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Contents

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Foreword

This ETSI Technical Report (ETR) was produced by the Terminal Equipment (TE) Technical Committee of the European Telecommunications Standards Institute (ETSI). ETRs are informative documents resulting from ETSI studies which are not appropriate for European Telecommunication Standard (ETS) or Interim European Telecommunication Standard (I-ETS) status. An ETR may be used to publish material which is either of an informative nature, relating to the use or application of ETSs or I-ETSs, or which is immature and not yet suitable for formal adoption as an ETS or I-ETS.

This ETR addresses the topic of "the Identification of required terminal characteristics over Integrated Services Digital Networks (ISDN) for Open Document Architecture (ODA) applications". The main reason for producing this ETR is to establish support for the introduction of ISDN by defining appropriate ODA applications with regard to a number of recommendations given by the ninth meeting of ETSI Technical Assembly. The context of this ETR is ISDN applications.

Outline:

As this is the first ETSI report addressing the topic of ODA services over ISDN, the main objective of this ETR is to provide an inventory on the subject and to highlight important issues for further study or standardisation. First, a market survey was carried out. The market survey was directed at the user's needs and supplier's support for ODA-based document interchange. In addition, the current ODA and telematic services markets were inventarized. In this way the market survey provides a sound base for the technical part of this ETR. The technical part relates the established market requirements to the different possible technical solutions for offering ODA based services over ISDN. In addition, it identifies the status of standardisation of both ODA and it's profiles and the telematic services or communication protocols on which ODA services can be based. The final part of this ETR consists of general ODA application scenarios and conclusions and recommendations, including issues for further study and priorities for standardisation activities. Due to the combination of the market survey and the technical overview on the ODA topic, this ETR can be seen as bridging the gap between the market and the more technical standardisation world. Only the combined support of the two sides provides a sound basis for future implementations of real, interoperable ODA services.

This ETR consists of four parts. Part A (Clause 5) deals with the market survey. Part B (Clauses 6 to 9) addresses the status of standardisation of ODA and a number of possible underlying communication platforms. Part C (Clauses 10 and 11) is concerned with the analysis of user requirements and gives an overview of existing products supporting ODA services. Part D (Clauses 12 and 13) outlines some scenarios for which new ODA services can be useful and contains the conclusions and recommendations. Two annexes contain the questionnaire used for the market survey and a follow-up on the market survey.

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1 Scope

The scope of this ETR is to "identify required terminal characteristics over ISDN for ODA applications". In this context, the ODA Standard provides for standardised electronic interchange of documents between heterogeneous environments. An ODA service includes both the ODA application itself (e.g. conversion to and from the ODA-format) as well as the underlying communication platform (by support for e.g. a CCITT communication protocol) needed for the transfer. The underlying network is the ISDN in the scope of this ETR, because it provides the necessary bandwidth needed for the interchange of large amounts of data.

Therefore, an ODA service over ISDN consists of an ODA application, an underlying communication platform and the ISDN. Many different ODA services can be identified. Each of these services requires it's own specific underlying ODA application and communication platform. To aid implementors in choosing the relevant selection of subprocesses from the ODA Standard, as well as choosing the best suited communication protocol, a series of terminal characteristics can be identified. The terminal characteristics shall, amongst other things, contain a description of the profile(s) to be used and communication protocol(s) to be applied. Relevant protocols to this project are the CCITT communications protocols of Document Transfer and Manipulation (DTAM) and Message Handling System (MHS) and the facsimile service. In addition, the ISO File Transfer Access Management (FTAM) protocol has been considered. Relevant Document Application Profiles (DAPs) for this project were, in general, all standardised DAPs.

Due to the limited time in which this ETR has been established the aim was not to define detailed terminal characteristics for new ODA services. Instead those terminal characteristics have been identified by giving guidelines towards new ODA services over ISDN, influenced by the real user needs obtained from a market survey. Thus, this ETR also aims at being a guideline for all ETSI members, including implementors, to reach the goal of a common understanding about ODA and ODA services, including the underlying communication platform. This may eventually lead to implementations of truly interoperable ODA services.

2 References

For the purposes of this ETR, the following references apply:

[1] "Open Document Architecture (1991): the Emerging Market", C. Chappell and R. McBryde, Ovum Ltd, London.

[2] "Electronic Document Interchange (1992): ODA and ISDN - A report to ETSI PT40", C. Chappell and R. McBryde, Ovum Ltd, London.

[3] European ISDN Atlas (1991): "Fischer & Lorenz and Ovum Ltd".

[4] RISE (Esprit project E2012) (1992): "Presentation brochure V.1.1".

[5] FODATEC document E5402/TN/UPC/45, J. Delgado (1992): "The advanced communication module: Specification of operations and interactions with other modules".

[6] ISO 7498 (1989): "Information Processing Systems - Open Systems Interconnection, Basic reference model - Parts 1 - 4".

[7] ISO 8613 (1989): "Information Processing - Test and office systems - Office Document Architecture (ODA) and interchange format - Parts 1, 2, 4, 5, 6, 7 and 8".

[8] ISO 8613-10 (1991): "Information Processing - Text and office systems - Office Document Architecture (ODA) and interchange format - Part 10: Formal specification".

[9] ISO/IEC TR 10183-1 (1993): "Information technology - Text and office systems - Office Document Architecture (ODA) and interchange format - Technical Report on ISO 8613 implementation testing - Part 1: Testing methodology".

[10] ISO PDTR 10183-2: "Office document architecture (ODA) and interchange format - Part 2: Abstract Test Cases".

[11] ISO ISP 10610 (1992): "Information technology - International Standardised Profile FOD 11 - Office document format - Simple document structure character architecture content only. Part 1: Document application profile".

[12] ISO ISP 11181-1 (1992): "Information technology - International Standardised Profile FOD 26 - Office document format - enhanced document structure - character, raster graphics and geometric graphics content architecture. Part 1: Document application profile".

[13] ISO ISP 11182-1 (1992): "Information technology - International Standardised Profile FOD 36 - Office document format - extended document structure - character, raster graphics and geometric graphics content architecture. Part 1: Document application profile".

[14] ENV 41509 (Q111): "ODA document application profile: Processable and formatted documents: Basic character content".

[15] ENV 41510 (Q112): "ODA document application profile: Processable and formatted documents: Extended mixed mode".

[16] ENV 41511 (Q121): "ODA document application profile: Processable and layout independent profile: Simple message profile".

[17] ISO 8879 (1986): "Information Processing - Text and office systems - Standard Generalised Markup Language (SGML)".

[18] ISO 10031 (1990): "Information technology - Text and office systems - Distribution-office-applications model".

[19] ISO 8571 (1988): "Information Processing Systems - Open Systems Interconnection - File Transfer, Access and Management, Parts 1 to 5".

[20] ISO 10021 (1990): "Information Technology - Text Communication Message - Oriented Text Interchange System, Parts 1 to 7".

[21] CCITT Recommendation T.4 (1988): "Standardisation of group 3 facsimile apparatus for document transmission".

[22] CCITT Recommendation T.6 (1988): "Facsimile coding schemes and coding control functions for group 4 facsimile apparatus".

[23] CCITT Recommendations T.400 to T.418 (1988): "Open Document Architecture (ODA) and interchange format".

[24] CCITT Recommendation T.30 (1988): "Procedure for document facsimile transmission in the general switched telephone network".

[25] CCITT Recommendation T.502 (1991): "Document application profile PM-11 for the interchange of character content documents in processable and formatted documents".

[26] CCITT Recommendation T.505 (1991): "Document application profile PM-26 for the interchange of mixed content documents in processable and formatted forms".

[27] Draft CCITT Recommendation T.434: "Binary file transfer protocol for telematic services".

[28] CCITT working document, DTAM T.43x: "Enhanced manipulation functions" (1992).

[29] CCITT "Red book" Fascicle VIII.7 Message handling systems. X.400-X.430.

[30] CCITT "Blue book" Fascicle VIII.7 Message handling systems. X.400-X.420.

[31] CCITT Recommendation T.502 (1991): "Document application profile PM-11 for the interchange of character content documents in processable and formatted forms".

[32] CCITT Recommendation T.503 (1991): "A document application profile for the interchange of group 4 facsimile documents".

[33] CCITT Recommendation T.563 (1991): "Terminal characteristics for group 4 facsimile apparatus".

[34] CCITT Recommendation X.217 (1988): "Association control service definition for Open Systems Interconnection for CCITT applications".

[35] CCITT Recommendation X.227 (1988): "Association control protocol specification for Open Systems Interconnection for CCITT applications".

[36] "PM-Entwicklungen Studie", R.Dotzert, H.Froelich, T.Martin, Dr. H.D.Schultz DANET GmbH (1990).

[37] "ODA survey 1990", Erik Lillevold and Gisle Hannemyr, TF N 24/90, Norwegian Telecom Research Department and Norwegian Computing Centre.

[38] CCITT "Blue Book" Fascicle II.6: "Message handling and directory services - Operations and definition of service, F400-F422, F.500".

[39] ISO 10166 (1990): "Information technology - Text and office systems - Document Filing and Retrieval (DFR)".

[40] Second Working Draft ISO 8613-9: "Office Document Architecture (ODA) and interchange format - Part 9: Audio Content Architecture".

[41] ETS 300 112: "Integrated Services Digital Network (ISDN); facsimile group 4 class 1 equipment on ISDN-End-to-end protocols".

[42] Revised Draft CCITT Recommendation T.33x (1992): "The inter working between telematic terminals: DTAM-Bulk-Transfer Normal Mode and MHS".

[43] ETS 300 081 (1992): "Integrated Services Digital Network (ISDN); Teletex end-to-end protocol over the ISDN".

[44] "Workflow Management Software (1991): the Business Opportunity", Keith Hales and Mandy Laverly, Ovum Ltd , London.

[45] "Concurrent Engineering; the Market Opportunity (1992)", Caroline Chappel and Iain Stevenson, Ovum Ltd.

[46] CCITT Recommendations T.431 - T.433 (1988): "Document transfer and manipulation (DTAM)".

[47] CCITT Recommendation T.501 (1988): "A document application profile for the interchange of formatted mixed mode documents".

[48] CCITT Recommendation T.504 (1988): "Document application profile for videotex inter working".

[49] CCITT Recommendation T.521 (1988): "Communication application profile BTO for document bulk transfer based on the session service (according to the rules defined in T.62bis)".

[50] CCITT Recommendation T.522 (1988): "Communication application profile BT1 for document bulk transfer".

[51] CCITT Recommendation T.62bis: "Telematic control procedures based on CCITT Recommendations X.215/X.225".

[52] CCITT Recommendation X.218 (1988): "Reliable transfer: model and service definition".

[53] CCITT Recommendation X.228 (1988): "Reliable transfer: Protocol specification".

[54] CCITT Recommendation X.219 (1988): "Remote operations: model, notation and service definition".

[55] CCITT Recommendation X.229 (1988): "Remote operations: Protocol specification".

[56] CCITT Recommendation X.208 (1988): "Specification of abstract syntax notation one (ASN.1)".

[57] CCITT Recommendation X.216 (1988): "Presentation service definition for open systems interconnection for CCITT application".

[58] CCITT Recommendation X.226 (1988): "Presentation protocol specification for open systems interconnection for CCITT application".

[59] CCITT Recommendation X.215 (1988): "Session service definition for open systems interconnection for CCITT application".

[60] CCITT Recommendation X.225 (1988): "Session protocol specification for open systems interconnection for CCITT application".

[61] Appelt. W: "Document Architecture in Open Systems - The ODA Standard", Springer - Verlog 1991.

[62] ISO 8802-3 (1990): "Information processing systems - Local area networks - Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications".

[63] ISO/IEC 8802-5 (1992): "Information processing systems - Local and metropolitan area networks - Token ring access method and physical layer specifications".

[64] CCITT Recommendation X.400: "Message handling system and service overview".

[65] CCITT Recommendation X.25: "Interface between data terminal equipment (DTE) and data circuit terminating equipment (DCE) for terminals operating in the packet mode and connected to public data networks by dedicated circuit".

[66] ISO 8802-4 (1990): "Information processing systems - Local area networks - Token-passing bus access method and physical layer specification".

[67] CCITT Recommendation F.200: "Teletex service".

[68] ISO 8632-1 PDAM 4 (1987): "Information processing systems- Computer graphics- Metafile for the storage and transfer of picture description information- Part 1: Functional specification".

3 Definitions

For the purposes of this ETR, the following definitions apply:

Computer Integrated company

A company in which all its business processes, internal and external to the organisation, are fully supported by computer applications that are able to communicate with each other. A computer integrated company might use Computer Aided Design (CAD), Computer Aided Manufacturing (CAM) Electronic Data Interchange (EDI) workflow management and concurrent engineering within its suite of supporting computer applications.

Workflow management

Workflow management is a methodology designed to support business processes within an organisation in order to achieve higher productivity and improved quality. It has its origins in integrated office systems and document image processing. Workflow management allows office workers in a multi-national company with a number of separate sides to co-operate efficiently within a single business process. An extension of this is likely to be in user scenarios developing in support of Complex Partnerships which aim to profit from new cross industry application environments.

Concurrent engineering

Concurrent engineering is a methodology which has found application in manufacturing and other industry sectors. It allows teams representing all functions in a company in addition to customers and suppliers in certain situations to work on products or integrated services design. The aim of concurrent engineering is to improve quality and to reduce lead times for bringing products or services to the market. Concurrent engineering has been shown to be of greatest value in large organisations, in which the various departments have tended to become "companies within a company" with the resulting loss of communications.

Retrieval and Interchange of Standards in Europe (RISE)

RISE is a project concerned with Retrieval and Interchange of Standards in Europe. It was launched in 1991 as part of the EC Commission programme known as the European Nervous System (ENS). The ENS programme aims to "support the establishment of trans-European networks between administrations". RISE is Project E2012 of the ENS programme. RISE comprises of 13 partners including ETSI, CEN and CENELEC.

