability Guide (XPG2); SunOS 4.1 is branded for XPG2 Base compliance
- SVID Issue 3 Volumes 1 & 2 - ATT System V Release 4 Interface Definition
- X/Open Portability Guide (XPG3); the following are branded for XPG3 compliance:
  - NetIsam 1.0 and higher: ISAM
  - SunOS 4.1 and higher: Terminal Interface
  - SunOS 4.1 and higher: Interprocess Communication
  - SunOS 4.1 and higher: Source Code Transfer
- ANSI X3.92-1981/R1987, FIPS PUB 46-1; DES encryption (SunOS 4.0 or higher)
- ANSI X3.4-1977, FIPS PUB 1-2; Code for information interchange
- ANSI X3.32-1973, FIPS PUB 1-2; Code for information interchange (ASCII)
- ANSI X3.41-1974, FIPS PUB 1-2; Code for information interchange
- ANSI X3.27-1978, FIPS PUB 79; Magnetic tape labels to read/write ANSI standard tapes
- ANSI X3.64-1979, FIPS PUB 86; Controls for Code for information interchange
- ANSI X3.106-1983, FIPS PUB 81; DES modes of operation (SunOS DES command)
- FIPS PUB 112; Password usage (SunOS 4.0 or higher via C2 module)
- RFC 742; Name/finger

- RFC 768; UDP
- RFC 783; TFTP
- RFC 791, MIL-STD 1777; Internet Protocol (IP)
- RFC 792; ICMP
- RFC 793, MIL-STD 1778; TCP
- RFC 821, MIL-STD 1781; SMTP
- RFC 822
- RFC 826; E-net address resolution protocol
- RFC 854, MIL-STD 1782; TELNET Protocol
- RFC 862; Echo Protocol
- RFC 863; Discard Protocol
- RFC 864; Character Generator Protocol
- RFC 867; Daytime Protocol
- RFC 868; Time Protocol
- RFC 882; Domain Names - Concepts and Facilities (updated by RFC 973)
- RFC 987; 1026 Mapping between X.400 and RFC 822
- RFC 894; Transmission of IP over Ethernet
- RFC 903; A Reverse Address Resolution Protocol
- RFC 906; Bootstrap Loading Using TFTP
- RFC 919; Broadcasting Internet Datagrams
- RFC 920; Domain Requirements
- RFC 922; Broadcasting Internet Datagrams in Subnets
- RFC 950; Internet Standard Subnetting Procedure
- RFC 954; NICNAME/WHOIS
- RFC 959, MIL-STD 1780; File Transfer Protocol (FTP)
- RFC 974; Mail Routing and the Domain System
- RFC 977; Network News Transfer Protocol
- RFC 1009; Requirements for Internet Gateways (obsoletes RFC 985)

Networking and Distributed Computing

- SVID; File and record locking
- ANSI X.409 ISO Abstract Syntax Notation
- ISO 8859/1 (Latin-1)
- CCITT X.25 (1980, 1984) protocols
- ANSI X.29/X.3 protocols for terminal-to-host connectivity
- ISO 8072; Transport service definition
- US GOSIP Version 1 (FIPS PUB 146), MAP/TOP 3.0
- CCITT X.400 (1984); Electronic mail
- IEEE 802.3; CSMA/CD LANs
- ANSI FDDI LAN
- ANSI X3T9.5; FDDI SMT protocols

