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Literature Review Of OSI Protocols For Distributed Interactive Simulation: Part 2

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Simulation, Training and Instrumentation Command

Literature Review of OSI Protocols for Distributed Interactive Simulation

Part 2

IST

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Part 2


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**LITERATURE REVIEW OF
OSI PROTOCOLS FOR
DISTRIBUTED INTERACTIVE SIMULATION
Part 2**

PREPARED FOR:

**U. S. ARMY SIMULATION, TRAINING AND INSTRUMENTATION COMMAND
12350 Research Parkway
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**INVESTIGATION OF OSI PROTOCOLS FOR
DISTRIBUTED INTERACTIVE SIMULATION**

**CONTRACT N61339-91-C-0103
CDRL A003**

June 30, 1992

**Institute for Simulation and Training
University of Central Florida
12424 Research Parkway
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1.0 INTRODUCTION

The purpose of this report is to document the results of a literature search performed to examine the relationship between Open Systems Interconnection (OSI) protocols and Distributed Interactive Simulation (DIS). The first literature search (documented in [1]) reviewed relevant articles and papers on performance and application of OSI protocols. The articles on Abstract Syntax Notation One (ASN.1) and the Estelle Formal Description Technique proved to be especially helpful in the design and analysis of those experiments.

In preparation for this report, it was decided that a second review of protocol performance would not provide additional information, especially since the ASN.1 and Estelle experiments had been completed. Instead the DIS Communications Architecture and Security Subgroup (CASS) would benefit from a review of actual OSI products. Consequently, this information search reviews OSI commercial-off-the-shelf (COTS) products applicable to the DIS communication architecture. A summary of the information obtained on those products has been provided to CASS.

2.0 INVESTIGATION METHODOLOGY

2.1 Procedures

The first literature survey was conducted through the University of Central Florida (UCF) library. The information search was conducted using various on-line databases by searching on keywords, such as OSI and Estelle. This literature survey identified very little information on actual products; most information documented protocol implementations and performance. Since this type of search would provide only limited information on OSI products, IST chose to look for a product listing in which information on products had already been accumulated. Therefore, this information search was not generated in the same manner as [1].

While attending INTEROP '91 in San Jose, CA, a trade show for computer vendors and researchers, an OSI product listing was identified. The advertisement for the listing was offered by the Corporation for Open Systems (COS) - the OSI conformance testing people. Various information on OSI products from individual vendors was also obtained at the tradeshow; however, no other comprehensive product listings were found.

2.2 Information Acquisition and Arrangement

The OSI product listing, **OSI Products**, was published by Technology Appraisals Limited in 1991. It is a comprehensive information catalog documenting 450 OSI products and other closely related standards from over 80 suppliers. **OSI Products** provides information on the availability of OSI products and the short and medium term plans of suppliers for planned development. The information comes in four volumes along with a product planning guide.

The documents are arranged in the following manner:

- 1 - OSI Products Planning Guide: This guide provides information for a manager or procurement team to judge which standards are relevant to their needs. The material presented is tutorial in nature and it is intended to be a comprehensive introduction to the OSI protocol suite.
- 2 - OSI Product Survey - Volume 1: This volume is intended for easy reference and updating of OSI products and their suppliers. It includes:
 - A Supplier Summary Table (included in Appendix A) which gives, at a glance, an overview of suppliers' support and plans for OSI. It shows, for each key standard or function, which suppliers have existing products or plans for products to be released by end of 1992.
 - Supplier Products Tables, organized per supplier, which details each product by its operating environment, standards supported and availability.
 - Standards and Profiles Supported Tables, organized per OSI standard or group of standards (comments on each standard/profile are included in Appendix B), which show all the products that claim to support or are planned to support a particular standard (e.g., MHS, MAP/TOP, X.500).
- 3 - OSI Supplier Reports - Volumes 2, 3 and 4: These contain individual reports that enables users to examine 22 suppliers' products and their operating environments in-depth. Information such as company background, product range, product details, and experience with the use of OSI are gathered for each of the selected companies (Appendix A) from the total roll of companies in Volume 1.