4 Abbreviations

For the purposes of this ETR, the following abbreviations apply:

ACSE	Association Control Service Element
AOW	Asiatic and Oceanic Workshop
API	Application Programming Interface
ASE	Application Service Element
CAD	Computer Aided Design
CALS	Computer-aided Acquisition and Logistic Support
CAM	Computer Aided Manufacturing
CAP	Communication Application Profile
CCITT	The International Telegraph and Telephone Consultative Committee
CD	Committee Draft
CDH	Computer Document Handling
CGM	Computer Graphics Metafile
CSCW	Computer Support for Co-operative Work
DAD	Draft Addendum
DAP	Document Application Profile
DAM	Draft Amendment
DFR	Document Filing and Retrieval
DIP	Document Image Processing
DIS	Draft International Standard
DOD	Department of Defence (US)
DSSSL	Document Style Semantics and Specification Language
DTAM	Document Transfer and Manipulation
DTP	Desktop Publishing
EDI	Electronic Data Interchange
ENS	European Nervous System
ETR	ETSI Technical Report
ETSI	European Telecommunications Standards Institute
EWOS	European Workshop for Open Systems
FTP	File Transfer Protocol

FOD	Format of Office Document
FODATEC	Feasibility demonstration of ODA Technical Documents
FTAM	File Transfer, Access and Management
INTAP	Interoperability Technology Association for Information Processing (Japan)
ISDN	Integrated Services Digital Network
ISP	International Standardised Profile
ISO	Organisation for International Standardisation
IT	Information Technology
LAN	Local Area Network
MHS	Message Handling System
NIST	National Institute for Standards and Technology (US)
ODA	Open Document Architecture
ODAC	ODA Consortium
ODIF	Open Document Interchange Format
ODL	Open Document Language
OEM	Other Equipment Manufacturers
OIW	OSI Implementors Workshop
OSI	Open Systems Interconnection
PAGODA	Profile Alignment Group for Open Document Architecture
PC	Personal Computer
PM	Processable Mode
PODA	Piloting ODA
PSPDN	Packet Switched Public Data Network
PSTN	Public Switched Telephone Network
RISE	Retrieval and Interchange of Standards in Europe
ROSE	Remote Operations Service Element
RTF	Rich Text Format
RTSE	Reliable Transfer Service Element
SGML	Standard Generalised Markup Language
SPDL	Standard Page Description Language
TQM	Total Quality Management

WAN	Wide Area Network
WOPODA	Word Processor for ODA

PART A: Market survey

5 Market survey

5.1 Introduction

One task of the suite of tasks defined during the production of this ETR is set in the context of the overall project whose objective is to identify required terminal characteristics over ISDN for ODA applications. The rational of the questionnaire, which addressed both users and suppliers, is explained and methods for obtaining information are discussed. Market information relating to user needs, obtained by analysis of a database held by a market research company, is summarised, and responses received direct from the suppliers are reported.

It is concluded that, notwithstanding some negative influences, there is an important and developing market for ODA and that the new applications of concurrent engineering and workflow management will be key drivers. In addition, it is concluded that these applications will influence the use of ISDN as a wide area communications network, as in for these applications the bandwidth advantages of ISDN will be of some significance. It is suggested that there may be a case for additional market research activity to clarify aspects of concurrent engineering and workflow management which are of relevance to the objectives of this ETR.

Subclause 5.2 outlines the basis of the Market Survey and discusses the methodology employed. Subclause 5.3 summarises the results of the survey on user needs whilst Subclause 5.4 provides a similar overview on the survey of supplier positions. Conclusions are given in Subclause 5.5. Annex B contains information about a follow up on the market survey addressing concurrent engineering and workflow management in relation to ODA.

5.2 Market survey overview

5.2.1 The questionnaire

The scope of this ETR is to identify required terminal characteristics over ISDN for ODA applications. In order to provide a sound base for much of the technical work it was considered essential to survey both potential users and suppliers in order to establish both requirements and likely ways of satisfying these requirements. This is the work outlined as TASK 1: Market Survey.

The questions of interest were encapsulated in a questionnaire suitable for sending to potential users and suppliers. The questionnaire is included as Annex A to this report.

The first part of the questionnaire was aimed at users and sought to establish the following:

- existing office automation systems in use;
- user needs for production and interchange of documents;
- user needs for storage and retrieval;
- user awareness and intentions towards ODA;
- communication platforms intended for use for document interchange;
- need for applications which require interactive mode of operations.

The first four areas covered in the questionnaire were designed to establish the degree to which ODA would or should feature in user plans. The remaining two areas were intended to establish the relevance of ISDN as a communications network.

Information about the current installed base and the need for interchange and storage allows assumptions to be made on the extent of a need for a standard such as ODA. Clearly, if the installed base contained a plethora of incompatible systems, and there were found to be a huge untapped demand for interchange, users would look for a standard to solve their interchange problems. Similarly, if business functions involved the long term electronic storage of documents for a variety of future uses, then users would be advised to seek a stable non-proprietary solution for their needs to ensure the long term viability of their businesses. Finally, the degree to which users are already aware of ODA and its benefits can be used to estimate the speed of uptake of the standard.

Information on the communications platforms planned, or in use now, can be used to estimate the relevance of ISDN in the minds of users. If ISDN is to have far reaching significance for ODA, it shall offer facilities which cannot be offered by conventional economic packet based networks. It is thought that the advantage of ISDN lies in its bandwidth compared with public X.25 data networks, and this would be relevant for applications requiring rapid file transfer or for interactive applications requiring small response times and the absence of store and forward processes in the communications chain. For this reason the questionnaire contained questions about use of interactive mode of communications.

The second part of the questionnaire was aimed at suppliers and was designed to establish the likely shape of supplier offerings in the future. Questions were asked on the following areas:

- involvement in ODA;

- products available or under development;

- Document Application Profiles supported;

- extensions of ODA in plan; and

- involvement in communications subsystems.

The first four areas in the questionnaire ought to establish the supplier's plans in full so that a judgement could be made on whether they were likely to satisfy user requirements which may be explicitly stated or implicit in their IT strategies to support their businesses. The fifth question ought to establish the degree to which suppliers believe ISDN and various open communications standards should play a part in their plans.

5.2.2 Methodology for obtaining information

In the case of suppliers it was thought practical to survey the relatively small number of suppliers involved in ODA, and, although it was not possible to establish a good contact with every supplier of interest, the questionnaire was sent to Microsoft, Lotus, Novell and WordPerfect. In addition some information was gleaned from existing market surveys. The results of this exercise are summarised in subclause 5.4.

The position regarding user needs was more complicated and four options were considered as below:

Option A - a direct survey of users with a sample size designed to meet the time constraints imposed by the terms of reference;

Option B - as above but with a sample size designed to meet the requirements for accuracy imposed by other tasks;

Option C - a request for information from ETSI members;

Option D - purchase of market information derived by processing relevant data held by a market research company.

Option A could have been undertaken within the time and cost constraints of producing this ETR but would have suffered from poor accuracy resulting from a small sample size. In view of the fact that the output of task 1 was required as input to the other tasks, any inaccuracy in task 1 would have resulted in increased error in the final ETR. For this reason Option A was rejected.

Option B would have resulted in improved accuracy, but the time taken to conduct a survey of, perhaps, up to 50 users, ruled this option out. The need not to lose time by "re-inventing the wheel", was borne in mind.

Option C would have resulted in the collection of useful information but it should be noted that any survey of ETSI members acting as suppliers or users could have been considered unrepresentative of the market at large; furthermore, any attempt to consolidate market data from ETSI members would have been difficult owing to the different methods and standards in use.

Option D allowed access to high quality market information (OVUM, a market research company in the UK, was chosen) in a timely manner which allowed it to work with confidence to the original timescales.

The data held by Ovum was known to be a superset of that required by ETSI and reflected the European slant of ETSI in addition to providing focus on what will be a global market. The full results obtained from Ovum are given in "Electronic Document Interchange: ODA and ISDN [2]" and these are summarised with a commentary in subclause 5.2.2.

5.3 User needs

5.3.1 Overview of existing systems

5.3.1.1 Does your organisation need to interchange documents within the specified computer applications?

Research conducted by Ovum suggests that there is a need for exchanging documents within a single application and between applications. The demand for these activities is currently similar but trends towards concurrent engineering will increase the demand for exchanging documents between applications in the future. Concurrent engineering is of particular importance to the manufacturing sector as it represents a way by which all concerned with product development can work together efficiently and, in a structured way, to bring new products to the market in the minimum time. It should be noted that concurrent engineering is beginning to find application outside the manufacturing sector in many interesting ways.

In traditional computer applications such as payroll and office automation there is a smaller need to exchange documents outside the application. However, there is evidence that leading edge users of IT will be attempting to build the "computer integrated company" in the future and this will have considerable impact on the need to exchange documents between applications, between different locations of the same organisation and between organisations.

Although some European companies are influenced by US developments, such as the US Department of Defence (DOD) Computer-aided Acquisition and Logistic Support (CALS) programme and may, therefore, be looking at systems using the Standard Generalised Markup Language (SGML) standard, ISO 8879 [17]. The greater awareness of the ODA standard in Europe will probably ensure that it is not dominated by US leadership in certain computer applications.

Finally, EC sponsored initiatives, such as European Nervous System (ENS) - RISE, which seeks to demonstrate open document interchange for European Standards bodies, will stimulate interest in ODA in Europe.

5.3.1.2 What are the three most widely used office software packages in your organisation?

Word processing, Spreadsheets and Electronic Mail headed the list of most widely used software packages in the survey conducted by OVUM. In interpreting this result it should be noted that in large organisations many users will run packages other than those supplied by the IT Department and may also use their own hardware. Any figures obtained by questioning corporate IT or Office Automation managers should therefore be treated with caution. However, this is thought to be more of a problem in US than in Europe where companies normally operate strict procurement policies and where the use of PCs is somewhat less widespread.

As a second point of caution, it should be noted that OVUM did not specifically ask its respondents about graphics packages. However, it is not thought that graphics packages would have featured in the top 3.

5.3.1.3 Can you qualify the problems you met with your office automation system?

The four most commonly cited problems were as follows:

- interchange of documents between different word processing systems;
- using documents created with a previous version of a word processing package;
- upgrading or changing software packages; and
- archival of electronic documents.

The problem of communicating between different word processing packages is somewhat more pronounced in Europe than in the US, which suggests either a stronger requirement for document interchange or less awareness of the possible solutions available. The second and third problems are strongly related and may restrict the uptake of electronic document systems in Europe. The fourth problem of electronic archiving is particularly evident in the insurance and legal sectors where records need to be retained for 25 years or more and where uncertainty over the effectiveness of electronic systems can be an inhibitor on their uptake as total replacements for paper systems.

These problems will be more evident for those companies that purchase office automation products as separate applications than those that purchase products as part of a consistent suite of applications. There is evidence to suggest a growing awareness of these issues, and it is believed that this will lead corporations to bring their office automation policies within their overall IT strategy so that the normal disciplines associated with an IT infrastructure that is critical to the business will be brought to bear on what, for some companies, has been a fragmented part of their IT activities. Taking this point further, it is likely that any IT strategy for handling the problems outlined above will embrace ODA to some degree.

Users are aware of other problems such as the difficulty of integrating different documents in a compound document and of the difficulty in replicating the sender's layout at the receiving end, but for many companies in Europe these are thought to be future problems which do not require a solution today.

An interesting difference between the perception of problems of users who are aware of ODA and those who are not has emerged in the research conducted by OVUM. ODA-aware users perceive the use of documents created with a different version of a word processing package to be a greater problem than the interchange of documents between different word processing systems. By contrast, the reverse is true for users who are not aware of ODA. This may be explained by the general trend to rationalising word processing systems among sophisticated users of office automation whilst the less sophisticated group may still be struggling to work with a variety of word processing packages installed in the same organisation.

5.3.1.4 Who are the three primary suppliers of office software in your organisation?

Research conducted by OVUM reveals that IBM is the dominant supplier of office software in Europe. IBM is followed by Lotus, Microsoft, and Digital who also have significant market shares. It is interesting to note that the American users tend to use a greater range of suppliers than their European counterparts.

5.3.1.5 Who are the prime users of office software?

Precise information is not available on this point. However, it is believed that clerical and administrative staff remain the main users in many organisations. In the manufacturing sector there is evidence to suggest that engineers and other professionals are direct users, and it is generally true that in highly computer literate companies (e.g. IBM) the professional and managerial classes are the main users of office software.

5.3.2 Evaluation of need for production and interchange

5.3.2.1.a In what areas do you see the need for document interchange in your organisation?

OVUM was unable to gain precise information on this point except through in-depth interviews. Of those companies interviewed (which of necessity was a small sample of the total number of survey participants) 80% required document interchange for communications, internal and external to the company, and 20% required the facility for internal communications only. It should be noted that the in-depth interviews were with substantial companies whose use of document interchange is not necessarily typical of companies as a whole. However, it is clear that the trend will be towards internal and external communications if organisations are to introduce new economies associated with the "computer integrated company".

5.3.2.1.b What kinds of documents do you want to interchange electronically (indicate the proportion)?

The following document types are of interest for interchange purposes:

- letters;
- reports (including spreadsheet and text);

- memos;
- technical specifications;
- forms;
- invoices.

Most companies require interchange of reports whilst letters are of great importance to the legal and insurance sectors. It is believed that the potential for interchange of technical specifications is very high and will be driven by developments in concurrent engineering. The interchange of forms is important to those organisations wishing to introduce extra efficiencies in the input of information. The requirement for invoices may be seen as part of an overall EDI requirement.

5.3.2.1.c What kinds of document contents does your organisation want to interchange?

Text, data, graphics, tables, spreadsheets and photographs featured strongly in the respondents replies to OVUM's questionnaire. Voice was not stated as a strong requirement.

5.3.2.1.d When you need to interchange documents what type of information about the contents is involved?

Most organisations want to interchange both structural and layout information. There is, therefore, a strong requirement for viewing and processing interchanged documents.

5.3.2.1.e For interchange purposes, are you prepared to lose structural information?

Generally the answer is no with the government and financial sectors being most definite in their insistence on preserving layout.

5.3.2.1.f Specify frequency of interchange internally and/or externally.

For external and internal interchange there is a strong requirement for daily exchange of information.

5.3.2.1.g When do you think there will be a real need for standardisation of document interchange in your organisation?