- DARPA RFC 1042, 1103
- ANSI X3.1-1976, FIPS PUB 22-1, Federal Standard 1013, EIA-RS269b; Synchronous signal rates
- ANSI X3.16-1976, FIPS PUB 17-1, Federal Standard 1011; Serial by bit data communications
- ANSI X3.25-1976, FIPS PUB 18-1, Federal Standard 1012; Parallel by bit data communications
- CCITT X.25, FIPS PUB 100, Federal Standard 1041; SunLink X.25
- EIA-RS232C Serial binary data interchange
- EIA-RS423A, CCITT V11/X.27; Voltage Digital Interface Circuits
- EIA-RS449, FIPS PUB 143, Federal Standard 1031; 37- and 9-position interface for DTEs
- ISO 8802.2, ANSI/IEEE 802.2, FIPS PUB 107; Ethernet LAN
- ISO 8802.3, ANSI/IEEE 802.3, FIPS PUB 107; Ethernet LAN
- FIPS PUB 60-2; I/O channel interface (waivers)
- ISO 9314-1:1989, ANSI X3.148-1988; FDDI Physical Layer
- ISO 9314-2:1989, ANSI X3.139-1987; FDDI MAC
- ISO 9314-3: ANSI X3.166-1989; FDDI PMD
- Federal Standard 1030A, FIBS PUB 142; Unbalanced Voltage Digital Interface Circuits
- Federal Standard 1020A, FIPS PUB 138; Balanced Voltage Digital Interface Circuits
- RFC 1013; X Window System Protocol, Version 11
- RFC 1014; XDR: External Data Representation Standard
- RFC 1034; Domain Names - Concepts and Facilities
- RFC 1035; Domain Names - Implementations and Specifications
- RFC 1057; Remote Procedure Call Protocol (obsoletes RFC 1050)
- RFC 1058; Routing Information Protocol
- RFC 1072; TCP Extensions for Long-Delay Paths
- RFC 1094; NFS: Network File System protocol specification
- RFC 1117; Internet numbers (obsoletes RFC 1062, RFC 1020 and RFC 997)
- Transfer Parameter Commands: MODE, PASV, PORT, STRU, TYPE
- Access Control Commands: USER, PASS, ACCT, CWD, CDUP, QUIT
- FTP Service Commands: ALLO, APPE, DELE, HELP, LIST, MKD, NLST, NOOP, PWD, RETR, RMD, RNFR, RNTO, STOR, and STOU
- ISO 8571-88; File Transfer Access and Management (FTAM)
- ISO 8650-88; Protocol Specification for the Association Control Service Element (ACSE)
- ISO 8822-88; Connection-Oriented Presentation Service Definition
- ISO 8823-88; Connection-Oriented Presentation Protocol Definition
- ISO 8326-87; Basic Connection-Oriented Session Service Definition
- ISO 8327-87; Basic Connection-Oriented Session Protocol Definition
- ISO 8073-88; Connection-Oriented Transport Protocol Specification Transport Class 0, 2
- ISO 8073-88; Connection-Oriented Transport Protocol Specification Transport Class 4
- ISO 8878-87; Use of X.25 to provide the Connection-Oriented Network Service (CONS)
- ISO 8473-88; Protocol for providing the Connectionless-mode Network Service (CLNS)
- ISO 8208-87; X.25 Packet Level Protocol for Data Terminal Equipment

- ISO 9542-88; ES-IS Routing Protocol
- ISO 7776-86; HDLC-Description of the X.25 LAPB-compatible DTE Data Link Procedures
- ISO 8802/2-89; Local Area Networks; LOgical Link Control
- ISO 8802/3-90; Local Area Networks; CSMA/CD
- ISO 9314-89; Fiber Distributed Data Interface (FDDI)
- ISO 8802/5-91; Token Ring

Windows

- Xlib C API specification
- Xlib API
- MIT X11 Release 4.1; X11 protocol
- FIPS PUB 158
- X11 Inter-Client Communications Conventions
- X Toolkit Intrinsics
- XDM Protocol
- XLFD: X Logical Font Definition
- SunView API
- Xt+ API specification
- Post Script (Adobe Red Book)
- Adobe bitmap font format
- F3 font format
- Open Windows 1.0 and higher, XPG3 Branded Window Management

Languages

- ANSI/IEEE 754-1985; Floating Point
- ANSI C
- MIL-STD 1753, ANSI X3.9-1978, IEEE 754-1985; FORTRAN
- ISO 1539-1980, BS 6832, FIPS PUB 69-1; FORTRAN
- ANSI X3.23-1985, FIPS PUB 21-2; COBOL
- Sun Fortran Release 1.4 and higher, XPG3 Branded FORTRAN
- ISO 7185 level 0 and level 1, ANSI/IEEE 770X3.97-1983; Pascal
- BS 6192, FIPS PUB 109; Pascal
- Sun Pascal Release 2.0 and higher, XPG3 Branded Pascal
- ANSI/MIL-STD 1815A-1983, FIPS PUB 119; Ada
- NSI X3.159-1989; C1.1
- X/Open Portability Guide (XPG3); the following are branded for XPG3 compliance:
  - SunOS4.1 and higher, Commands and Utilities
  - SunOS 4.0 C Compiler and C Language

Graphics

- ISO 9592, ANSI X3.144.1-1988, FIPS PUB 153; PHIGS
- ISO 7942-1985, ANSI X3.124-1985, FIPS PUB 120; GKS
- ISO 8632, ANSI X3.122-1986, FIPS PUB 128; CGM

Internationalized Software

- ISO 8859/1; 8-bit clean coding scheme
- ISO 646; 7-bit code for information interchange
- ISO 6937; 7- or 8-bit code for network communications
- POSIX 1003.1, XPG2; Specifying locale variables
- ANSI X3.32-1973, FIPS PUB 1-2; Graphic Representation of Control Characters
- ANSI X3.4-1977, FIPS PUB 1-2; 7-bit ASCII
- ANSI X3.41-1974, FIPS PUB 1-2; 7-bit Coded Character Set
- ANSI X3.15-1976/R1983, FIPS PUB 16-1; Bit Sequencing of ASCII
- ISO 9945/1, IEEE 1003.1-1988, FIPS PUB 151-1; POSIX

Standards Compliance 15

Introduction

Standardization is a growing presence in the Information Technology (IT) industry. This chapter examines some of the issues related to standardization and tries to draw some general rules on when and how standardization can be accomplished.