The standards and profiles currently supported and listed in the tables are:

- Message Handling System (MHS - X.400)
- File Transfer, Access and Management (FTAM)
- Directory (X.500)
- Virtual Terminal Protocol (VTP)
- OSI Management (CMIP)
- Manufacturing Message Specifications (MMS) and Job Transfer Manipulation (JTM)
- Office Document Architecture (ODA) and Standard Generalized Markup Language (SGML)
- Character & Control Repertoires
- Electronic Data Interchange (EDI)
- Upper Layer Support Standards (Application, Presentation and Session)
- Transport Layer (TP0, TP4, etc.)
- Local Area Network (LAN)
- Wide Area Networks (WANs) & Routing Protocols

- United Kingdom Government OSI Profile (UK GOSIP)
- United States Government OSI Profile (US GOSIP)
- Manufacturing Automation Protocol (MAP) and Technical & Office Protocol (TOP)

3.0 SUMMARY

This literature survey was undertaken to evaluate available OSI products in the market and their suppliers. This survey indicates that there is broad support of OSI by all major computer vendors. This provides a viable infrastructure for developing OSI applications. Limited conformance testing has been completed for many of the products listed, with most of the suppliers relying more on interoperability testing.

As defined by the CASS, the DIS protocol suite must include the following protocols to meet communication service requirements: file transfer, virtual terminal, network management, reliable Transport, datagram service, and seamless Local/Global communication. From the product listing, IST has determined the following:

- There is a strong support for the FTAM protocol. All major suppliers offer this product as an alternative to the proprietary solutions for file access and transfer.
- Virtual Terminal is sufficiently supported to make pilot installations possible, although it is not strongly supported.
- There is a strong future support for the OSI Management standards with a quarter of the respondents indicating their commitment to CMIP.
- The OSI Transport Layer standard is supported by a majority of suppliers. Support is widest for classes 0, 2 and 4 with the first two mainly used for operation over Connection-mode Network Service and the latter used over Connectionless-mode Network Service. DIS will use Transport Protocol Class 4 (TP4) for all reliable data transfer (e.g., bulk transfer for databases). The ISO Transport standards have been complete for several years. With stability and increasing use, second generation implementation are beginning to appear, giving improved performance and reduced memory and processor overhead; whereas earlier products often included all possible options, tailored and tuned versions are now available.
- The OSI datagram service is not widely available but is a product planned by most vendors for the near future.
- The support shown for the lower layers indicates that all suppliers can offer OSI networking over both LAN and WAN environments.

The four volumes of **OSI Products** reside at IST and are available to the DIS community for review.