50% of European respondents in the OVUM survey believed that the need existed in 1991 and a further 25% believed the need would arise by the end of 1992. The final 25% anticipated the need arising by 1995 or beyond.

5.3.2.1.h Which are the formats you intend to use for interchange/archival of documents?

In Europe more organisations expect to use ODA than any other standard. After ODA respondents cited DCA, and RFT formats. Few European users expect to employ SGML.

5.3.2.1.i For each category of document indicate the percentage of interchange.

Information obtained on this point is plentiful but is considered dubious because of the difficulty respondents may have in understanding the question. Taken at face value the results suggest a high percentage - in many cases 50% or over.

5.3.2.2 What are the organisation's needs for security features when documents are interchanged?

Little data is available on this, reflecting the general difficulty users have in articulating precise security requirements. However, it is clear that there is a general level of awareness and that this will be a key issue in the future.

5.3.2.3 Is there a need to store/retrieve your documents in a standardised format?

As discussed in 5.3.1.3 there is an awareness of the need to store and retrieve documents in a standard format and in the legal and insurance sectors this will be one of the drivers for ODA.

5.3.2.4 Are you going to adopt ODA?

Although most European organisations are still examining their requirements, approximately 30% had decided to adopt ODA in a one to three year time frame. Those that had decided explicitly against ODA had probably done so because of significant investment in a proprietary technology or because of the need to retain compatibility with the US use of SGML.

5.3.2.5 What problems do you expect when installing ODA?

The problems that are expected by European users in descending order of importance are:

- negotiating the right level of interchange;
- training users;
- loss of functionality in converting from proprietary document structures to ODA;
- problem diagnosis;
- deciding final layout of review documents; and
- establishing who should be able to interchange documents.

It is clear from the emphasis given to the problem of negotiating the right level of interchange that users are sceptical of manufacturers' ability to implement ODA in a standard way. They are less concerned that the use of converters to achieve conformance to ODA will introduce loss of functionality.

Operational and administrative issues are in the minds of users and training is regarded as a key issue in Europe at it would be for the introduction of any new technology.

5.3.3 Communication platforms

5.3.3.1 Which kind of computer system does your organisation want to use for document interchange?

If it is accepted that the key driver for ODA lies in the application of workflow management software, then it is clear that PC/LAN technology will dominate the hardware platforms used for ODA. The use of open systems plays a key role in the development of workflow management systems making ODA a natural choice. It is fair to say that the growth of PC/LAN technology has proceeded in step with the acceptance of (LAN) standards such as ISO 8802-3 [62] and ISO 8802-5 [63] and operating system standards such as UNIX.

The growth of workflow software is expected to be considerable over the next few years for the following reasons:

- in a similar way to EDI productivity savings in the office can be achieved;
- it supports the drive for greater quality;
- it is proactive in nature forcing use by otherwise reluctant participants; and
- it is supported by an increasing number of vendors.

An important aspect of workflow management and, additionally, of concurrent engineering, is that they will not only drive the requirement for ODA but will also tend to dominate the communications requirements. Both are processes that require good building communications (i.e. LANs) and inter site communications (i.e. Wide Area Networks(WANs)). They both aim to speed up processes through timely information exchange and are, therefore, capable of driving bandwidth requirements higher than those associated with applications such as conventional electronic mail.

5.3.3.2 What protocol is used for communication within your organisation?

Although precise information on current status is not available, there is considerable information available on migration timescales for such protocols as CCITT Recommendation X.400 [64] and FTAM. This is relevant because of the link between ODA and OSI protocols.

As regards network standards, CCITT Recommendation X.25 [65] is well established and most organisations will be committed to this standard by 1995. It should be noted that Europe leads the US in the application of this standard giving some support to the notion that Europe could lead the US in the application of ODA. Similarly there is an acceptance of the ISO 8802-3 [62] CSMA/CD (Ethernet) standard and most users expect to have LANs of this type in place by 1995. By contrast the ISO 8802-4 [66] Token Bus LAN is less widespread and with the exception of Germany, it is unlikely to be of great significance in European countries. Somewhat surprisingly the ISO 8802-5 [63] Token ring standard is more widespread in Europe than in the US and will remain significant for many years. Enthusiasm for FDDI is strongest in the UK but about 50% of European organisations expect to employ it by 1995.

In connection with application service standards, CCITT Recommendation X.400 [64] is growing in popularity in France and the UK and 50% of European organisations considering OSI expect to use it by 1992. Similarly most users expect to implement FTAM by the end of 1992. Interest in OSI Security Standards is high and most organisations expect to use these by 1995.

Figures for Application Format Standards (of which ODA is one) indicate that about 40% of organisations expect to employ ODA by 1995 with some users expecting to be operational by the end of 1992. Interest in EDIFACT is significant with the highest level of application expected in France (70% by the end of 1992).

5.3.3.3 Which underlying network is used for the communication?

An overview of network termination points (ntps) in Europe (Eurotel'92 from the Eurodata Foundation) suggest that the Public Switched Telephone Network (PSTN) accounts for half of the ntps in use. Removing the leased circuit usage leaves just 12% for public data networks (packet or circuit switched). Of these, the packet switched networks are growing much faster and can be expected to dominate pure circuit switched data networks in the future.

ISDN is growing fast in France (150,000 basic accesses) and Germany (45,000 basic accesses) but progress elsewhere has been modest.

5.3.3.4 Do you already use ISDN in your organisation?

Significant number of organisations in France and Germany are users of ISDN but there remains a degree of scepticism among UK users. In France and Germany users have applied ISDN for graphics and for the transfer of large files. Other applications include leased line back up, computer based training, video conferencing and credit card authorisation.

5.3.3.5 Is there any preferential communication protocol for document interchange?

Information related to this question is discussed in 5.3.2.3. There is general acceptance that most users believe CCITT Recommendation to be X.400 [64] the appropriate protocol for ODA.

5.3.3.6 The following are features of the document transfer. Please rank them as High, Medium or Low priority for your organisation:

Security High;

Low transmission costs High particularly for long distance broadband communications;

Transmission time Medium except for high volume users (e.g. in newspaper publishing) where timely delivery is critical to the business;

Continuous availability believed to be low.

5.3.4 Interactive mode of operation

5.3.4.1 Is there any need in your organisation not only to transfer whole documents between two users but to be able to create, transfer, edit and manipulate parts of documents by groups of users?

There is little precise information on this point but the key is believed to be in the developing applications of concurrent engineering and workflow management. It is believed that these will be significant users of ODA in the next 2 to 3 years.

5.3.4.2 The following are different scenarios of document manipulation in an open environment. Please rank them as High, Medium, or Low priority in your organisation.

There are market surveys available on users of concurrent engineering and workflow management that address this question precisely but from a general understanding of the applications it can be assumed that remote retrieval, remote editing and conferencing are high priority facilities.

5.4 Suppliers

The information contained in this subclause is based on a survey conducted by the Norwegian Telecom Research Department (NTR) and the Norwegian Computing Centre (NCC) "ODA Survey 1990" [37] together with the OVUM survey of the ODA market.

5.4.1 Status of development and marketing products

Suppliers were asked for details of which type of products they were developing and marketing. OVUM found that ODA converters, ODA tool kits and ODIF testers were generally available or would be in the near future. The NTR report "ODA survey" [37] pointed to the development of ODA Editors and suggested that Document Databases and ODA Validation Suites would also be available in the future.

The importance of filters or converters lies in their use to assist document interchange between proprietary formats. Tool kits are required to allow software suppliers to develop linked products. The ODAC Consortium has developed Application Programming Interfaces (APIs) for converting ODIF data streams to the internal formats of proprietary document processors.

The importance of ODA Editors is considered to be difficult and indeed none are available on the market at this time.

The availability of ODA Testers or Validation Suites will greatly assist the move forwards interoperability of ODA products from different vendors.

5.4.2 Preference for profiles

Generally converters and Tester conform to Q112. This was the profile used in an interoperability demonstration in 1990, and, possibly as a result, has gained acceptance. The DAP level API created by ODAC supports FOD11 and FOD26.

5.4.3 ODA extensions/implementation

The NTR/NCC ODA survey [37] revealed that suppliers intend to implement the following extensions to their product in descending order of importance:

- tables;
- spreadsheets;
- data;
- external references;
- colour;
- hypertext;
- mathematics;
- voice;
- video.

5.4.4 Interchange/communications

Suppliers were asked if they were currently marketing or developing products to interchange documents. Suppliers recognise that the success of ODA depends on facilities for interchange in an open environment and the NTR/NCC survey [37] found that the following products were either available or in development:

- X.400 (1984 & 1988);
- File Transfer (FTAM & FTP);
- DTAM;
- Teletex; and
- G4 Facsimile.

5.4.5 ISDN products

No information obtained from suppliers.

5.4.6 Position towards ISDN

No information obtained from suppliers.

5.5 Conclusions

The market survey described in this ETR has provided some valuable information relating to user needs and suppliers, although it is fair to say that is has not been possible to obtain a precise and complete answer to every question raised in the survey. However, the following conclusions can be drawn.

The review of existing office automation systems together with the evaluation of real user needs suggests that there is a pressing requirement for a standard such as ODA. Users are conscious of the difficulties ahead in developing the "computer integrated company" and this is true for document interchange as it is for storage and archival. In both cases users planning substantial investment in a new generation of office automation will need the confidence that new systems will offer a degree of future proofing to protect operations which may be critical to the business.

In general, user concerns about effective interchange and storage will lead them to place office automation strategy firmly in the IT strategy area, and this will lead to strategic solutions based on open systems. ODA will benefit from this, and Europe may well lead US in this connection because of its early involvement in ODA and because of the greater control European IT Departments exercise over PC and LAN procurement. In addition, Europe's leadership role may be enhanced by EC sponsored initiatives, such as RISE which seeks to demonstrate the benefits of open document interchange through ODA for European Standards bodies.

It is thought that key drivers to the growth in the use of ODA will be the use of the relatively new concepts of workflow management and concurrent engineering - including the existing initiatives in CALS. These applications are directly related to the concept of the "computer integrated company" and are essentially proactive thus enforcing use of the systems which are designed to improve productivity and enhance Total Quality Management. An important by-product of these developments will be a further drive towards standardised PC/LAN technology and open systems generally. Thus ODA will fit naturally in the suite of products that will form part of future corporate IT strategies.

Another aspect of workflow management and concurrent engineering, which is relevant to the ISDN focus of this study, is that these new applications are likely to drive the requirement for interactive mode of operation for ODA. In addition, in the case of concurrent engineering in particular, it is likely that a requirement for rapid file transfer will be created.

As an extension of the above, user scenarios for ODA services over ISDN are developing in support Complex Partnerships which aim to profit from the new cross industry application environments.

In examining user attitudes towards communications networks to support document interchange, it is fair to say that most users would expect to use X.400 over X.25 as the main method of networking. However, the advantages of the higher bandwidth of ISDN will become evident as users make significant use of the new type of applications. The drive towards greater automation of work processes through workflow management and concurrent engineering is therefore key to this project. A follow up of the market survey has therefore been conducted, focusing on workflow management and concurrent engineering. The results have been added as Annex B of this ETR. Suppliers are developing useful products in what appears to be a systematic way to support the further growth of ODA. They will need to follow closely user developments of the type outlined above in order to be ready to take advantage of the expanding market.

PART B: Status of standardisation

6 ODA standard

6.1 Overview

The **Open Document Architecture** is the compound (i.e. text, master images and geomatric images) document interchange standard in the open systems world. It defines an abstract architecture that enables interchanging electronic documents between different systems without loss of any content or structure information.

According to the ODA standard, a document can include three categories of information:

1) logical;
2) layout;
3) content.

The first category is the structural information independent from any physical representation of the document itself. The subdivision of a document into chapters, paragraphs and figures is an example of this category.

There are no definitions of "chapter" or "paragraph" in ODA. It defines only **logical objects** and a hierarchical structure (named **logical structure)** upon these objects.

The defined logical objects are:

- logical root;
- composite logical objects;
- basic logical objects.

The second category is the layout structure. It deals with the information needed to properly image the document. This includes the subdivision into page-sets and pages, and the imaging properties of the content, such as size and positioning. This information is also organised in a hierarchical structure called the **layout structure**.

The constituents of this structure are the **layout objects**. The defined layout objects are:

- layout root;
- page-sets;
- pages (either composite or basic pages);
- frames;
- blocks.

The third category of information is the content of the document. The content (text and/or graphics) is structured into constituents called **content portions**. Each content portion contains only one type of content information and may include several attributes related to that part of the content. The current version of the ODA standard supports the use of three types of content in documents. These so called **content architectures** are:

- character (text);
- raster graphics (like facsimile);
- geometric graphics ("vector graphics").

The content portions are linked both to the logical structure (through basic logical objects) and to the layout structure (through blocks or "basic pages").