Why Standardization

Standardization should be viewed as one of the things for which end users of a system will ask when it is appropriate to their business needs. If standardization is seen as a product attribute, such as price, performance, safety, or any of the many other things that cause customers to buy, then it is correctly positioned. There are times that it may not appeal to some customers at some level, and then there are times when it is nearly almost always mandatory, depending upon the nature and intent of the end user. End users may not care about the collision detection schema used in their LAN (ISO/IEEE 8802-3), but they may be very interested as to whether or not the keyboard has a QWERTY (ANSI X3) layout. Conversely, a software designer needs to know things such as when to use a standardized interface for shell and utilities (IEEE 1003.2) or if a standardized C++ is needed (X3Jl6).

In any case involving voluntary standards, there is the option of not adhering to a standard. Voluntary standards are a price of doing business; if a customer demands them and you do not have them, you do not sell your product. In some cases, you can convince a buyer that the nonstandard solution that you offer is significantly better, but it must be better by a margin large enough to justify the extra expense of ignoring a standard. Ultimately, standardization comes down to a matter of economics.

End users require standards because they believe standards promote inter-working and interconnection. Governments specify standardization so that they can compare two or more dissimilar products and make a business decision. Many governments are required by law to specify standards in their procurements for exactly this reason. Providers use standardization to provide a base from which to expand capabilities or to provide expandability of a system into areas into which they have little expertise. The use of the SCSI port for disk drives is an example, as is the use of TCP/IP for communications.

The key thing to remember as you read this chapter is that standards are a business tool, and should be used for business reasons. Standards are an enabler; if you do not have the standards that a user wants, then you will not even have a chance to sell a product, no matter how good or advanced it is. On the other hand, if you have standards in your product, and the product is inferior, you probably will also not win too many sales. Standards do not sell products; they merely make it possible for you to enter the market to try to sell your efforts.

Note – Regulatory standards are a different matter. They deal with safety, telephonic network interconnect, and environmental concerns, and are usually required by law. If you sell product without meeting these standards, you are illegal. Regulatory standards are considered to be mandatory and are not dealt with in this chapter.

This chapter will describe some of the more important standardization organizations and their products.

Sources of Standards

Standards come in different types and are created by a variety of organizations. This section discusses the derivation of standards.

Types of Standards

There are two distinct types of standards that exist: *de jure* standards and *de facto* standards. *De jure* standards are created by *Standards Developing Organizations* (SDOs), which are organizations that operate under specific rules to create standards. No consortium produces *de jure* standards, because consortia limit participation in their specification producing processes.

De facto standards are volume standards—that is, a true *de facto* standard is a product that leads in market share, in the industry, and from this gains standing as the “industry standard.” Consortia try to develop *de facto* standards from their specification by having large numbers of users and providers adopt their specifications. Ultimately, most consortia wish to have their specifications made into standards by submitting them to an SDO and gaining a national and international seal of approval.

For purposes of this chapter, *standards* will refer to technical descriptions formally accepted and endorsed by an SDO. *Specification* will refer to a consortium document, and the term *de facto standard* will be used to indicate a product that is a dominant market leader.

Standards Developing Organizations (SDOs)

The following organizations develop industry-wide standards.

The International Organization for Standardization (ISO)

ISO is the premier standardization organization in the world. Based in Geneva, ISO standardizes everything from screw threads to mica to humane animal traps. It has, in conjunction with the *International Electrotechnical Committee* (IEC), one joint technical committee, imaginatively called *ISO/IEC Joint Technical Committee* l (JTC l), which is charged with information technology standardization. JTC l is also the largest and most productive standards committee in existence. It has 22 Primary (or voting) members and 19 Observer (nonvoting but contributing) members, with 2500 standards documents and over 3500 volunteers in 41 nations.

JTC 1 is composed of subcommittees (SCs) that deal with the technical areas listed on Table 15-1. JTC l currently has eighteen SCs. (Note that subcommittee numbers, once used, are not reused when the committee goes out of existence to ensure that duplicate documents are not created.)

Table 15-1 ISO/JTC 1 Standards Subcommittees

SC	Name	Country
SC l	Vocabulary	France
SC 2	Character Sets and Information Coding	France
SC 6	Data Communications	USA
SC 7	Design and Documentation	Canada
SC 11	Flexible Magnetic Media	USA
SC 14	Representation of Data Elements	Sweden
SC 15	Labeling and File Structure	Switzerland
SC 17	Identification and Credit Cards	Switzerland
SC 18	Text and Office Systems	USA
SC 21	Open Systems Support Services	USA
SC 22	Languages	Canada
SC 23	Optical Digital Data Disks	Japan
SC 24	Graphics	Germany
SC 25	Interconnection and Information Technology	Germany
SC 26	Microprocessor Systems	Japan
SC 27	Security Techniques	Germany
SC 28	Office Machinery and Stand Alone Printers	Japan
SC 29	Coded Representation for Hypermedia	France

These subcommittees and their subordinate Working Groups (WGs) create JTC 1 standards. It is in these committees that drafts are written, reviews are accomplished, and technical agreements are reached. After a complex balloting process, the document becomes an International Standard.