APPENDIX A
OSI PRODUCT SURVEY TABLE

Supplier	Application					Application Extensions		Upper Layer Support					Transport & N/W Service				WAN		LAN		Notes											
	X 400(84)	X 400(88)	FTAM	VTP	Directory	CMIP	MMS	JTM	EDIFACT	ODADIF	SGML	SDIF	ACSE	ROSE	RTSE	CCR	TP	Presentation	ASN 1	Session		Transport	CO NS/WAN	CL NS/WAN	CL NS/LAN	X 25(80)	X 25(84)	X 25(88)	8802-3	8802-4	8802-5	FDDI
3Com ²			S	S	S								S					S	S	S	S			S	S	P		S		S		
ACT Logsys ³	S		S	S	S								S	S				S	S	S	S	S			S	S						
Alcatel TITN ³	S	S	S	S	S								S	S				S	S	S	S	S	S	S	S	S	S	S				
Alprange Communications ²	S	S						P					S	S				S	S	S	S	S	S	S	S			S				
Amdahl ³	P	P																				S	S	S	S	S	S	S			S	
Apricot Computers ^{1, 2}	P		P	P									P					P	P	P	P			P				P		P		
ATM Computer ³			P			P							P	P	P			P	P	P	S	S		P	P	S	S		S			
AT&T EasyLink Service ³	S								S												S					S						
BBN Communications ³																									S	S	S	S	S	S		
Boldon James ³	S		P																		S	S	S	S	S							
British Telecom ^{1, 2}	S	S	S		P	S			S	S			S	S	S			S	S	S	S		S	S	S	S	S	P		P		
Bull HN ^{1, 2}	S		S		P				S				S	P				S	S	S	S	S	S	S	S	S	S	S				
CASE Communications																															see Dowty Communications	
Chernikoff Telecommunications																															see Cisco Systems	
Cisco Systems ³																						S		S	S	S		S	S	S		
CoCoNet ³			S										S	S				S	S	S	S											
Concord Communications ²							S						S					S	S	S	S			S				S	S			
Concurrent Computer ¹	P		P										P					P	P	P	S	P	P	S	S	S		S		S		
Cray Research ²			S	S									S					S	S	S	S			S								
Data Connection ³	S	S			P								S	S	S			S	S	S	S	S		S								
Data General ²	S		S	S		S							S	S				S	S	S	S	S	S	S	S	S		S	S			
Datapoint ³	S																				S	S		S	S		S					
Digital ¹	S	P	S	P	S	P	S		S	P			S	S				S	S	S	S	S	P	S	S	S		S	S			
Dowty Communications ^{1, 2}	P	P	P		P								P	P	P			P	P	P	S	P	P	P	S	S	S	P		P		
Dowty Network Systems (ex Dataco) A/S																															see Dowty Communications	
Eicon Technology ³																					P	S			S	S						
Ericsson ³																					S	S		S	S	S		S				
European Network Engineering (ENE)																															see Wollongong Group	
General DataComm ³																					S	S		S	S	S	S		S			
GPT ³	P	P											P	P	P			P	P	P	P	P		P	S	S		P				
Hewlett-Packard ^{1, 2}	S	S	S		S	S							S	S				S	S	S	S	S	S	S	S	S		S	S			
IBM ¹	S		S		S	S	S		S	S	S	S	S	S				S	S	S	S	S	S	S	S	S		S	S	S		
ICL ^{1, 2}	S	P	S	S	P								S	S	P	P	P	S	S	S	S	S	S	S	S	S	S		S		S	
Integralls ³	S		S		S	S							S	S	S			S	S	S	S	S	S	S	S	S	S	S	S	S	S	
Integrated Business Networks ³																					S						S					
Intel ³							S						S	S				S	S	S	S			S				S	S			
International Network Services (INS) ²								S													S					S		S				
Jaguar Communications ³																									S	S						
Marben Produkt ³	S		S		S	S	S						S	S	S			S	S		S	S	S	S	S							
Marcol Group ²	S																			S	S	S	S	S	S	S		S				
McDonnell Douglas Information Systems ³	S		P	P									P					P	P	S	S	S	S	S	S	S	S		S			
Metascybe Systems ³																					P	P		P		P		P				
Motorola Computer Group ³	S	P	P		P	S		P					S	P	P			S	S	S	S	S		S		S	S	S	S	P	P	
NCR ¹	S		S		S	S							S	S				S	S	S	S	S	S	S	S	S		S	S			

¹ Detailed Report available² Modified entries ³ New supplierS - Supported products available now
P - Products planned