An example of an ODA document structure is shown in the figure 1 below:

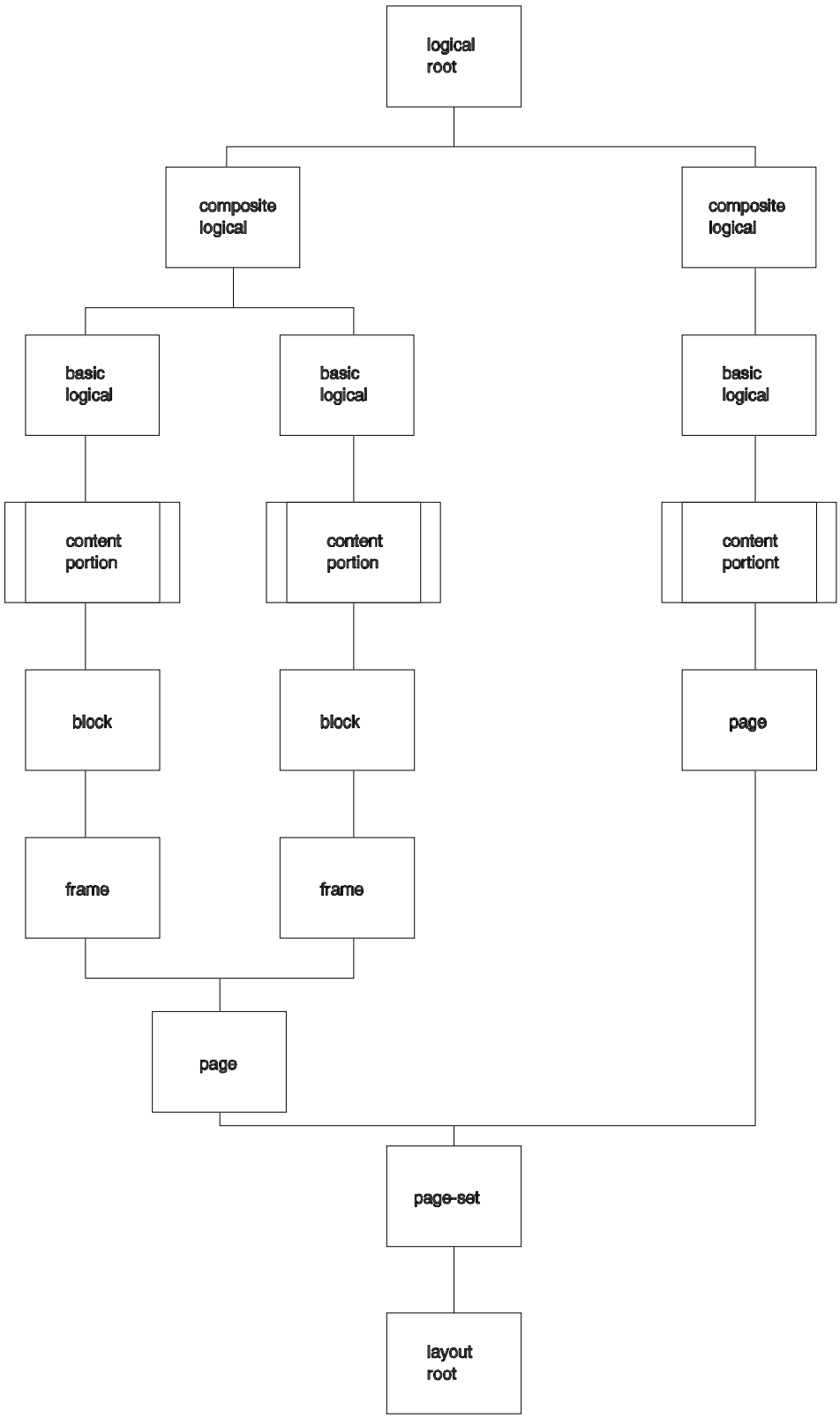


Figure 1: ODA document structures

Each of the constituents of the document structure is described by a set of attributes, e.g. a page is described by its size, orientation, etc...

The ODA standard also contains the concept of generic structure. In the case where several objects have common properties, it is possible to relate these objects to **classes**. For groups of similar logical and/or layout objects, the standard defines the concept of an **object class** as a specification of the set of

properties that are common to it's members. Such object classes constitute a **document class** which specifies the set of properties that are common to a group of similar documents, e.g. letters or reports.

The set of logical and layout object classes associated with a document, is substructured into the so-called generic logical structure and generic layout structure. The structures that are particular to an instantiation of a document are called specific logical structure and specific layout structure.

The attributes associated with the document as a whole (like title, author(s), etc.) are collected in a constituent called **document profile**. Furthermore, the document profile also contains a set of document characteristics, by which a recipient can determine the capabilities needed for processing or imaging the document (e.g. which content types are used in the document). It is possible to interchange only the document profile, in order to determine if the recipient is capable of processing or imaging the document in case only a subset of the ODA standard has been implemented. If not, interchange of the whole document can be aborted.

The ODA standard defines three processes which can be applied to an ODA document:

1) editing process;
2) layout process;
3) imaging process.

The editing process includes creation and modification of a document. It also includes creation/ modification of the generic structures, of the logical structure (according to rules specified in the generic logical structure, if any), and of the contents. The result is a new or modified document, in processable form.

The layout process is concerned with defining a page-oriented organisation for the document content. The specific layout structure is created according to the rules specified in the generic layout structure. The resulting document is either a formatted document or a formatted processable document, depending on whether the recipient is intended to be able to edit the document.

The imaging process produces an image of the document in a human perceptible form, e.g. on paper or on a screen. This process is largely device-dependant.

The standard does not describe the processes in detail, but gives only reference models (i.e. guidelines) for their implementation. In fact, in a particular implementation these processes may run in parallel.

A document can be interchanged in one of the following three forms:

- processable;
- formatted;
- formatted-processable.

When a document is exchanged in **processable** form the recipient can either edit it first or immediately invoke the layout process on it, after which the document can be imaged. When a document is exchanged in **formatted** form the document can be only imaged by the recipient. When exchanged in **formatted-processable** form, all the ODA processes can be applied to the document.

The ODA standard defines two interchange formats: **ODIF** and **ODL**. Both enable the exchange of all ODA structures and constituents, but ODIF is based on ASN.1 (CCITT Recommendation X.208 [56]) and ODL on SGML (ISO 8879 [17]).

ODA does not associate semantics to the objects, e.g. does not define chapters (for logical objects) or columns of text (for layout objects of the type frame). The semantics are usually added by definition of ODA Profiles. These profiles are known as Document Application Profiles (DAPs). DAPs are sets of constraints imposed to the ODA constituents. For example, a DAP defines a chapter as a composed logical object which has as a subordinate a basic object representing the title and one or more composed objects representing paragraphs. DAPs can also put restrictions on the content types allowed in the documents. In this way the DAPs create different levels of functionality within the standard.

6.2 Standardisation bodies

There are two main bodies responsible for the base standard: ISO (ISO/IEC JTC1/SC18/WG 3) and CCITT Study Group (SG) VIII. The base standard currently comprises eight parts as depicted in the following table:

Table 1: ODA base standards

ISO	CCITT	Title
8613-1	T.411	Introduction and general principles
8613-2	T.412	Document structures
8613-4	T.414	Document profile
8613-5	T.415	Open document interchange format
8613-6	T.416	Character content architecture
8613-7	T.417	Raster graphics content architecture
8613-8	T.418	Geometric graphics content architecture
8613-10	not available	Formal specification of ODA (FODA)

There is only one technical difference between the ISO 8613 [7] and the CCITT Recommendations T.400 to T.418 [23] version of the standard: ODL is only included in ISO 8613 [7]. A number of new addenda and amendments have been agreed within ISO and CCITT will be inserted into the new edition of the base standard (1993). They are summarised in the following table:

Table 2: ODA extensions

ISO reference	Title
8613-1/DAM 1	Annex E: Use of MHS to interchange documents conforming to ODA
8613/DAD 1	Addendum 1: Tiled raster graphics
8613/DAM 2.2	Amendment 2: Colour
8613/DAM 5.2	Amendment 5: Streams
8613/DAD 4	Addendum 4: Security
8613-1/DAD 1	Addendum 1: Document Profile Proforma and Notation
8613/DAD 6	Addendum 6: Styles
8613/DAD 3	Addendum 3: Alternate Representation

In addition to ISO and CCITT, there are regional OSI workshops involved in the definition of DAPs. These OSI workshops are: European Workshop for Open Systems (EWOS), Asian-Oceanic Workshop (AOW) and OSI Implementors Workshop (OIW), a subgroup of NIST, USA). The co-ordination between them is performed by the Profile Alignment Group for ODA (POGODA).

In ISO a co-ordination between the developers of ODA and the Document Style Semantics and Specification Language (DSSSL) (a draft standard that adds layout to SGML) will be established. And in EWOS a report on ODA/SGML inter networking has been produced by EWOS Project Team 11.

6.3 Status of ODA profiles

As pointed out in the description of the ODA standard, a number of DAPs have been defined in addition to the standard. The application profiles restrict the base standard to certain levels of use.

The Three ODA profiles defined by these three OSI workshops were also accepted as International Standard Profiles (ISP) by ISO:

- ISO ISP 10610 [11] (**FOD 11**): Simple document structure;
- ISO ISP 11181 [12] (**FOD 26**): Enhanced document structure;
- ISO ISP 11182 [13] (**FOD 36**): Extended document structure.

These profiles are **related hierarchically**, i.e. ISO ISP 10610 [11], FOD11 is a proper subset of ISO ISP 11181 [12], FOD26, which is a subset of ISO ISP 11182 [13], FOD36.

ISO ISP 10610 [11], **FOD11** defines simple documents with plain text and a simple logical structure which divides a document into paragraphs. Layout features allowed by this profile are for instance, recto and verso pages, page headers and footers and automatic page numbering.

ISO ISP 11181 [12], FOD26 defines enhanced document structures. The profile covers most features found in common office word-processing systems. The logical structures allow for example automatic numbering of chapters, paragraphs and footnotes. Furthermore, it supports layout features like multicolumn layout, and raster and geometric graphics content types.

ISO ISP 11182 [13], FOD36 allows documents with more complex structures and features than ISO ISP 11181 [12], FOD26. A typical application of this profile is the exchange of documents produced by "simple" publishing systems. For example the profile includes artworks (composite images consisting of a combination of text, raster and geometric graphics), captions and cross-referencing in documents.

These profiles are now stable, and can be used to base implementations on.

In Europe, **EWOS** has defined two DAPs: ENV 41509 **(Q111)** [14] and ENV 41510 **(Q112)** [15], but they **will be replaced** by the equivalent ISP's (respectively ISO ISP 10610 [11], FOD11 and ISO ISP 11181 [12], FOD26).

In parallel with the new edition of the ODA base standard that will be available in 1993, new versions of the FOD-profiles will be developed (so called FODs version 2). They will include new ODA features like security and colours.

CCITT has defined the following profiles:

- CCITT Recommendation T.501 [47] (**MM**): formatted mixed mode documents;
- CCITT Recommendation T.502 [[25] (**PM11**): character content documents in processable and formatted forms;
- CCITT Recommendation T.503 [32]: DAP for interchange of group 4 facsimile documents;
- CCITT Recommendation T.504 [48]: DAP for videotext inter networking;
- CCITT Recommendation T.505 [26] (**PM26**): mixed content documents in processable and formatted forms.

CCITT Recommendation T.502 [25], PM11 and CCITT Recommendation T.505 [26], PM26 are functionally equivalent to ISO ISP 10610 [11], FOD11 and ISO ISP 11181 [12], FOD26 respectively. They differ from the ISO profiles only with regard to the interchange format (ISO also enables SGML-ODL format) and with regard to conformance (see Clause 7 of this ETR).

The CCITT ODA profile equivalent to ISO ISP 11182 [13], FOD36 (namely PM36), is at present not publicly available.

The CCITT Recommendation T.501 [47] profile allows (formatted) documents with character and raster graphics. It is intended to be used in the Teletex service (CCITT Recommendation F.200) [67].

The CCITT Recommendation T.504 [48] profile allows exchanging formatted Videotex pages between different national Videotex services.

Two new DAPs to exchange images are under development by EWOS. One DAP is intended for exchanging only raster images, the other permits also text and geometric graphics. They will be compatible with ISO ISP 11181 [12], FOD26 and ISO ISP 11182 [13], FOD36.

A new work item for the EWOS Expert Group on ODA is the development of a set of Computer Graphic Metafile (CGM) DAPs. These include definition of CGM profiles for the content part according to ISO 8632-1 PDAM 4 [68] (Amendment 4: Rules for CGM profiles).

All these profiles will be internationally aligned in PAGODA, and then submitted to ISO for approval as ISPs.

6.4 Future extensions

A number of future extensions to the ODA standard are planned or already available as committee draft. ISO and CCITT jointly work on the extensions.

An important extension is the definition of an abstract interface for the manipulation of ODA documents. It is intended to become ISO 8613 [7], part 3. See Clause 9 for more details about this extension.

Furthermore, there exists a second working draft version of ISO 8613 [40], part 9: Audio Content Architecture.

Other important proposed extensions (included in the ISO/IEC/JTC1/SC18 Programme of Work) are:

- tabular structure and tabular layout;
- data in documents;
- hyperODA;
- enhancements to ISO 8613 [7] document structures;
- enhanced Document Layout and Imaging Capabilities.

For data in documents HyperODA committee drafts are available in ISO/IEC JTC1/SC18/WG5.

7 ODA conformance testing

7.1 Overview and status of the art

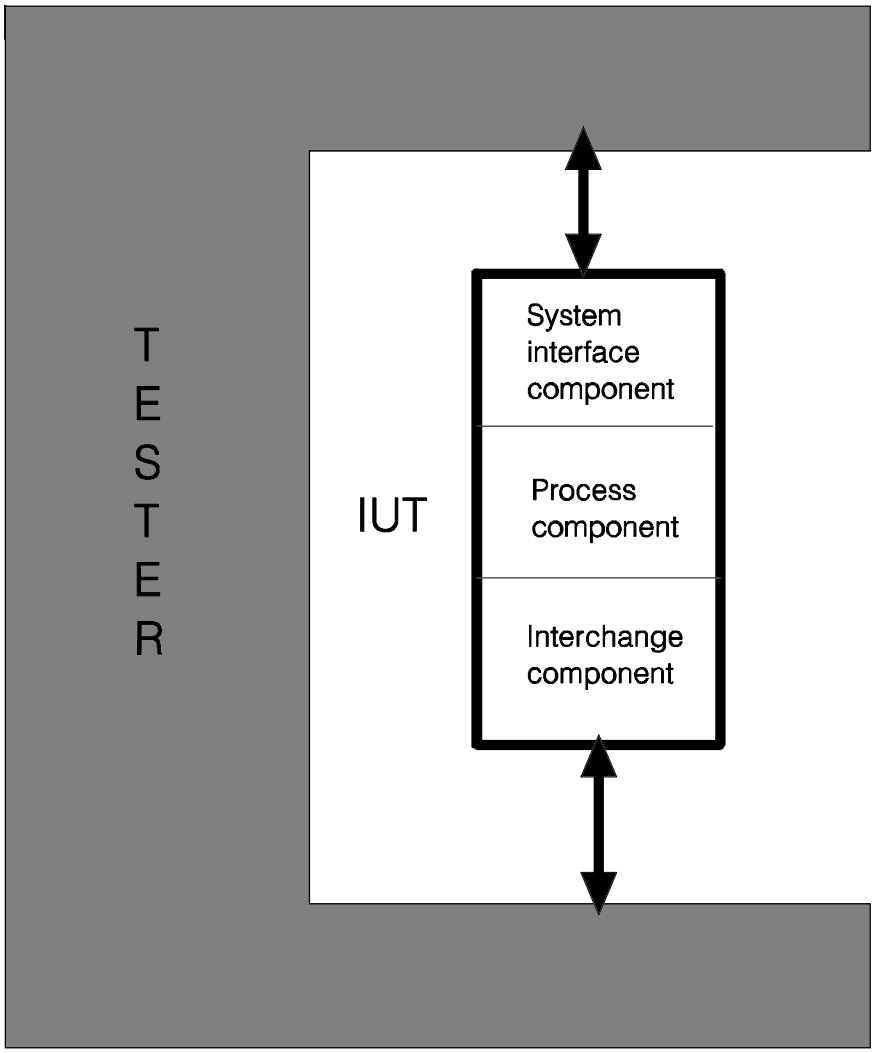
The ODA base standard defines only the **data-stream conformance**, i.e. conformance is checked only on the data streams (ODIF or ODL) produced by the ODA application. This does not guarantee that the application implements correctly the ODA processes and the interoperability with other applications.