The standards produced by ISO/IEC JTC l are the dominant information technology standards in the world, and are usually the standards to which government and private procurements point. The U.S. position in ISO/IEC/JTC 1 is voted by ANSI with advice from the U.S. Technical Advisory Group (TAG) to JTC 1.

American National Standards Institute (ANSI)

Most nations have a single SDO that oversees national standards activities. In the United States, the American National Standards Institute (ANSI) is the umbrella organization for standards. ANSI makes the rules by which standards are written, and accredits organizations that follow its rules.

These rules serve two purposes:

- to allow free and open participation to any concerned party
- to achieve consensus in the creation of a standard. (Concensus is defined as a state achieved when all parties reach a substantial agreement. This indicates more than majority, but does not mean unanimity. Rather, it indicates that all arguments have been heard and addressed, and dealt with in a constructive fashion.)

All U.S. formal SDOs must follow the rules of ANSI in the creation of standards.

There are over 200 SDOs accredited by ANSI. The most important in IT standardization is ASC X3. X3 produces approximately 90% of the IT standards in the U.S. and contributes to nearly all other worldwide IT standards. The IEEE produces the majority of the remainder of the IT standards in the U.S., but has little impact on the course of international standardization except in the areas of POSIX and LANs.

Accredited Standards Committee X3 (ASC X3)

ASC X3 consists of a general committee of the whole (which meets approximately three times a year), three management committees, and seven general Technical Committees. Members of X3 belong to the JTC 1 TAG and advise ANSI on how to vote on international standards matters.

X3 tries to maintain a balance in X3 membership between producers, users, and general interest groups to prevent the domination of the process by any one group. Membership is open to any interested organization and requires payment of nominal dues. Voting is by organization to preclude any interest group flooding a committee thereby gaining a disproportionate advantage in standards creation. ASC X3 sets broad policy, general direction, and votes on each proposed standard presented to it by the Technical Committees.

The Technical Committees (TCs) of X3 are divided into of eight major areas, with Technical Management Committees overseeing the TCs. These areas are shown in the following table:

Table 15-2 X3 Technical Committees

Technical Management Committee	Technical Committee Designation	Committee Descriptor
Recognition (X3A)	X3A1	OCR and MICR
Media (X3B)	X3B5	Digital Magnetic Media
	X3B6	Instrumentation Tape
	X3B7	Magnetic Disks
	X3B8	Flexible Disk Cartridges
	X3B9	Paper Forms/Layouts
	X3B10	Credit/ID Cards
	X3B11	Optical Digital Data Disks
Languages (X3H&J)	X3H2	Database
	X3H3	Computer Graphics
	X3H4	Information Resource and Dictionary (IRDS)
	X3H5	Parallel processing Constructs for High-Level Programming Languages
	X3H6	Case Tool Integration Models
	X3H7	Object Information Management
	X3J1	PL/1
	X3J2	BASIC
	X3J3	FORTRAN
	X3J4	COBOL
	X3J7	APT
	X3J9	Pascal
	X3J10	APL
	X3J11	C language
	X3J12	DIBOL
	X3J13	Common Lisp
	X3J14	Forth
	X3J15	Databus
	X3J16	C++
	X3J17	Prolog
	X3J18	Rexx

Table 15-2 X3 Technical Committees

Technical Management Committee	Technical Committee Designation	Committee Descriptor
Documentation (X3K)	X3K5	Vocabulary for Information Processing Standards
Data Representation (X3L)	X3L2	Codes and Character Sets
	X3L3	Audio/Picture Coding
	X3L8	Data Representation
Communication (X3S)	X3S3	Data Communication
Systems Technology (X3T, V, & W)	X3T2	Data Interchange
	X3T3	Open Distributed Processing
	X3T4	Security Techniques
	X3T5	Open Systems Interconnection (OSI)
	X3T6	Non-Contact Information Systems Interfaces
	X3T7	Internationalization
	X3T9	I/O Interface
	X3Vl	Text and Office Publishing Systems
	X3W1	Office Machines

The major reason for the continued existence of these committees is to ensure that future developments in their standard are tied to changes in other standards. For example, the FORTRAN committee must be aware of what is happening in objects, communications, and I18N to ensure that FORTRAN is not obsoleted and that it can make use of newer technologies.

The Institute of Electrical and Electronics Engineers (IEEE)

The IEEE is an organization devoted to education and continued professional training of electrical engineers, but publishes standards as an offshoot of this educational activity. The IEEE has multiple Societies representing multiple disciplines. The Society of greatest interest to Solaris 2.x is the IEEE Computer Society.