Supplier Summary

Supplier	Application				Application Extensions				Upper Layer Support				Transport & N/W Service				WAN	LAN	Notes														
	X 400(84)	X 400(88)	FTAM	VTP	Directory	CMIP	MMS	JTM	EDIFACT	ODAP/ODIF	SGML	SDIF	ACSE	ROSE	RTSE	CCR	TP	Presentation		ASN 1	Session	Transport	CO NSWAN	CL NSWAN	CO NSLAN	CL NSLAN	X 25(80)	X 25(84)	X 25(88)	8802-3	8802-4	8802-5	FDDI
Netcomm ²																						S	S		S	S	S		S				
NET-TEL Computer Systems ²	S	P																	S	S	S	S			S	S	S		S				
Nokia Data Systems ²	S		S	S									S						S	S	S	S	P		P	S	S	S		S			
Norsk Data ³	S																																
Northern Telecom ³						P							P	P					P	P	P	P			P				P				
Norwegian Telecom ³	P												P	P					P	P	P	P				P	P						
Novell ²			S										S						S	S	S	S			S	S	S		S		S		
Olivetti ^{1, 2}	S	P	S	P									S	S					S	S	S	S		P	S	S	S	S	S		S		
Open Systems Solutions ³						P							P	P	P				P	S	P												
Philips Business Systems ¹	P	P											P						P	P	P	P		P	P	P	P	P	P				
Prime Computer ¹	S	P											P						P	S	S	S	S	S	S	S	S		S				
PROGINET ³																																	see TCI
Proton International ³																							S		S	S			S		S	S	
Quantec Systems & Software ³	S												S	S					S	S	S	S			S	S	S	S					
Rank Xerox ^{1, 2}	S	P								S	S										S	S	S		S	S	S		S				
RCE ³																							S	S	S	S	S		S				
Retix ^{1, 2}	S	S	S	S	S	S	S	S					S	S					S	S	S	S	S	S	S	S	S		S		S		
SAGEM ³																																	see Satecom
Salford Software Services ³							P									P																	
Santa Cruz Operation ²	P	P	P										P						P	P	P	P		P				P	P	P			
Satecom ³																						S	S		S	S	S	P	S		P		
SD-Scicon ³	S	S							S										S	S	S				S	S			S				
Sema Group ^{1, 2}	S	S	S	S	S	S	S	S	S	S			S	S	S				S	S	S	S	S	S	S	S	S	S					
Sequent Computer Systems ³	S	S	P						S	P			S	S	S				S	S	S	S	S	S	S	S	S		S			P	
Siemens Nixdorf ²	S				S	P			S				S	S	S				S	S													
Soft-Switch ³	S																				S	S	S		S			S					
Software Forge ²	P	P	P	P	P																P	S	S		S	S	S						
Spider Systems ²	P	P	P		P								P	P	P				P	P	P	S	S	S	S	S	S	S	S		S		
Stratus Computer ³																					S	S	S	S		S	P	S					
Sun Microsystems ¹	S	S											S	S	S				S	S	S	S	S	S	S	S	S		S			S	
Symcicon ³																					S				S	S	S						
Tandem Computers ³	P	P	P						P				S	P					S	S	S	S	S	S	S	S	S		S				
TCI ³			P																														
Tecsisel ³	S	S	S		S								S	S					S	S	S												
Telematics ³	S	S			S								S	S							S	S			S	S	S	S					
Touch Communications ²	S																		S	S	S	S	S	S	S	S	S		S				
Unisys ^{1, 2}	S	S	S	P	S	P			S				S	P	S				S	S	S	S	S	P	S	S	S		S		S		
UNIX System Laboratories ³	P	P	S	P	P	S							S						S	S	S	S			S								
Wang ^{1, 2}	S	P	P										S						S	S	S	S	S	S	S	P		S					
Willow Down Systems ³					P																												
Wollongong Group ^{1, 2}	S	P	S	S	S								S	S	S				S	S	S	S	S	S		S							
Xerox Corporation																																	see Rank Xerox

¹ Detailed Report available
² Modified entries ³ New supplier

S - Supported products available now
P - Products planned

APPENDIX B
COMMENTS ON OSI PROTOCOLS AND PROFILES

Standards & Profiles Supported: MHS

Comment

There is now widespread support for the **1984 MHS** standards with 70 percent of suppliers surveyed having products available or planned. Most products include a combined MTA and IPM UA, with many acting as a gateway to proprietary electronic mail systems and/or industry-standard protocols (eg, SMTP). The relatively large number supporting conversion may in many cases reflect the need to convert between character sets and word processing formats in the proprietary regimes. Most products claim conformance to one or both European profiles (A/311 and A/3211) and/or similar OIW implementation agreements; thus many also claim support of UK and/or US GOSIP.

Although the **1988 MHS** standards were approved in 1988, profiles are not yet fully stable. Thus, it is not surprising that only 30 percent of suppliers have or plan 1988 products; indeed the existence of about 20 products with some 1988 MHS capability is encouraging. These products have much variety of function with some comprising only an MTA, UA or MS. There is also variance in the combinations of major service groups, including use of Directory, secure messaging, distribution lists and physical delivery, although most vendors will support interworking with 1984 systems. An increased range of body part type support is seen with IA5 (ASCII) still predominant but with many products also supporting General Text (for use of richer character sets) and externally-defined body part types; the latter should at last begin to stimulate wider use of MHS for non-Email purposes.

The market for 1984 MHS products is mature giving users wide choice. However, many products have only been tested for interworking with certain other vendors' implementations, and relatively few have undergone more formal conformance testing. Users are therefore advised to insist on demonstrable interoperability when purchasing for a mixed environment.

Users should also be able to find 1988 products provided that they are not too demanding in the particular selection of features to be supported in the short term. They should also be aware that the development of conformance and interoperability testing is still at a relatively early stage.