To improve the testing of ODA applications, ISO has produced a Technical Report (**ISO TR 10183**) which describes a methodology for ODA Implementation Testing.

This report is subdivided into three parts:

- **Part 1:** Framework for Testing Methodology;
- **Part 2:** Abstract Test Cases;
- **Part 3:** Testing procedures (is currently under development).

The methodology is based on a simple testing architecture as shown in figure 2.



IUT: Implementation Under Test

Figure 2: ODA/ISP based system architecture

In figure 2, the **IUT** (**I**mplementation **U**nder **T**est) is modelled as composing of three parts:

- **system interface component**: it includes the user interface of the application (may be an API), the printout of documents, etc.
- **process component**: it includes all aspects of the application regarding the modification, layout and view transformations on ODA documents, support features, etc..
- **interchange component**: represents the functionality of transferring ODA data streams in and out of the system.

The conformance tester interacts with the interchange and the system interface components. For **reception testing**, it submits ODA data streams, usually based on DAPs, to the IUT; It also checks by the system interface the behaviour of the application (e.g. if the IUT correctly prints the document). In **generation testing** the IUT shall produce valid ODA data streams, usually also based on DAPs. Then the conformance of the produced data stream is checked.

Before his implementation is being tested, any supplier of an ODA application has to claim which DAP-features are supported by the IUT. This is done by filling in the Implementation Requirements Statement Proforma (IRS-P). This proforma lists all the DAP features (like footnotes, running header, automatic page numbering), and shows which of them are supported for reception and generation.

The way of checking each DAPs features is done by the Abstract Test Cases) (ATCs). An ATC specifies all elements needed to check a DAP feature, and a script which describes how the checking must be done and how a verdict is produced. The second part of the ISO Technical Report defines a language to describe ATCs in.

Each ISO DAP will contain the IRS-P and the ATCs needed to check the implementation conformance to the DAP itself. Currently several organisations are involved in the development of these proforma and ATCs: AOW for FOD36 and FOD11, EWOS for FOD26, and PAGODA.

In Europe, EWOS has produced a report (EWOS PTN009) for ODA conformance testing for FOD26. It is subdivided into two parts: a technical guide, that describes the methodology for ODA implementation conformance testing, and the IRS-P for FOD26.

The CCITT Recommendations define Implementation Requirements only for PM11 and PM26. For the other profiles the Implementation Requirements are included in the Terminal Characteristics. The following table shows the relationship between the DAPs and the Terminal Characteristics (including Implementation Requirements).

Table 3: CCITT implementation requirements

CCITT ODA profiles	Implementation Requirements (or Terminal Characteristics)
T.501 (MM)	T.561
T.502 (PM11)	T.512 (NOTE)
T.503 (G4 facsimile documents)	T.563
T.504 (Videotex)	T.564 (gateway characteristics)
T.505 (PM26)	T.515 (NOTE)
NOTE: CCITT Recommendations T.512 and T.515 are not available.	

The main actual problem of implementation conformance testing is that the interoperability between different "conformant" applications is not guaranteed.

The above problem is related to the presence of the "optional" features in the ISR-P. Furthermore the 'boundaries' for conformance are not well defined (e.g. which character fonts will be supported and how, which values are allowed in the CGM content parts, etc.) and fall-back definitions add other interoperability problems (mainly for document reception).

Another problem is that, at the moment in PAGODA there is not an agreement between the regional workshops for a common format of FODs IRS-P.

8 Communication platforms for document interchange and access

Different communication protocols or services exist to transport a document over a wide area network. The existing hardware and software may be described by a heterogeneous landscape. In this ETR only open communication models are regarded which are based on the OSI architecture.

The different communication protocols and services can be divided in four groups:

1) Document Distribution Transfer;

2) End-to-End Document Transfer;

3) Remote Document Access;

4) other Communication Types.

In some cases a document protocol or service may cover more aspects of communication. This will be indicated in the respective communication application.

The first type of communication is most suitable for messaging systems based on the store-and-forward transmission principle, especially in conjunction with multi-addressing.

The second type of communication provides the ability to negotiate the capabilities of the application.

The third type of communication is mainly characterised by filing and retrieval of documents.

All previously mentioned models will be described, especially focused on the status of standardisation and on the parties involved in the standardisation activities.

The final subclause deals with the exchange of ODA documents over ISDN in relation to the communication protocols.

8.1 Document distribution transfer

8.1.1 Message handling systems

Message Handling Systems (MHS) provide for the global transfer of electronic mail between local systems of different design and implementation. Both CCITT and ISO have defined a family of MHS-standards, to provide for standardised exchange of electronic mail between users. These are:

- CCITT X.400 series of Recommendations on MHS, X.400 to X.430 (1984) [29] and X.400 to X.420 (1988) [30];
- Message Oriented Text Interchange System (MOTIS), ISO 10021 [20].

The early versions of the CCITT X.400 series of Recommendations [29] and MOTIS (ISO 10021 [20]) showed a lot of differences between the two standards. Later on, ISO and CCITT agreed upon close co-operation. As a result the latest versions for MHS, the CCITT X.400 to X.420 [30] series of Recommendations and MOTIS, ISO 10021 [20] (the 1988 versions) share almost the same text. The remaining differences are mentioned in an annex to both standards.

The one remaining important difference concerns the backward compatibility of the 1988 version with the CCITT X.400-1984 version of the X.400 series. In the CCITT series of X.400 Recommendations [30] version it is mandatory to also support the 1984-protocol stack to ensure backward compatibility. In the ISO 10021 [20] version this is not the case so that may cause problems, e.g. when an ISO 1988 implementation tries to connect to an CCITT X.400-1984 implementation. Therefore only the CCITT X.400 series of Recommendations will be considered in the rest of the subclause.

8.1.1.1 Principles of MHS

The basic principle of MHS is that a message (all types of data) may be sent to one or more users at a remote place. A message consists of the content which contains the user information to be interchanged and an envelope which contains mainly addressing information.

To be able to send messages, a user has access to the MHS service via his own so called User Agent (UA). Users can write messages, address the envelope(s) and then send them to their own UA. The UA will take over and finally the envelope with the content will arrive at the UA of the receiving party.

For the transport of messages between UAs, the MHS service uses so called Message Transfer Agents (MTAs). A message goes from an UA to the local MTA, which sorts out the addresses and forwards the message to the local MTA of one or more the recipient(s). This principle of forwarding messages is called store and forward.

The 1988 CCITT X.400 series Recommendations [30] also includes the principle of a Message Store (MS). It provides for a message buffer, when a user is temporarily unavailable. When a MS is available UAs do not need to be continuously available anymore. When a recipient UA is unavailable, the MTA sends the message to the MS instead. The MS takes care of final delivery when the UA is reachable again. The MS principle made MHS implementations on PCs (which are not always reachable) much more useful. See also figure 3 for an overview of the 1988 MHS model.

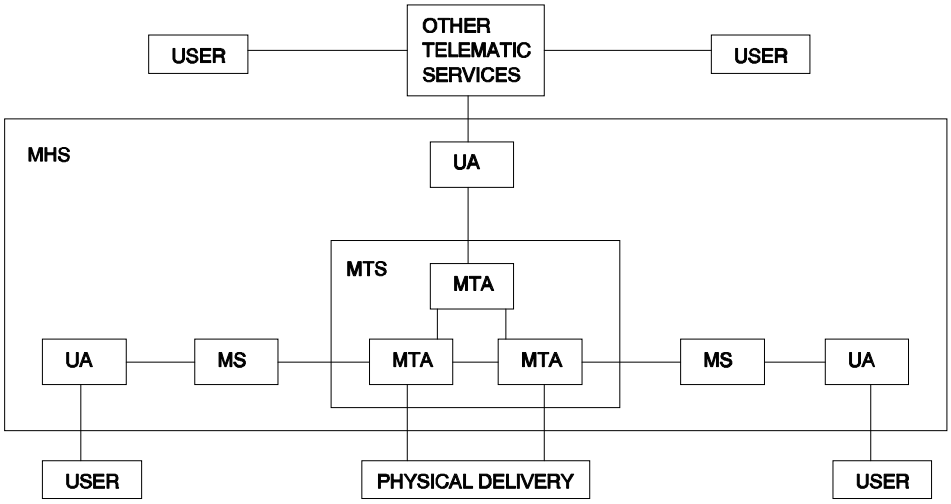


Figure 3: The MHS model according to the 1988 standard

8.1.1.2 The MHS standards

The CCITT MHS standards are defined in the X.400 series. One has to distinguish between the 1984 version [29] and the 1988 version [30]. However, at present, there are still a significant number of MHS implementations that are based on the 1984 version of the standard. The standards are known as:

- CCITT X.400 series of Recommendations on MHS (X.400-430) (Red Book, 1984) [29];
- CCITT X.400 series of Recommendations on MHS (X.400-420) (Blue Book, 1988) [30].

Besides the CCITT X.400 series of Recommendations [30] there is the F.-series on MHS (CCITT Recommendation F.400 to F.422 [38]) giving the functional description of MHS.

The X.400 series of CCITT Recommendations [30] define the already mentioned MHS model (consisting of UAs, MTAs and MSs) and a number of protocols along which communication between the different components of the model takes place. These protocols are:

- P1 protocol for MTA-MTA communication;
- P3 protocol for MTA-UA communication (also MTA-MS in 1988 version);
- P7 protocol for MS-UA communication (1988 standard);
- P2 content protocol for Inter Personal Messaging (IPM) (1984 standard);
- P22 content protocol for IPM (P2 equivalent in 1988 standard);
- P5 protocol for inter working between IPM-service and Teletex.

NOTE: A protocol for user-UA communication has not been defined. Implementors are free to make their own choices on that part.

The 1988 CCITT X.400 series of Recommendations [30] and ISO 10021 [20] form the base MHS standards, now and in the future. New extensions will only be made in the form of enhancements. Both CCITT and ISO are (in close co-operation) working on a number of enhancements, of whom some have already been approved. One important extension deals with enhancements to the security features in MHS.

8.1.1.3 The MHS services

The MHS offers basically two types of services:

- The Message Transfer (MT) Service: The MTS provides the general, application independent store-and-forward message transfer service. The MTS provides the means by which UA's can exchange messages.

- The Interpersonal Messaging (IPM) Service: The Interpersonal Messaging System (IPMS) provides its users (originators and recipients) with services to assist them in communicating with other users. The IPMS comprises the MTS and a specific class of co-operating UA's, IPM UA's.

The users of the IPMS are typically people. The IPMS always makes use of the MTS for the delivery of messages.

8.1.1.4 MHS and ODA

CCITT Recommendation T.411 [23], Annex E, defines how ODA documents can be identified in the P1 and P2 protocols of MHS. However, this only applies to the CCITT '88 standard. In relation to that standard, the Annex defines an ODA identification in P1 for the exchange of information between MTA's about the content of the message being an ODIF data stream, and also to notify which profile(s) have been used. Therefore some ASN.1 object identifiers are defined in the Annex: one for the ODA-document notification, and one or more for the document application profiles to which the message body parts conform.

Comparably, the Annex defines an ODA identification for P2. ODA-conformant documents are identified as ODA extended body parts. Furthermore, each extended body part contains parameter information about the applicable document application profile and document architecture class used.

The conveyance of ODA documents over the CCITT X.400 '84 MHS is described in an informative annex to each document application profile. These annexes define an ODA identification for P2 which is similar to the one defined for the X.400-'88 version. The P1 protocol indicates an ODA document only by a tag.

8.2 End-to-end document transfer

8.2.1 Document Transfer and Manipulation (DTAM)

Document Transfer and Manipulation (DTAM) is defined in the CCITT Recommendations T.430 to T.433 [46] to facilitate the interconnection of telematic systems and terminals. CCITT defines DTAM as the common communication platform for end-to-end telematic applications. It is concerned with document handling facilities in order to realise document bulk transfer, document manipulation, document access and document management between application processes.

DTAM is developed as a full OSI-protocol stack and currently organised as only one Application Service Element (ASE) in the application layer of the ISO/OSI model. DTAM makes use of other ASEs like Application Control Service Element (ACSE) (see CCITT Recommendation X.217 [34] and X.227 [35]) and, optionally, Reliable Transfer Service Element (RTSE) (see CCITT Recommendations X.218 [52] and X.228 [53]) and Remote Operations Service Element (ROSE) (see CCITT Recommendations X.219 [54] and X.229 [55]).

The intention of DTAM is to provide a uniform communication platform for telematic services. Different telematic services activate a special communication profile according to their needs. Multifunctional terminals (e.g. PCs) will then be able to support different telematic services in one terminal.

8.2.1.1 DTAM Standards

The CCITT T.430 series of Recommendations [46] consists of three components:

- T.431: "Document Transfer and Manipulation (DTAM): - Services and protocols - introduction and general principles";
- T.432: "Document Transfer and Manipulation (DTAM): - Services and protocols - service definitions";
- T.433: "Document Transfer and Manipulation (DTAM): - Services and protocols - protocol specifications".