The IEEE operates in much the same way as ASC X3, because it adheres to ANSI rules on consensus. Its voting members are individuals, rather than organizations. Organizations, such as SPARC International, may be represented and may vote, but basically, each participant represents as individual and votes as an individual.

The Computer Society of the IEEE

The Computer Society is best known for its standards activities in the area of the ISO/IEC 8802-x series of LANs and the Portable Operating System Interface (POSIX). The LANs will not be covered here, but are the basic low speed LANs (as differentiated from the FDDI and HPPI of X3T9). The Technical Committee on Operating Systems (TCOS) sponsors POSIX. Table 15-3 summarizes the major POSIX committees (1003):

Table 15-3 POSIX Projects

P1003.0	Guide to POSIX-based Open System Architecture
P1003.1	ISO 9945-1:1990 System Application Program Interface (POSIX Part 1)
P1003.2	IEEE/ANSI Std. 1003.2-1992 Shell and Utility Application Interface
P1003.3	IEEE/ANSI Std. 1003. 3-1991 Test Methods for Insuring Conformance to POSIX
P1003.4	Real Time POSIX Extensions
P1003.5	ADA Language Binding for POSIX
Pl003.6	Security Interface Standards for POSIX
P1003.7	System Administration Interface
Pl003.8	Network Services for Portable Application
Pl003.9	Standard FORTRAN Language Bindings to POSIX
P1003.10	Supercomputing Applications
Pl003.l1	Transaction Processing Applications
P1003.12	Part 1: API Network Process-to-Process Communication
Pl003.13	POSIX Real Time Application Support
Pl003.14	POSIX Multiprocessing Application Support
P1003.15	POSIX Batch Environment Amendments
P1003.16	POSIX Language Bindings - C Language to System API
P1003.l7	POSIX Part l: Directory Services API
P1003.18	POSIX Platform

As can be seen, there are currently 18 POSIX working groups. Of these groups, three have become (as of 1992) national or international standards. The drive in the IEEE Computer Society is to have all of the POSIX standards become international, which will allow porting of applications across both platforms and international borders.

Standardization Consortia

Standardization consortia are usually vendor-funded interest groups interested in expediting the market acceptance of a particular interface specification. As previously noted, they do not produce standards, but rather provide specifications which they hope will become either *de facto* standards or *de jure* standards.

Some consortia, however, have a different function. Because most software and systems standards contain options, there needs to be a group, usually outside the standards process, that selects implementable subsets of the options contained in the standard. As an example of a successful consortium, the SQL Access Group (SAG) has taken the SQL standard and provided implementation guidelines for the standard, indicating what options work together to accomplish a task at hand. Additionally, some consortia provide testing and conformance validation, find holes or oversights in standards, and also find problems and bugs with the standard. They normally work in close conjunction with the SDOs and are useful adjuncts to the work of SDOs.

Other consortia are *proof-of-concept* consortia, in that they take a new technology and determine if it is a practicable technology to attempt to standardize. The Object Management Group (OMG) has done this with the concept of objects. They took a technology, gained industry acceptance of the concept, forced a direction on the industry, and then became involved with the object standardization process.

Major Consortia

X/Open Company, Limited is a consortium best known for its *Common Applications Environment* (CAE), a multivendor open systems environment based upon both *de jure* and *de facto* standards. It hopes, through the use of this CAE, to increase the implementation of open systems.

The most notable output of this consortium is the set of specifications that X/Open believes will produce interoperable systems. These specifications, when bundled together, are called the X/Open Portability Guide (XPG). To ensure that there is a way of determining who has met the requirements of the XPG specifications, X/Open offers a branding service that tests products against the XPG and then awards a brand if the products pass. XPG4 contains ISO/IEC standards as major components. XPG4 was approved in late 1992, and Sun products are beginning to be branded for XPG4 compliance as test suites are developed.

The Solaris 2.x system software conforms to XPG-3. The Solaris 2.x environment is XPG-3 BASE-branded.

The following SunOS/SVR4 products are XPG-3 BASE-branded:

Table 15-4 SunOS/SVR4 DTP XPG3 Brands

Product	Component
SunOS/SVR4 DTP	BASE
SunOS/SVR4 DTP	Internationalized System Calls and Libraries
SunOS/SVR4 DTP	Commands & Utilities
Sun C Compiler	C Language
OpenWindows 1.0 and higher	Windows Management
SunOS/SVR4 DTP	Terminal Interfaces
SunOS/SVR4 DTP	Interprocess Communication
SunOS/SVR4 DTP	Source Code Transfer

Object Management Group (OMG)

The OMG is a "proof of technology" consortium founded to stabilize and give critical mass to object oriented technologies. OMG is best known for its Object Request Broker, the OMG interface between object services and application objects/common facilities.