Standards & Profiles Supported: FTAM

Comment

Excluding the suppliers whose primary market is telecommunications and networking equipment (for use at Network Layer and below), more than 75% of suppliers surveyed, including all major suppliers, can now provide implementations of FTAM.

The actual number of suppliers shown with support available now has also increased by more than 50% over the numbers in the 1990-91 Product Survey. What is perhaps more important is that, whereas in the earlier survey many large suppliers indicated support on only part of their product range (frequently early implementations of portable packages on UNIX-based systems), in this survey those large suppliers now have fully functional implementations on all systems in their range.

Support for the transfer service classe is found in all products with almost 90% also providing the management service class and two thirds the access service class. There is also full support for the simple unstructured document types (FTAM-1 & FTAM-3), and broad support for both sequential text (FTAM-3) and file directory (NBS-9). However, there is only limited support for sequential binary (FTAM-4) and record file (INTAP-1) document types. Support for restart and recovery is also growing with more than 40% of suppliers with or planning products.

Support for particular profiles matches service classes with predominant support for simple transfer profiles (eg, AFT11, UK GOSIP T1 and OIW T1). Approximately 75% of suppliers claim conformance with a UK GOSIP FTAM subprofile and 50% with a US GOSIP subprofile.

Most of the available products have undergone either or both conformance testing and interoperability testing.

The market for FTAM is becoming mature. It is now possible to procure FTAM implementations from a wide range of suppliers and have some confidence that they will be able to interwork and be able to transfer at least simple unstructured files. In many cases, it will also be possible to transfer more complex files.

Standards & Profiles Supported: Directory

Comment

More than a quarter of respondents have indicated that they now have Directory products or plan to have them by mid-1992. However, a proportion of the current products is still based on the early MAP 3.0 intercept of the standards and hence are not necessarily fully compatible with products based on the final version of the standards.

Many of the products now available (generally only since late 1990) or planned by the end of 1991 are portable implementations. As these are taken up by system suppliers, as has happened with other OSI applications, considerable growth in the number of end-user products can be expected over the next two years. There are already, however, some major suppliers with support for the Directory on at least part of their product range.

Since many of the products are portable, and hence full-functionality implementations, most support both DUA and DSA roles. There are also a few products aimed solely at providing the user with a DUA interface to the Directory. There is also limited support for the authentication framework.

Support for particular profiles is not yet wide-spread, although this is not surprising given that there are as yet no Directory ISPs and the existing profiles are generally not yet considered to be mature.

There has been very limited interoperability testing and no conformance testing of the products in the survey. Any potential user should, therefore, insist on interoperability tests for the environment in which the products are to be used.

Overall, the survey indicates that products are becoming available and that long to medium term plans for use of the Directory can now be made. Experienced users may find products to meet specific requirements today. However, the ability to procure Directory products as an off-the-shelf item seems to be several years away.

Standards & Profiles Supported: Virtual Terminal

Comment

More than a quarter of suppliers have indicated that products are available or planned for VT with most of the latter available by the end of 1991. All but one of the products are based on the final standards. Many of the planned products noted in the 1990-91 edition of *OSI Products* were still at the speculative stage and some have not emerged. However, the number of new entries has more than offset this loss resulting in a 40% increase in supplier support. The profile of suppliers has changed with a move towards smaller companies which now make up 70% of those responding to the VT survey.

As to be expected, the A-mode Telnet profile attracts the most support with 95% of suppliers claiming products. The Telnet profile is relatively simple to support and there is a ready made TCP/IP TELNET migration market to tap. The other two A-mode profiles, X.3 PAD and Transparent, are not far behind with about 70% support.

The more complex S-mode Forms profile attracts less support with a quarter of VT suppliers claiming products. However, this is expected to change now that UK GOSIP 4.0 gives this profile 'confirmed' status and US GOSIP V2 includes it as a mandatory profile for Federal procurement from 1992.

Conformance test services for VT do not yet exist. However, several suppliers claim interoperability tests have been completed. Purchasers are advised to insist on proof of interoperability with other products where necessary. Several products are based on RETIX portable software so interoperability between them should be more straightforward to establish.