All three above mentioned recommendations have been revised since their publication in the 1988 Blue Books. The revised versions have been passed during the CCITT meeting in Geneva in March 1992. They can now be seen as stable recommendations.

8.2.1.2 DTAM service classes

The DTAM service consists of functional units that define the characteristics of the DTAM service. A service class in the CCITT Recommendation T.431 [46] defines which functional units are mandatory and which are optional in each service class. The following service classes are defined:

1) document bulk transfer;
2) document manipulation;
3) document bulk transfer and manipulation.

Document bulk transfer applications transmit a document as a whole from one system (terminal) to another system (terminal). DTAM provides besides the establishment and release of an association the option to prepare a transfer (with D-CAPABILITY service), that allows to indicate which type of information (FOD11, FOD26 etc.) will be transferred next. The bulk-transfer of the document is realised by the D-TRANSFER service.

In a Document Manipulation Class parts of a document may be transferred to generate a whole document sequentially, concatenating parts stored in different resources. For document manipulation the following unconfirmed services are standardised: Create, Delete and Modify. Further services (document confirmed manipulation, remote document access and remote document management) are currently being considered in the standardisation committees. For these services a CCITT working draft "Enhanced Manipulation Functions" [28] already exists. This service class makes use of ROSE (refer to CCITT Recommendations X.219 [54] and X.229 [55]).

A document bulk transfer and manipulation class consists of a combination of the above mentioned service classes.

8.2.1.3 Communication Application Profiles (CAPs)

In the CCITT T.520 series of Recommendations different CAPs are defined in order to apply CCITT T.430 series of Recommendations [46] to various telematic applications. An application profile fixes a service class, where some optional functional units are classified as mandatory, optional or unused. Two CAPs describe a document bulk transfer where a document is transferred from one system to another system in an end-to-end communication:

- CCITT Recommendation T.521 [49] specifies a document bulk transfer which makes direct use of the session service according to the rules defined in CCITT Recommendation T.62 bis [51]. In this profile DTAM protocol elements are directly mapped to the session layer (see CCITT Recommendation X.215 [59] and X.225 [60]). This mode of bulk transfer is called transparent mode and is used only for facsimile Group 4 applications at the moment (see figure 4).

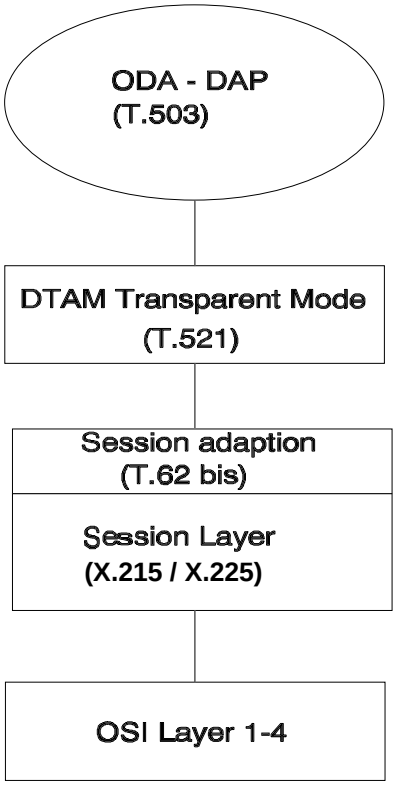


Figure 4: DTAM transparent mode

- CCITT Recommendation T.522 [50] specifies a document bulk transfer which uses a X.200 environment (RTSE, ACSE and presentation service). This mode of document bulk transfer is called normal mode (see figure 5). The documents transferred may be ODA documents or files according to Draft CCITT Recommendation T.434 (BFT) [27].

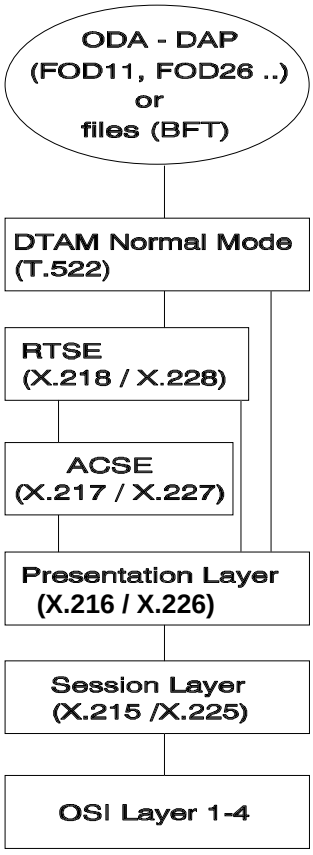


Figure 5: DTAM normal mode

Both recommendations have been revised and the revised recommendations have been approved during the CCITT meeting in Geneva in March 1992.

8.2.1.4 DTAM and ODA

The DTAM bulk transfer supports the transmission of ODA documents as well as files encoded according to the Draft CCITT Recommendation T.434, Binary File Transfer Protocol for the Telematic Services [27]. DTAM fits very well in the Distributed Office application Model (DOAM) (see ISO 10031 [18]), especially with Document Filing and Retrieval (DFR) (see ISO 1066 [39]). While DFR handles a whole document, DTAM deals with the inner manipulation of an ODA document so that both standards are complementary. This characteristic is used to standardise remote manipulation of ODA-documents (see Clause 9).

DTAM provides the mechanism to negotiate characteristics of the terminals and exchanged documents between sender and receiver which is typical for an end-to-end communication. This includes the negotiation of the DAP, the document architecture class (only in the DTAM transparent mode) and non-basic document characteristics. This ensures that the document shall only be transmitted if the receiver is able to deal with the received document.

8.2.2 Facsimile

CCITT Recommendation T.0 [28] "Classification of facsimile apparatus for document transmission over the public networks" distinguishes between two different kinds of applications:

Terminal for use over public telephone network:

Group 3 (CCITT Recommendations T.4 [21] and T.30 [24]).

Terminal for use over public data network:

Group 4 (CCITT Recommendations T.6 [22], T.503 [32], T.521 [49], T.563 [33]).

The standards of both Facsimile terminals are passed and provide the ability to transmit and reproduce image coded information.

Group 3 facsimile is the non-OSI approach for the Telefax service. CCITT Recommendations T.30 [24] describes the procedures and signals to be used where facsimile equipments are operated over the general switched telephone network. CCITT Recommendation T.4 [21] defines the coding scheme for Group 3 facsimile.

In contrast to Group 3 facsimile, Group 4 facsimile uses OSI protocols namely the DTAM transparent mode and the document application profile of CCITT Recommendation T.503 [32]. The DAP defined in CCITT Recommendation T.503 [32] allows the transfer of the complete layout of a document. Only raster graphics content is allowed in this profile.

CCITT Recommendation T.6 [22] defines the facsimile coding schemes and their control functions to be used in the Group 4 facsimile. CCITT Recommendation T.563 [33] defines the terminal characteristics for Group 4 facsimile apparatus.

From a standardisation point of view, at the moment Group 3 facsimile terminals can only be seen in conjunction with the Public Switched Telephone Network (PSTN). Nevertheless, Group 3 Facsimile Terminals can be connected to the ISDN via a terminal adaptor.

Beside this, CCITT is considering to adapt Group 3 facsimile to ISDN without using a terminal adaptor, but the topic is very controversial and a decision may not be taken in the near future.

Group 4 facsimile terminals are intended to be used over the ISDN network.

8.2.2.1 Facsimile and ODA

Dedicated facsimile terminals (Group 3 and Group 4) are not able to transfer processable ODA documents. Nevertheless computerised facsimile terminals (CCITT Recommendation T.4 [21] makes a reference to "soft copy machines") could use the facsimile service as a carrier of document transfer.

The Group 4 facsimile service uses the DTAM transparent mode to transfer formatted ODA documents. This communication protocol also supports a simple file transfer, a file transfer according to draft CCITT Recommendation T.434 [27]. However, the Group 4 facsimile service does not support simple file transfer. It seems not to be very conclusive to extend the terminal characteristics of Group 4 facsimile to misuse this existing ODA application for a file transfer. Also using this option of the DTAM protocol in the facsimile service does not enable the sender and receiver of the document to negotiate the document characteristics.

For computerised Group 3 facsimile terminals value added features have been defined to allow file transfer over PSTN. CCITT Recommendation T.30 [24] has been extended in order to support a simple file transfer according to draft CCITT Recommendation T.434 [27] and the transfer of FOD26 documents.

8.3 Remote document access

8.3.1 FTAM

The File Transfer, Access and Management standard (FTAM) is an ISO standard only, known as ISO 8571 [19] or the OSI file service. FTAM is derived from the data communication and has been developed to allow users to get access to a remote filestore.

FTAM is mainly concerned with the access and management of files stored in a virtual filestore. A virtual filestore is an abstract model for describing files and filestores, where a filestore is a collection of files residing at a particular open system. Besides this, FTAM enables the transfer of a file from one system to a remote system.

The management and access of files is controlled by the use of attributes which describe the characteristics of a file. Several services are offered by FTAM to transfer, access and manipulate files (write, read, copy, send data, etc.).

8.3.1.1 The FTAM standard

ISO 8571 [19] is mainly built up out of four parts:

- Part 1 - General description: this part provides a general introduction to the concepts and mechanisms of FTAM;

- Part 2 - Virtual Filestore Definition;

- Part 3 - File service definition: defines in an abstract way the externally visible FTAM service within the OSI Application Layer;

- Part 4 - File Protocol Specification.

Several addenda have been added.

Figure 6 gives an example of how FTAM is used:

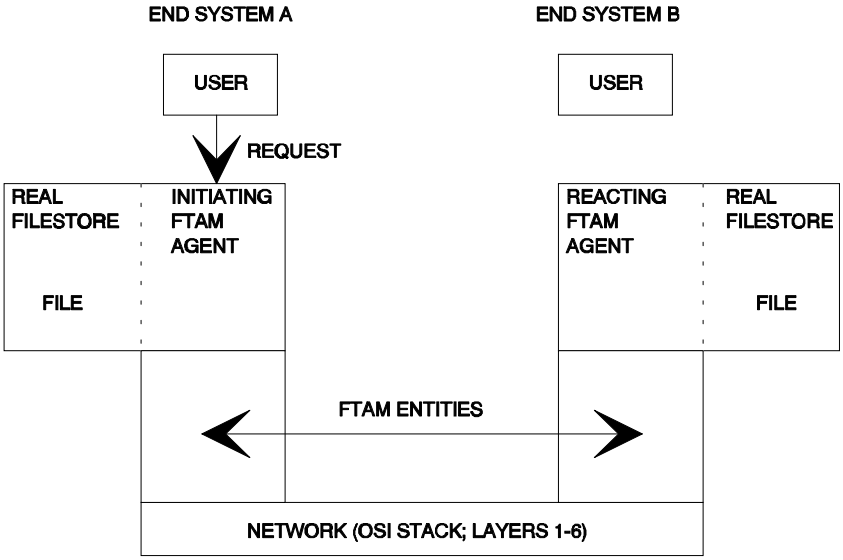


Figure 6: Usage of FTAM

Following figure 6 above, a user requests the transfer of a file from another filestore to his filestore. The request is forwarded to his FTAM Agent. This FTAM Agent identifies through the FTAM service the right file in the other filestore. In the next step, the reacting FTAM Agent at the other site also identifies the file asked for. Then the initiating FTAM Agent forwards the request for the actual transfer. The transfer takes place and finally the requesting user is informed about the result. The FTAM protocol uses the virtual filestore concept. At the site of the reacting Agent the virtual filestore is mapped onto the real filestore in order to establish the transfer of the real file.

8.3.1.2 FTAM and ODA

For remote access and management FTAM treats ODA documents as any other files or documents. The management attributes that are contained in the document profile of an ODA document cannot be used by FTAM.

FTAM can be used to transfer ODA documents. When FTAM is used for that purpose, the ISO 8571 [19] Part 3 "FTAM unstructured binary" document type may be specified. In this way the whole ODA data stream is contained in the binary file that is transferred. However, files which do not contain ODA data streams can also be transferred using the same document type. This means that it is left up to the user who receives the file to know that the file contains an ODA data stream. The same applies for the Document Application Profile the data stream conforms to. Currently the EWOS EG FT (the expert group on FTAM) is looking at two possible extensions on the FTAM standard to meet this problem. The first possibility lies in defining an ODA specific unstructured binary document type within the FTAM standard. It will be basically the same as the ISO 8571 [19], Part 3 document type, with the difference that it is meant for transfer of ODA data streams only. The other option is to define within the FTAM standard a more hierarchically structured document type for ODA , thus permitting access to the substructure of the ODA stream. In that case it will also be possible to determine the DAP-level(s) being supported by the datastream.

8.3.2 DFR

ISO 10166 [39] Document Filing and Retrieval (DFR) application provides the capability for large capacity non-volatile document storage to multiple users in a distributed office system. This facility is particularly useful in an environment where a large population of desktop workstations that have limited storage capacity require access to large expensive storage devices. DFR is concentrating on filing and retrieval of documents and not on all types of filestore.

ISO 10166 [39] is a component of the Distributed Office Application Model (DOAM).The DFR resides in the application layer of the ISO Reference Model as a distributed application. For the protocol definition the application service elements ACSE, ROSE and, optionally, RTSE are used.

8.3.2.1 Information model

The information model is defined in the form of a structured DFR-Document Store. A document store represents a collection of documents, which may be hierarchically structured. A document store provides specified objects which may be selected for user operations.

The smallest information objects in a document store are documents, which may be collected in DFR-Groups. A DFR-document consists of attributes and content. The attributes are defined for the qualification and description of specified characteristics of a document and its use. The content consists of the information currently contained within a document.

DFR-Groups consist of identifiable collections of information objects which may be manipulated as logical units. DFR-References permit a document or group of documents to belong to several groups a the same time without the necessity of maintaining copies. DFR supports management of different versions of a document, including such concepts as "previous version", "next version" and "last version". The security mechanisms "authentication" and "access authorisation" are addressed by DFR.

8.3.2.2 Operational model

The operational model defines the operations that are performed within a DFR-Document-Store.

The operations Create, Delete, Copy and Move support the structuring of the document store.