OMG works closely with other consortia and SDOs to ensure that the definition of object management – from technology creation through implementation is main streamed in the IT arena. Its major methodology of doing this is to provide a reference architecture with terms and definitions upon which all adopted specifications are based. Members are given the right to receive implementations of these specifications for their use.

OMG attempts to coordinate the activities of over 10 SDOs, along with several user and vendor consortia currently involved in standardization of objects.

The Unicode Consortium

The Unicode Consortium is an implementation consortium that was created in 1991 to encourage the use of Unicode as a *de facto* industry standard. The creation of Unicode was in response to the creation by the ISO/IEC JT C 1/SC2/WG2 of the draft ISO standard 10646, which developed a *multi-octet* (4x8 bit octet) *character* set (MOC). After many discussions, Unicode was included in ISO 10646 as a subset of the MOC. The MOC (full ISO 10646) is variable length (1 to 4 octets can be used), and has up to 32,000 planes that can be used to describe a national language. The Unicode base plane has a 16 bit fixed length. With over 65,000 character descriptions available, Unicode is acceptable for most current applications.

ISO 10646 now includes the fixed 16-bit version of Unicode as the basic plane of the internationalized character set. Unicode has also upgraded its specification to Unicode 1.1, which is now in conformance with the international standard.

It is important to remember that the use of the Unicode Base Plan does not meet full ISO 10646 requirements. Unicode is a subset of full 10646 capabilities; if a request for full compliance with multi-planar 10646 is received, it should be handled differently from Unicode.

The specification of this consortium is Unicode 1.1, The Unicode Standard.

UNIX International (UI)

UNIX International (UI) is a consortium focused upon directing the controlled evolution of open systems based on UNIX® System V. UI acts as a filter for market needs to be delivered to UNIX Systems Laboratories (USL), which produces and licenses the operating system code.

The original intent of USL was to stop the proliferation of disparate types of UNIX systems that were flooding the market, and to join all of the major UNIX variants into a singular variant called UNIX System V, Release 4 (SVR4). This stable platform was to be the departure point for unifying the UNIX market and permitting it to advance on a common front.

The specification of this consortium is UNIX SVR4.

SPARC International (SI)

SPARC® International (SI) is a consortium that was started in 1987 when Sun Microsystems openly licensed its SPARC microprocessor architecture to a not-for-profit group to encourage the evolution and use of the architecture throughout the industry. The key to the success of this group is the *SPARC Compliance Definitions*, (SCD) which provides members of the consortium the ability to create a broad base of compatible SPARC/UNIX products that can be verified compliant through openly agreed-upon standards definitions. This compliance with the SCD will verify and offer market assurance of binary compatibility.

The product of this consortium is the SPARC Compliance Definition (SCD).

Governmental Agencies

The *National Institute for Standards and Technology* (NIST) replaced the old National Bureau of Standards (NBS) in 1989. The *Computer Systems Laboratory* (CSL) is the federal government's primary player in the standardization arena. Although it is a formally-chartered SDO in its own right, NIST rarely creates standards, preferring to rely upon the private process for standards. The most important role of NIST is the maintenance of the *Federal Information Processing Standards* (FIPS), which are those standards that the government will use in its procurement efforts. By adopting a set of standards such as FIPS, NIST can cause the market to move to that standard for federal procurement. In this way, NIST has significant clout in the economic policies of standardization.

Solaris Support for Standards

The following is a partial list of the standards supported by Solaris 2.x:

Sun Architecture

- IEEE 754-1985 Floating Point Standard
- ISO 9316, ANSI X3.131-1986, FIPS PUB 131; SCSI
- ANSI X3.22-1973, FIPS PUB 3-1; 800 CPI/NRZI tape
- ANSI X3.39-1973, FIPS PUB 25; 1600 CPI/Phase Encoded tape
- ANSI X3.54-1976, FIPS PUB 50; 6250 CPI/GCR tape
- ANSI X3.91M-1982, FIPS PUB 111; SMD
- ISO 9318-1, ANSI X3.129-1986, FIPS PUB 130; IPI 1(Physical Layer)
- ISO 9318-2, ANSI X3.130-1986, FIPS PUB 130; IPI 2 (Disk)
- ANSI X3.132-1987, FIPS PUB 130; IPI
- ANSI X3.147-1987, FIPS PUB 130; IPI
- ANSI X3.15-1976/R1983, FIPS PUB 16-1, Fed Std 1010; Bit sequencing