The increase in support for VT profiles identified in the 1991-92 issue of *OSI Products* continues and supplier intentions appear to have become more firm. Although the market for VT products is still at a relatively early stage, purchasers may now plan for the introduction of VT into their systems with confidence that a wide range of products will be available by 1993.

Standards & Profiles Supported: OSI Management

Comment

Approximately one quarter of the suppliers responding to the survey have or plan (most by the end of 1991) to have implementations of the management communications standard CMIP. Of these, a number are based on the MAP/TOP intercept (based on an early draft of the standard); however, most of those suppliers have also indicated a commitment to migrate their product to the latest version.

More than half of the respondents have indicated that their product conforms to the OSI/Network Management Forum (OSI/NMF) Release 1 which, for CMIP, is close to the specification of the final standard. There are many supplier members of the OSI/NMF who have not yet responded with details of their implementation plans; these can also be expected to increase product availability over the next two years.

Lack of declared support for profile AOM12 is likely to reflect that suppliers were not aware of its contents; support can be expected because of its relative closeness to OSI/NMF specifications.

Although CMIP is not sufficient by itself for the implementation of OSI Management, it is clear that many suppliers are building a good foundation for future standards.

Standards & Profiles Supported: MMS & JTM

Comment

JTM

Only one planned implementation of the Job Transfer and Manipulation standard has been reported in the survey. In some respects, this is surprising since to some extent the functionality provided by the standard reflects that provided by the remote job entry (RJE) capabilities of traditional mainframe computing. It may be that the lack of interest in the JTM standard reflects that those users and suppliers are content to continue with their proprietary RJE protocols. Alternatively, this mode of computing may be seen as declining and deemed not worthy of investment in new protocols.

MMS

The Manufacturing Message Specification and supporting standards are aimed at a niche market for industrial automation equipment in the manufacturing industry. There has been no significant increase in the number of suppliers supporting MMS over that shown in the 1990-91 edition of OSI Products.

This may be a reflection of the fact that it is a specialist market and that some relevant suppliers, not typically known for support of OSI, have not yet found their way into the survey.

Standards & Profiles Supported: ODA & SGML

Comment

Compared with the 1990-91 edition of the Product Survey, there has been little growth in the number of major suppliers reporting support for ODA products, although many plans have turned into products.

The few ODA implementations that are available or planned are spread across a range of Level 1 and Level 2 DAPs. These DAPs were the precursors of the harmonisation effort that resulted in the development of ISPs; stability of the ISPs can be expected to result in the migration of DAPs and products to the ISPs. Absence of Level 3 implementations is a reflection of the feeling that this level of functionality is currently beyond user requirements; the current target is seen as the open interchange of mixed content 'word processor' documents which is satisfied by Level 2.

Only one ODA native editor product is offered and none are planned. These are a degree of magnitude more difficult to produce than converters and more are likely to emerge following the availability of ODA developers' tool kits for the popular office platforms.

The future for ODA is, however, not as limited as might appear from this survey. A number of major suppliers are known to have products under development although not yet advanced enough to give a firm response to this survey. Indeed, some suppliers have established an ODA consortium, and IBM has announced that it is adopting ODA instead of the revisable form of the Mixed Object DCA. Additionally, a range of PC and MAC products and services are appearing and are planned. These are being developed by sources not normally associated with OSI and hence are not yet reflected in the tables; the number of these will also grow as system developers' tool kits emerge.

Neither the ability of an implementation to receive and represent a document, nor the integrity of a converter is yet tested. Users are advised to insist upon extensive interoperability demonstrations.

Strong support is also lacking for SGML and SDIF in this survey. Again this reflects the fact that SGML suppliers are also not normally associated with OSI and hence few SGML products have been reported.

Profiles Supported: Character & Control Repertoires

Comment

The overall supplier awareness of character repertoire standards and profiles seems to be very low with only 10% of respondents to the survey indicating support for any of the specified standards and profiles.

Support is likely to be present, although not reported, in order for application layer products to be acceptable in many European countries. Lack of support, or awareness of the specific standards and profiles, may be understandable for North American suppliers, in whose main market use of ASCII is normal and hence support for other character repertoires is not required.

Few suppliers have provided a detailed break-down of character repertoire support by product, and, in at least one case, that supplier has been prominent in its support of standardisation in the area.