The Search-operation uses the attribute values of DFR-Entries in the store and the search criteria specified to create a result list that can be stored as DFR-Search-Result-List and/or enumerated with List-operation.

The Reserve-operation specifies a "reservation level" for a DFR-Entry (DFR-Group, DFR-Document etc.) which defines "read" and "write" access of a DFR-Entry.

8.3.2.3 DFR and ODA

As mentioned, DFR-Documents consist of attributes and content. DFR supports two sets of attributes: the DFR-Basic-Attribute-Set which is mandatory for any DFR and the DFR-Extension-Attribute-Set which is optional.

A subset of attributes of the ODA Document Profile can be mapped to the DFR-Attribute which is mainly the DFR-Extension-Attribute-Set. Therefore, the DFR protocol is well aligned with ODA to fulfil a Filing and Retrieval service.

8.4 Other communication types

8.4.1 MHS/DTAM inter working

Inter working between the DTAM Bulk-Transfer (Normal Mode) and the Message Handling Systems enables an user of DTAM to participate in the Interpersonal Messaging Service (IPMS). This interworking is only possible for the 1988 version of CCITT X.400 [30] MHS.

The principles of inter working between telematic terminals and MHS are defined in CCITT Recommendation T.30 [24]. Interworking between DTAM Bulk-Transfer and MHS is defined in the revised draft CCITT Recommendation T.33x [42].

Both DTAM and MHS use the same underlying communication protocols which are ACSE and RTSE. Therefore the differences between the two different applications are reduced to a minimum. If this standard is finalised, users of the DTAM service will be able to use the interpersonal messaging system. This enlarges the possibilities to transmit documents not only in a end-to-end communication (DTAM), but to use the same telematic service in a store-and-forward message system (MHS).

8.5 ODA document exchange over ISDN

It is obvious that ISDN will be the most convenient transport medium for the interchange of mixed content ODA documents reflecting the aspects of transmission time and related charges. In subclauses 8.5.1 to

8.5.3, ISDN will be compared with the relevant communication protocols that have been identified to be suitable for ODA document transfer, access, filing and retrieval.

8.5.1 MHS over ISDN

ISDN is an end-to-end connection on network level. This connection does not correspond to the virtual connection between UAs in the MHS environment. ISDN can only be used as an end-to-end connection between two MTAs. Because of the store-and-forward principle of MHS (several MTAs are sequentially involved in a MHS connection) in general no ISDN end-to-end connection can be established between sender and receiver. Therefore MHS and ISDN are not directly related.

However, as transmission of ODA documents often implies high transmission times over PSPDN, it may be recommended to use ISDN for the MTA-MTA connections.

8.5.2 DTAM over ISDN

DTAM bulk-transfer (see figure 5) supports the exchange of documents and/or files in end-to-end (PC-to-PC) communication which corresponds to ISDN. DTAM has been standardised as a protocol that supports ISDN-based applications like the ODA CCITT Recommendation T.502 [25] processable mode PM1, CCITT Recommendation T.501 [47] Mixed Mode and CCITT Recommendation T.503 [32] Group 4 facsimile. A service identifier in the D-channel indicates the teleservice making use of ISDN (ETS 300 112 [41] and ETS 300 081 [43]).

Therefore DTAM is very well suited to ISDN.

8.5.3 FTAM and DFR over ISDN

FTAM and DFR have been designed independently of network aspects. Currently FTAM and DFR products are mostly running over PSPDN but future filing and retrieval seem even more promising over ISDN. Both FTAM and DFR are end-to-end protocols. Therefore they both interwork very well with ISDN.

The same is true for the combined inner manipulation/filing and retrieval of ODA documents via DTAM/DFR which has been identified as most suitable for this kind of application (see Clause 9). A promising realisation (acceptable for the user in terms of response times) can only be established over an ISDN end-to-end connection.

9 Remote manipulation of ODA documents

Up to now only standardisation activities have been described that deal with the interchange of complete ODA documents. If documents are stored in different environments connected by a network the requirement for remote manipulation of documents arises. This implies that in some cases there is a need to manipulate a remote document (or part of it) without having to interchange the whole document.

The following subclauses give an overview about the current work on standardisation.

9.1 Status of standardisation

Remote manipulation of ODA-documents is a very new study area within standardisation bodies from ISO and CCITT. Currently the following bodies are performing work on the subject:

- ISO/IEC JTC1/SC 18/WG 3: This Working Group is preparing future versions of the base standard, ISO 8613 [7]. A new part (part 3) of ISO 8613 [7] will be the Abstract Interface for Manipulation of ODA documents;

- CCITT SG VIII, Q27: One task of Q27 is the definition of a new part of the CCITT T.410 series of Recommendations, the series, containing the ODA standard version of CCITT. The new part will be the same as the new part of ISO 8613 [7], the Abstract Interface for Manipulation of ODA documents. Besides that, Q27 also deals with the joint provision for document filing, retrieval and inner document manipulation (DFR & DTAM), in liaison with ISO/IEC JTC1/SC 18/WG 4;

- ISO IEC/JTC1/SC 18/WG 4: See above, they are working on the joint provision for DFR and DTAM in liaison with CCITT SG VIII, Q27. WG 4 puts effort in to this issue as it forms a part of their work on defining the Distributed Office Architecture Model (DOAM);

- CCITT SG VIII, Q26: this sub-group is defining a new study Question on Co-operative Document Handling (CDH);

- CCITT SG I: this study group looks, among other tasks, at Service Extensions on collaborative/interactive handling of ODA documents.

9.2 Abstract interface for manipulation of ODA documents

One of the main new activities that are currently taking place in the field of remote manipulation of ODA documents is the definition of the Abstract Interface for Manipulation of ODA Documents. In this context the Abstract Interface is independent of the communication mechanism. It only provides application programmers with functions that are applicable to parts of ODA documents, to facilitate the remote manipulation of ODA documents. In fact, general operations like Get (to request the transfer of selected ODA constituents), Search (to find specific information) etc. are defined to manipulate ODA documents.

9.3 Co-operative document handling

The other major new activity is the new CCITT study Question on Co-operative Document Handling (CDH). The reason for defining the new Question is the appearance of new applications allowing for groups of users to process documents in a co-operative way. Work on the basic components is already underway. The basic components consist of the Abstract Interface and the communication support for document manipulation together with the ODA DAPs. In the case of interactive communication, the combination of DFR and DTAM is supported. In this context the scope of DTAM Manipulation is to manipulate parts of documents such as paragraphs and figures. DFR on the other hand is in charge of manipulating the document as a whole, for example document creation or deletion.

The main objective of the new Question is for CCITT to offer one standardised solution to perform the new co-operative document processing applications. This objective is being met by combining the existing (draft) Recommendations on the basic components and studying necessary extensions in order to meet the DH requirements.

Work on DH only started very recently. Final deliverables are not expected before 1994. The expected results with their target dates are:

- Specification of the documents to be handled by CDH (1994);

- Specification of the communication platform (1994);

- Complete specification of CDH (1996).

It is to be noticed that the definition of the appropriate communication platform for CDH shall not only include end-to-end interactive communications (DTAM/DFR) but store and forward asynchronous communication as well. Therefore, a liaison/collaboration with CCITT SG VII (X.400 group communication, etc.) has been foreseen. Other liaisons are with CCITT SG I and ISO IEC/JTC1/SC 18/WG 4.

PART C: Analysis of requirements and overview of products

10 User needs

This Clause analyses the user needs as obtained from the market survey, highlighting their expectations for:

- **Production and interchange of documents** both within and between different application environments such as office automation, manufacturing, financial accounting, etc. Therefore, this study will not only take into account the office automation environment which is the conventional application environment in the scope of ODA. The main features of the documents that users want to interchange will be analysed and the DAPs which meet the requirements will be deduced;

- **Communication platforms for document interchange**. The most used computer systems and communication means within organisations are identified. From that, and from interchange needs, the required communication platforms will be deduced.

Attention is paid to the emerging concepts of **concurrent engineering and workflow management** which will create a need for **remote manipulation of documents**. Groups of user will be able to create, transfer, edit and manipulate documents or parts of documents remotely and in co-operation with each other. The concepts of concurrent engineering and workflow management are described in detail in Annex B.

10.1 Production and interchange of documents

The number of electronically produced documents is proliferating in user organisations. In the early days of office automation, users were promised that electronic documents would very soon replace paper documents, the so-called "paperless office". This concept quickly fell into disrepute. There were two reasons why documents were printed out before circulation, thus generating more paper rather than less:

- because a satisfactory electronic means of interchanging documents was lacking;
- because most organisations have a paper-oriented culture in place.

Nowadays, the office automation systems are more powerful and, in addition, the communication means are more adapted to the user's requirements. Moreover, communication networks such as X.400 provide a basic desk-to-desk communication service which can be used to deliver documents electronically with little effort. Therefore the interchange of documents in electronic form has strongly improved.

The following subclauses analyse the user needs taking into account the results from the OVUM report [1] and Clause 5 addressing the market survey. The number of interviewed companies is 68: 40 from Europe and 28 from the US. The study takes into account US companies because they influence the European market and also some of them have plants in Europe.

10.1.1 Features of interchanged documents

Most of the interviewed companies see an urgent need for standardised document interchange both within their organisation and to the outside world. This subclause deals with features of interchanged documents and which types of documents are interchanged, which content types do they contain and between, or within, which environment(s) the interchange takes place.

10.1.1.1 Application environments

The study takes into account not only the applications in the area of office automation but also those relating to other application environments such as manufacturing, financial accounting, etc. So, the scope of ODA is extended to non-conventional application environments in which ODA may play an important role for document interchange.

The survey results highlighted a number of application environments in which standardised document interchange plays a role. These environments are classified in a descending order of importance, as indicated by the users in relation to the need they see for document interchange in the specified environments:

- office automation;
- financial accounting;
- payroll/personnel;
- customer transaction;
- order processing;
- CAD;
- stock control;
- production planning;
- manufacturing;
- reservations.

The results highlight the **important need for document interchange in the office automation environment**. This is not surprising because office automation is usually the conventional application environment identified as being relevant to ODA, and, in addition, it is the most widespread application in all the industry sectors.

Nevertheless, even if ODA is born in the office environment, this standard is now getting open to other application environments. The previous classification shows for example that users see the **financial accounting** environment as another environment with an important need for standardised document interchange. In fact, there is a high amount of documents interchanged in financial accounting applications across all industry sectors.

According to the information available, the need for document interchange can be evaluated in two directions. The first one is within an application environment, the second one is between application environments.

10.1.1.1a Interchange within an application environment

This means that, for example, within the office automation environment there is a need for interchange of documents between heterogeneous word processing systems and also there may be a need for integration of parts of documents produced by different heterogeneous office automation systems.

An overview of the existing office automation systems used in most organisations shows that **word processing, spreadsheets, electronic mail and databases** are the most widely used software packages, usually on PCs. Taking into account the fact that PCs are spread throughout the organisation (many differing local sites), there is more scope for users to choose their own software packages in all those local environments. Consequently, problems may occur when documents are interchanged because of the heterogeneous software environments. These problems are stated in subclause 10.1.2.

10.1.1.1b Interchange between different application environments

This means for example that within an organisation documents are interchanged between the financial environment and other environments like office automation, payroll/personnel and customer transactions. Moreover, documents can also be interchanged between different environments of different organisations.

However, the information available from the survey on this topic has to be used with care because most of the interviewed companies could not respond clearly to the questions addressing it. It is important to notice that interchange of documents between application environments is close to the emerging concept of concurrent engineering. See the definition in Clause 3 and Annex B for more details about concurrent engineering and it's relation to document interchange.

10.1.1.1c Internal/external exchange

As mentioned before, document interchange is needed **internally** within the organisation and also **externally** with other companies. It depends on the kind of applications involved. For both internal and external interchange there is a strong requirement for a **daily exchange** of information.

10.1.1.2 Documents types and contents

Taking into account the different application environments as described in the above subclauses, the documents produced and interchanged in these environments are of different types. The following

classification shows a number of types of documents users want to interchange in descending order of importance:

- letters;
- reports;
- memos;
- forms;
- technical specifications;
- invoices.

10.1.1.2a Letters, memos

The results highlight the important need for the interchange of letters, which is not surprising because, usually, letters are the most used documents within organisations. Memos are also often used.

Most of the time letters and memos do not need to be reprocessed by the recipient. That means they can be interchanged as formatted documents. They often have a fixed non-changeable structure, only containing text and the logo of the company. Sometimes they may contain drawings.

Nowadays, letters and memos are mostly interchanged by facsimile or by mail, but as communication networks such as X.400 become widely available, it will allow for electronic interchange of these documents. Especially for letters, insurance companies and legal and services organisations have an additional need for security and authentication when they exchange those documents. Therefore these capabilities shall also be provided when letters are interchanged electronically.

10.1.1.2b Reports

There is also an important need for the interchange of reports. Reports are often reprocessed by the recipient. That means they must be interchanged as formatted and processable documents, which allows for modification. Depending on the document, the structure may be complex. Reports may, for example, be documents with footnotes, automatic numbering of Clauses and subclauses, multicolumns and so on.

Reports usually contain text, drawings and logos. Moreover they may be more complex, containing additional kinds of content like spreadsheet data, other data, photos and charts. Reports become more and more multimedia, as they may, in the near future, contain voice or even video as well.

10.1.1.2c Forms

Forms are used in application environments such as stock control, reservations, payroll/personnel and also more generally by service organisations who want, for example, to streamline the input of information.

Forms have a simple logical structure which describes the different possibilities to fill in the form, this structure is usually fixed. On the other hand, the layout structure is more complex but stable for a specific form. Forms may contain text, a logo and drawings. The content type is mainly data.

10.1.1.2d Technical specifications

Technical specifications are the most sophisticated type of documents because, mostly, they require advanced types of content. They may include product descriptions, molecular models, 2D and 3D CAD drawings and engineering and manufacturing data. Most of the manufacturing companies produce documents with these requirements. Some of them foresee the potential for multimedia product specifications in documents that can be retrieved electronically by customers.

Technical specifications are usually interchanged in formatted processable mode. Their structures are usually complex. As explained above, any kind of content type may be used, in particular advanced content types such as data, complex formulae and more dimensional drawings. Sometimes there is an additional need for security when interchanging technical specifications.