SunOS

- ISO 9660-1988; CD-ROM File Format
- Orange Book US DOD5200.28-STD C2 level security
- ISO 8859/1
- ISO 9945/1, IEEE 1003.1 - 1988, FIPS PUB 151-1; POSIX OS interface (SunOS 4.1 or higher)
- SVID Issue 2 Volumes 1 & 2 - ATT System V Release 3.2 Interface Definition
- X/Open Portability Guide (XPG2); SunOS 4.1 is branded for XPG2 Base compliance
- SVID Issue 3 Volumes 1 & 2 - ATT System V Release 4 Interface Definition
- X/Open Portability Guide (XPG3); the following are branded for XPG3 compliance:
  - NetIsam 1.0 and higher: ISAM
  - SunOS 4.1 and higher: Terminal Interface
  - SunOS 4.1 and higher: Interprocess Communication
  - SunOS 4.1 and higher: Source Code Transfer
- ANSI X3.92-1981/R1987, FIPS PUB 46-1; DES encryption (SunOS 4.0 or higher)
- ANSI X3.4-1977, FIPS PUB 1-2; Code for information interchange
- ANSI X3.32-1973, FIPS PUB 1-2; Code for information interchange (ASCII)
- ANSI X3.41-1974, FIPS PUB 1-2; Code for information interchange
- ANSI X3.27-1978, FIPS PUB 79; Magnetic tape labels to read/write ANSI standard tapes
- ANSI X3.64-1979, FIPS PUB 86; Controls for Code for information interchange
- ANSI X3.106-1983, FIPS PUB 81; DES modes of operation (SunOS DES command)
- FIPS PUB 112; Password usage (SunOS 4.0 or higher via C2 module)
- RFC 742; Name/finger

- RFC 768; UDP
- RFC 783; TFTP
- RFC 791, MIL-STD 1777; Internet Protocol (IP)
- RFC 792; ICMP
- RFC 793, MIL-STD 1778; TCP
- RFC 821, MIL-STD 1781; SMTP
- RFC 822
- RFC 826; E-net address resolution protocol
- RFC 854, MIL-STD 1782; TELNET Protocol
- RFC 862; Echo Protocol
- RFC 863; Discard Protocol
- RFC 864; Character Generator Protocol
- RFC 867; Daytime Protocol
- RFC 868; Time Protocol
- RFC 882; Domain Names - Concepts and Facilities (updated by RFC 973)
- RFC 987; 1026 Mapping between X.400 and RFC 822
- RFC 894; Transmission of IP over Ethernet
- RFC 903; A Reverse Address Resolution Protocol
- RFC 906; Bootstrap Loading Using TFTP
- RFC 919; Broadcasting Internet Datagrams
- RFC 920; Domain Requirements
- RFC 922; Broadcasting Internet Datagrams in Subnets
- RFC 950; Internet Standard Subnetting Procedure
- RFC 954; NICNAME/WHOIS
- RFC 959, MIL-STD 1780; File Transfer Protocol (FTP)
- RFC 974; Mail Routing and the Domain System
- RFC 977; Network News Transfer Protocol
- RFC 1009; Requirements for Internet Gateways (obsoletes RFC 985)

Networking and Distributed Computing

- SVID; File and record locking
- ANSI X.409 ISO Abstract Syntax Notation
- ISO 8859/1 (Latin-1)
- CCITT X.25 (1980, 1984) protocols
- ANSI X.29/X.3 protocols for terminal-to-host connectivity
- ISO 8072; Transport service definition
- US GOSIP Version 1 (FIPS PUB 146), MAP/TOP 3.0
- CCITT X.400 (1984); Electronic mail
- IEEE 802.3; CSMA/CD LANs
- ANSI FDDI LAN
- ANSI X3T9.5; FDDI SMT protocols