Standards & Profiles Supported: EDI & Other Data Interchange Formats

Comment

The survey indicates that less than 20% of respondents have EDI products. However, this is not surprising since support for the EDIFACT syntax and related message types is not within the scope of the product line of many suppliers of communications and networking equipment who have replied for the Product Survey.

Among the traditional DP suppliers (and particularly those providing large mainframes), support is greater. EDI is also a specialist market. Increasingly, some suppliers (eg, small systems houses), not normally associated with support for OSI, are understood to have products (frequently translator products); not all of these have been included in this version of the Product Survey.

Support for EDIFACT messages does not necessarily mean that they have to be transferred using OSI communications (or, indeed, telecommunications of any kind), although it is generally possible to connect to the EDI services noted in the survey using OSI standards up to layer 3 or 4. Support or announced plans for use of X.400 (including the recently defined X.435, *P_{edi}*) is not yet common. However, informal discussions with suppliers indicate that further X.435 support is planned.

Given the derivation of the EDIFACT syntax and many of the EDI applications today, it is not chance that support for the UN/TDI Tradacoms and ANSI X12 syntaxes is common to many of the products that support EDIFACT.

For particular environments it is possible to buy EDIFACT products, although the choice of supplier and product may not be wide.

Standards Supported: Upper Layer Support

Comment

Some 75% of the suppliers surveyed responded to questions in this area; in the main, those without support are the suppliers of networking-only products. The majority of support for the upper layer support standards stems from that required by standardised applications. However, a certain amount of unbundling has taken place and a significant 55% of suppliers are estimated to be providing platform implementations that can be shared by standardised applications. Some platforms provide commonality up to the Session layer whilst others include ACSE, ROSE and RTSE.

Support for ACSE and Presentation is running at around 85%, the remainder being roughly accounted for by those suppliers with X.400 (1984) products only. Support for Session V1 and V2 is evenly split at just over 70% of suppliers for each. The support shown for ROS and RTS reflects that required for X.400 (1984) products whereas that for ROSE and RTSE is as needed for X.400 (1988), X.500 Directory and CMIP products. Support for ASN.1 is also high since it is required for every standardised application. Returns from some suppliers did not indicate fully which of these standards were supported or were inconsistent with the applications supported; thus there is likely to be some small variance from the following tables.

Support for CCR and TP has yet to take off with approximately five suppliers claiming product plans. However, given the high level of interest in TP/CCR standardisation, these figures are expected to climb steeply over the next few years.

Products supporting Connectionless Session and Presentation remain low at 5% and 16% reflecting the lack of standardised applications requiring these protocols; and support for symmetric synchronisation in the Session layer has risen to 22%.

Standards Supported: Transport Layer

Comment

Support for ISO Transport layer standards is a prerequisite for any supplier's implementation of OSI above the Network layer. Thus, the majority of suppliers surveyed have an implementation of one or more classes of the standard.

Support is widest for classes 0, 2 and 4 with the first two mainly used for operation over Connection-mode Node Network Service (usually across WANs) and the latter used over Connectionless-mode Network Service. Support for class 1 is negligible and few implementations of class 3 exist except in the UK market.

Implementations of ISO Connectionless Transport and the Network Connection Management subprotocol are relatively uncommon, perhaps due to lack of market demand. However, the availability of portable software means that suppliers can usually introduce such features with little delay.

Completion of formal conformance tests to the ISO standard is claimed for a relatively small number of Transport implementations. In the case of some portable software, conformance testing would need to be carried out on each ported version, so base versions of widely used portable software are not identified as conformant. Interoperability testing is claimed for a larger number of products.

The ISO Transport standards have been complete for several years. With stability and increasing use, second generation implementations are beginning to appear, giving improved performance and reduced memory and processor overheads; whereas earlier products often included all possible options, tailored and tuned versions are now obtainable.

Standards & Profiles Supported: LANs

Comment

Support for the CSMA/CD media remains predominant among the products included in this survey although support for Token Ring in an OSI environment has increased at a greater rate since the 1990-91 edition of OSI Products. Token Bus occupies a niche market primarily in industrial automation systems with implementations mainly from specialist suppliers. FDDI standards are now sufficiently complete and stable for implementation, with some products already offered; considerable FDDI market growth is to be expected.

Logical Link Control class 1 is by far the most common product option with class 2, including LLC type 2, still not widely supported. LLC 3 is of interest mainly for MAP implementations, which are not themselves numerous.

Connectionless-mode Network Service across LANs receives support from most suppliers with, by comparison to the previous edition of OSI Products, there now being wide-spread support for the full internet variant. There is also a large increase, to more than a third of the total, in the number of suppliers supporting or planning support of Connection-mode Network Service across LANs.

Most products claiming support for a particular combination of media and network service also claim conformance to the relevant profiles.

Claims for conformance tested products are relatively rare; this may be due to the nature of the testing process. Some implementations are in the form of packaged or ROM software, which would not normally be eligible for formal conformance certification by the originator. Interoperability testing is claimed for many of the included products, which can be a less expensive procedure than conformance testing.

Standards & Profiles Supported: WANS & Routing Protocols

Comment

All the major suppliers of IT systems and services are now able to provide OSI WAN support. The majority of the suppliers offer CO NS over PSDN with a lesser number claiming CL NS.

Support for X.25 standards in layers 2 and 3 is almost universal with most now supporting X.25 (1984) and a few X.25 (1988). Support for OSI over ISDN is still limited but evidence suggests that it will increase quickly.

Most suppliers support one or more of the recognised functional profiles.

Certification for attachment to public packet data networks is often taken as a measure of conformance testing for X.25. An increasing proportion of implementations now have NET2 approval for connection to X.25 networks; some have also undergone other conformance testing. Most have undergone some form of interoperability testing.

Some suppliers provide only higher layer implementations, perhaps from Transport (layer 4) upwards, relying on the use of third party interface cards to provide layers 3 and below. Omission from this table need not necessarily imply lack of WAN support on their systems.

Support for ISO 9542 ES-IS routing protocol is increasing with a substantial number of suppliers showing support or plans therefor; fewer suppliers have indicated plans for the more recently approved ISO 10030, the ES-IS routing protocol for use with CO NS. Note: these routing protocols and the support shown are applicable in both WAN and LAN environments

Profiles Supported: UK GOSIP

Comment

There are now more than 60 suppliers claiming support, or planning to support, at least part of UK GOSIP, an increase of almost 100% over the previous edition of OSI Products. Approximately half of these have or plan to support the FTAM subprofile and two thirds the MHS X.400 (1984) subprofile. There is certainly an adequate choice of suppliers for these primary OSI applications.

Smaller numbers of suppliers have disclosed products or plans for the X.400 (1988) and X.500 Directory subprofiles although there are still 10 or more of each. There is lesser support for the Virtual Terminal forms subprofile.

There is limited support for the application extension standards, EDIFACT, GDAP1 & 2 and the character repertoires.

There is broad support for most elements of the lower layers, GOSIP-T. In the LAN environment, support for CL NS predominates although 25% of the suppliers now offer CO NS across LANs. There is less support for FDDI LANs although this is expected to increase.

Although only limited formal conformance testing facilities are currently offered for UK GOSIP itself, a number of implementations have been tested in other contexts. Similarly, interoperability testing has been completed in many cases.

Profiles Supported: US GOSIP

Comment

Approximately 50 suppliers claim support or plan to support at least part of US GOSIP. Approximately half of these have or plan to support the FTAM profile and 60% the MHS X.400 (1984) profile. More than a third also support or have plans for the VT profile with most selecting the Telnet variant. Thus, there is an adequate choice of suppliers for these primary OSI applications.

There is limited support shown for the ODA profile, reflecting the general status of support for the base standards.

There is broad support for most elements of the lower layers with those elements specified in V1 having strongest backing.

Some conformance tested implementations are claimed in the table. Interoperability testing has also been completed frequently in the context of OSInet or similar demonstrations.

Profiles Supported: MAP/TOP 3.0

Comment

The MAP and TOP profiles have existed in a stable form for some years. MAP 3.0 is very much a target for specialist suppliers of industrial automation products, although the entries included here represent many of the main suppliers to this market.

Approximately half the suppliers responding to the survey claim support for some element of MAP or TOP or both.

MAP can be expected to continue as the profile of choice for its niche market. TOP will continue also but not due to unique functionality. There are several other recognised profiles which are close synonyms for elements of TOP and which are likely to replace it in the future.

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