- DARPA RFC 1042, 1103
- ANSI X3.1-1976, FIPS PUB 22-1, Federal Standard 1013, EIA-RS269b; Synchronous signal rates
- ANSI X3.16-1976, FIPS PUB 17-1, Federal Standard 1011; Serial by bit data communications
- ANSI X3.25-1976, FIPS PUB 18-1, Federal Standard 1012; Parallel by bit data communications
- CCITT X.25, FIPS PUB 100, Federal Standard 1041; SunLink X.25
- EIA-RS232C Serial binary data interchange
- EIA-RS423A, CCITT V11/X.27; Voltage Digital Interface Circuits
- EIA-RS449, FIPS PUB 143, Federal Standard 1031; 37- and 9-position interface for DTEs
- ISO 8802.2, ANSI/IEEE 802.2, FIPS PUB 107; Ethernet LAN
- ISO 8802.3, ANSI/IEEE 802.3, FIPS PUB 107; Ethernet LAN
- FIPS PUB 60-2; I/O channel interface (waivers)
- ISO 9314-1:1989, ANSI X3.148-1988; FDDI Physical Layer
- ISO 9314-2:1989, ANSI X3.139-1987; FDDI MAC
- ISO 9314-3: ANSI X3.166-1989; FDDI PMD
- Federal Standard 1030A, FIBS PUB 142; Unbalanced Voltage Digital Interface Circuits
- Federal Standard 1020A, FIPS PUB 138; Balanced Voltage Digital Interface Circuits
- RFC 1013; X Window System Protocol, Version 11
- RFC 1014; XDR: External Data Representation Standard
- RFC 1034; Domain Names - Concepts and Facilities
- RFC 1035; Domain Names - Implementations and Specifications
- RFC 1057; Remote Procedure Call Protocol (obsoletes RFC 1050)
- RFC 1058; Routing Information Protocol
- RFC 1072; TCP Extensions for Long-Delay Paths
- RFC 1094; NFS: Network File System protocol specification
- RFC 1117; Internet numbers (obsoletes RFC 1062, RFC 1020 and RFC 997)
- Transfer Parameter Commands: MODE, PASV, PORT, STRU, TYPE
- Access Control Commands: USER, PASS, ACCT, CWD, CDUP, QUIT
- FTP Service Commands: ALLO, APPE, DELE, HELP, LIST, MKD, NLST, NOOP, PWD, RETR, RMD, RNFR, RNTO, STOR, and STOU
- ISO 8571-88; File Transfer Access and Management (FTAM)
- ISO 8650-88; Protocol Specification for the Association Control Service Element (ACSE)
- ISO 8822-88; Connection-Oriented Presentation Service Definition
- ISO 8823-88; Connection-Oriented Presentation Protocol Definition
- ISO 8326-87; Basic Connection-Oriented Session Service Definition
- ISO 8327-87; Basic Connection-Oriented Session Protocol Definition
- ISO 8073-88; Connection-Oriented Transport Protocol Specification Transport Class 0, 2
- ISO 8073-88; Connection-Oriented Transport Protocol Specification Transport Class 4
- ISO 8878-87; Use of X.25 to provide the Connection-Oriented Network Service (CONS)
- ISO 8473-88; Protocol for providing the Connectionless-mode Network Service (CLNS)
- ISO 8208-87; X.25 Packet Level Protocol for Data Terminal Equipment

- ISO 9542-88; ES-IS Routing Protocol
- ISO 7776-86; HDLC-Description of the X.25 LAPB-compatible DTE Data Link Procedures
- ISO 8802/2-89; Local Area Networks; LOgical Link Control
- ISO 8802/3-90; Local Area Networks; CSMA/CD
- ISO 9314-89; Fiber Distributed Data Interface (FDDI)
- ISO 8802/5-91; Token Ring

Windows

- Xlib C API specification
- Xlib API
- MIT X11 Release 4.1; X11 protocol
- FIPS PUB 158
- X11 Inter-Client Communications Conventions
- X Toolkit Intrinsics
- XDM Protocol
- XLFD: X Logical Font Definition
- SunView API
- Xt+ API specification
- Post Script (Adobe Red Book)
- Adobe bitmap font format
- F3 font format
- Open Windows 1.0 and higher, XPG3 Branded Window Management

Languages

- ANSI/IEEE 754-1985; Floating Point
- ANSI C
- MIL-STD 1753, ANSI X3.9-1978, IEEE 754-1985; FORTRAN
- ISO 1539-1980, BS 6832, FIPS PUB 69-1; FORTRAN
- ANSI X3.23-1985, FIPS PUB 21-2; COBOL
- Sun Fortran Release 1.4 and higher, XPG3 Branded FORTRAN
- ISO 7185 level 0 and level 1, ANSI/IEEE 770X3.97-1983; Pascal
- BS 6192, FIPS PUB 109; Pascal
- Sun Pascal Release 2.0 and higher, XPG3 Branded Pascal
- ANSI/MIL-STD 1815A-1983, FIPS PUB 119; Ada
- NSI X3.159-1989; C1.1
- X/Open Portability Guide (XPG3); the following are branded for XPG3 compliance:
  - SunOS4.1 and higher, Commands and Utilities
  - SunOS 4.0 C Compiler and C Language

Graphics

- ISO 9592, ANSI X3.144.1-1988, FIPS PUB 153; PHIGS
- ISO 7942-1985, ANSI X3.124-1985, FIPS PUB 120; GKS
- ISO 8632, ANSI X3.122-1986, FIPS PUB 128; CGM

Internationalized Software

- ISO 8859/1; 8-bit clean coding scheme
- ISO 646; 7-bit code for information interchange
- ISO 6937; 7- or 8-bit code for network communications
- POSIX 1003.1, XPG2; Specifying locale variables
- ANSI X3.32-1973, FIPS PUB 1-2; Graphic Representation of Control Characters
- ANSI X3.4-1977, FIPS PUB 1-2; 7-bit ASCII
- ANSI X3.41-1974, FIPS PUB 1-2; 7-bit Coded Character Set
- ANSI X3.15-1976/R1983, FIPS PUB 16-1; Bit Sequencing of ASCII
- ISO 9945/1, IEEE 1003.1-1988, FIPS PUB 151-1; POSIX