10.1.1.2e Invoices

This is the most simple type of document with usually only text. Often security is needed during interchange.

The ability to transfer documents in processable mode, so they can be reprocessed by the recipient, is seen as a key requirement for users over the next five years. In fact, formatted and processable documents with mixed contents represent a growing demand, but the level of interchange is low because of the lack of products. It may be expected that in the near future this level of interchange will increase when the appropriate tools will become available.

In addition, there is a need for **security and authentication** for letters, invoices and sometimes for technical specifications.

Furthermore, the results highlight the need for advanced content types in documents, varying from spreadsheet data to complex CAD drawings. Leading-edge users are already anticipating at the arrival of real multimedia documents, possibly including voice and full motion video.

10.1.1.3 Content types

From the above, users want to incorporate a lot of different content types in documents to be interchanged. They classify the need for specific content types in documents in descending order of importance as following:

- text;
- data;
- spreadsheets;
- logos;
- photos/charts;
- drawings;
- formulae;
- colour;
- multimedia.

Users were not asked what they understood by data. It can be assumed that data means data to be incorporated in forms or order processing documents, like EDI-data.

10.1.1.4 ODA extension priorities

The Ovum report [1] highlights the ODA extension priorities as ranked by the users. It follows that:

- security extensions came out as the top priority. This user requirement is now covered by one addendum to ISO 8613 [7] (see subclause 6.2);

- support for tables and list generation, data in documents and spreadsheet data are also of high priority;

- there is also a need for business graphics, but this is less urgent;

- support for colour, voice and hypertext were regarded as of lower priority.

10.1.1.5 The document application profiles

Table 4 below makes a link between the document types as described above and the DAPs which meet the requirements.

Table 4: Link between the document types and the DAPs required

Kind of Document	DAP	Comments
Letters	**FOD 11** **FOD 26**	Both the logical and the layout structures are simple. Usually, formatted document. Security and authentication are requested.
Memos	**FOD11** **FOD 26**	Mostly simple formatted document, so FOD 11. Sometimes, more complex structure.
Reports	**FOD 26** **FOD 36**	May have a complex structure, depending on the reports. Security and new content types (see subclause 10.1.1.3) are requested.
Forms	**FOD 26**	Simple and fixed Logical structure. Complex but quite stable layout structure. New content types (see subclause 10.1.1.3) are requested.
Technical specifications	**FOD 26** **FOD 36**	Most sophisticated structure with an additional need of content types like Data, Formulae and Multimedia.
Invoices	**FOD 11**	The most simple document type.

10.1.2 Problems identified

10.1.2.1 Problems with office automation systems

The most significant problems users have with their office automation systems are the following:

- Interchange of documents between different word processing systems.
  The use of ODA as an interchange format will solve this problem, if interoperability is guaranteed between different ODA products.

- Upgrading to new versions of office automation packages.
  This problem is close to the previous one because upgrading may often be considered as a change of package.

A smaller proportion of users identified **archival of documents** as a problem because of the long term storage and retrieval aspects. The perception of this problem relies upon the industry sector. For example, insurance and law firms are highly concerned by archival of documents. Law firms in particular have a requirement to maintain documents for a very long time. Insurance companies have to keep records of policies maturing over 25 to 30 years.

The examples of insurance and law companies highlight a potential problem in case of retrieval of "old" documents. In order to be able to retrieve documents that have been produced with earlier versions or even different types of office automation systems, the interface between the storage system and the current office automation system has to be maintained. These problems are linked to the problem dealing with upgrading to different versions of office automation packages. This is likely to be more a problem for companies which buy office automation applications separately and not as part of a suite of applications. Most integrated office automation suites include document image processing modules and the suppliers ensure the upwards compatibility of the system as a whole.

It is realistic to foresee that many advanced organisations will increasingly be putting an IT infrastructure in place that will either:

- store data in a **neutral format**: this is what **ODA** is for. Hence, it is only necessary to buy office automation products that support ODA;

- use a **supplier document interchange architecture** and buy an integrated office automation suite that supports that structure.

Choosing ODA as a neutral format is the best solution because it guarantees the independence of the users towards the supplier's products.

Problems with **changing layouts of documents between sender and receiving sides** were highlighted by companies from particular industry sectors like law firms. Indeed, it is important that the sending and

receiving sides see the same document in every respect for legal reasons. It is important to notice that users who are aware of the difficulties to keep up the same layout of a document on both sides are usually leading-edge users. ODA documents can be interchanged in a "formatted form" where the recipient is only able to image the document (see subclause 6.1) and therefore, will see the same document as the sending side.

10.1.2.2 Problems anticipated when using ODA products

The greatest problem respondents anticipate when using products that support ODA is **negotiating the right level of interchange between products**. Users are obviously sceptical that all products will support ODA in a standard way. They are afraid of implementations supporting supersets of the standard that will make guaranteed interchange difficult.

Training users is seen as the second most serious problem. In fact, the users shall not be aware of ODA, it follows that the ODA products shall be user friendly.

The third problem addresses the **real interoperability between ODA products**. Surprisingly users are not so worried that support for ODA in conversion mode may mean that there may be discrepancies in the ways that products interpret the ODA standard, although it is still regarded as a problem.

10.1.2.3 SGML(DSSSL) versus ODA

Users see two contenders for an international open document architecture standard. One is ODA and the other is the forthcoming SGML-related family of standards, including Document Style Semantics and Specification Language (DSSSL). DSSSL is a complementary standard to SGML that will provide the instructions about how the logical elements of a SGML document are to be imaged and are to be passed to formatting software.

Undoubtedly, at the moment users have a high level of interest for the SGML/DSSSL option. The main reason is that, mainly in the publishing environment, many SGML-products are already available on the market. These products threaten the ODA market. This is because SGML is a mature standard compared to the ODA standard which is newer and much more complex. Another reason is the growing installed base of SGML in the influential US Defence market through the Computer-aided Acquisition and Logistics Support systems project (the CALS project).

At the moment it is unclear which standard will become the most widely used. SGML/DSSSL could become an industry norm in the USA, while the rest of the world is likely to move to ODA. The publishing sector may continue to align itself to SGML/DSSSL, while the wider business community uses ODA as it was developed primarily for business applications. Also, there is a growing conscience that in fact ODA and SGML are no rivals but should be used together in close co-operation. Implementations based on ODA-SGML inter working can profit from the strong points of both standards, thus giving more value to products.

10.1.3 Requirements

The survey highlights that there is an urgent need for standardisation of document interchange. Moreover, many respondents expect to use ODA in the near future.

It was obvious for the respondents that implementing a standard document architecture is better than to keep on using heterogeneous proprietary document architectures without links between them. Users see the role of the document architecture component of the infrastructure as making information contained in documents:

- available electronically, rather than in paper form;
- manageable by electronic means (in databases, optical storage systems);
- interchangeable between heterogeneous systems and products;
- able to be combined in idiosyncratic ways, whatever the content type of the information (text, graphics, image, table, voice, video) or the type of document (management report, memo or letter, spreadsheet, CAD drawing, technical manual, technical paper, purchase order or timesheet) may be.

In other words, the document architecture should support all aspects of document management and interchange.

There are two further user prerequisites for a document architecture:

- the architecture shall be open, this means able to be implemented in any system within the organisation that produces or manipulates documents;
- it should be implemented in a standard way by all suppliers of systems that produce or process documents.

The DAPs required to support the user's needs are mainly FOD 26 and for more complex documents such as technical specifications and reports, FOD 36 (or other DAPs with comparable functionality).

Extensions to the ODA standard as regarded as high priority by the users are, support for tables, data in documents and spreadsheets and list generation (such as table of content, table of figures etc.). Formulae and other new content types are required in the near future for reports and technical specifications, putting a demand on the support of real multimedia documents.

10.2 Communication platforms for document interchange

10.2.1 Existing structures in organisations

The Ovum survey [1] did not explicitly ask about the hardware environment for document interchange. Therefore the information has to be drawn off related results.

10.2.1.1 Computer systems

The analysis of the office automation applications of companies interviewed by Ovum clearly stated that, at the moment, word processing packages are the most widely used office software packages. This result corresponds to other survey results, where word processing packages are the most used application tools for PCs. This implies that PCs will be the dominant hardware resources for document interchange at present. The status of PCs as the most used computer system for document interchange shall be confirmed when workflow management software as a possible key driver of ODA is getting more widespread.

The importance of the PCs is shown in a forecast of the spread of PCs for white collar workers in Europe. In 1996 nearly 82% of the white collar workers will work with a PC. At the same time the number of PCs connected to a LAN will increase. The forecast based on "Electronic Data Interchange: ODA and ISDN - A report to ETSI PT 40" [2] forecasts nearly 40% of white collar workers with PCs connected to a LAN in 1996. If we assume that most PCs will be provide word processing possibilities, most white collar workers will be potential users of an electronic document interchange.

If it is accepted that PCs will be the dominant terminals for the document interchange, then it is very easy to get access to the ISDN network. ISDN PC cards (see subclause 11.4) provide the possibility to use the PC as an ISDN terminal. In the case that PCs are connected to a LAN , one PC will act as a communication server with direct access to ISDN.

10.2.1.2 Communication platforms

At present it is hard to say something about the acceptance of G4 FAX cards in PCs (see subclause 11.4) in Europe which might be used as a telematic carrier not only for formatted documents but as well as for processable documents. This is mainly of interest to France and Germany as ISDN is becoming more and more widespread in both countries.

There is no precise information available in the Ovum report [1] about the communication protocols used for document interchange in the companies. However the forecasts for protocols uptaken by users considering OSI clearly indicates that X.400 will play a significant role. This is supported by a forecast which predicts that, in 1996, about 40% of the white collar workers will have X.400 Email boxes. Also in the in-depth interviews of Ovum most users mentioned X.400 or other Email system with gateways to X.400 as the suitable communication protocol for the interchange of ODA documents.

FTAM seems not to play such an important role for the interchange of documents from the users point of view, although a forecast for the uptake of the FTAM standard amongst users considering OSI shows a significant interest.

DTAM is not particularly well-known to users as the standards have just been approved and very limited implementations are available. DTAM should achieve greater significance when Group 4 facsimile becomes more popular as the Group 4 facsimile service uses the DTAM transparent mode.

10.2.1.3 Wide Area Networks (WANs)

The number of companies who are already using ISDN is still very low although a growing demand can be realised. This is expressed by the fact that initial ISDN applications have been implemented already (see subclause 11.4). A lot of these applications are based on PCs which use ISDN cards to get access to ISDN.

For the acceptance of a new service over ISDN, it is important that ISDN will also be interconnected with other networks. Taking into account that electronic mail might be very important for ODA applications, the interconnection with the PSPDN shall be most important.

10.2.2 Required interchange features

An important feature for users to use electronic document transfer are low costs of transmission. Users are mainly concerned about the cost of transferring large amounts of data over long distances. As ODA documents may consist of mixed content types including images and graphics a large amount of data has to be transmitted. This implies that the costs for ISDN - both services and equipment - have to be as low as possible.

This required interchange feature has also an impact on implementations creating ODA documents which are at the moment primarily converters from and to proprietary document formats. During the conversion from proprietary document formats to the ODA format the minimum amount of data should be generated (see subclause 11.1).

As a lot of sensitive information will be transmitted in the office environment the secure transmission of documents is very important to the users. It can be assumed that this is true for the engineering environment as well.

Low transmission times are only important for some specialised users and continuous availability seems to be of minor interest to users at the moment.

10.3 Remote manipulation of documents

It is realistic to say that most applications dealing with the interchange of documents are only concerned with the transfer of whole documents. Nevertheless, there is a need for users to be able to create, transfer, edit and manipulate parts of the documents by groups of users.

In the future the developing applications of concurrent engineering and workflow management are assumed to have a need for remote retrieval, remote editing and conferencing of documents. Further studies are necessary to identify more clearly the different scenarios.

With the introduction of ISDN several organisations are developing or using ISDN applications that may also effect the interactive handling of documents. One application deals with PC desktop conferencing where two PCs are interconnected via ISDN. Screen sharing and interchange of screen control describe this application. This may also include the ability to edit parts of the document of the recipient. PC desktop conferencing shall make the collaboration between employees in different locations more effective. Other applications promote the use of ISDN for the support of employees working remotely from their employer. These may include the remote editing of documents located at the employer.

11 Supplier's support

11.1 ODA products

Besides user needs, existing and planned products also have an influence on the market for ODA services. This subclause gives an overview of existing or planned ODA products.

Three types of ODA-products can be distinguished:

- ODA toolkits;
- ODA converters;
- native ODA editors.

"Native" ODA editors which directly implement all ODA features and interchange format are not available, due to problems in implementing the ODA standard. One company (Interface Connection, Germany) have announced an ODA editor for 1993. At present, it cannot be said whether the editor implements all ODA features and ODIF.

The ODA toolkits are software modules implementing a set of common services that support generation, reception and interpretation of ODA documents. The access to these services is provided by a publicly available API. These toolkits may be used to develop any kind of ODA application (e.g. word-processors or converters).

Two consortia are involved into the development of toolkits:

- **PODA**: (**P**iloting **ODA**);
- **ODAC**: (**ODA C**onsortium).

PODA was an ESPRIT consortium, which started it's activities in the 1980's. The PODA members were:

- British Telecom (UK);
- Groupe Bull (F);
- IBM (UK);
- ICL (UK);
- Oce (NL);
- Siemens-Nixdorf (D);
- Olivetti Syntax Sistemi (I);
- Alcatel TITN (F);
- University College of London (UK).

The PODA toolkit is based on **SODA** (**S**tored **ODA**: a database with an API that may be used to store ODA components and attributes). The toolkit is available and the supported profile is Q112 (only ODIF in processable format is supported). The PODA project is currently continuing under the name PODA-SAX. At the moment PODA-SAX is developing an integrated ODA-based office system (i.e., it integrates ODA with others standards such as ISO 10166 [39].

ODAC is an open consortium consisting of several US and European suppliers. It includes:

- Apple (US);
- Digital Equipment Corporation (US);
- IBM (US);
- Unisys (US);
- Groupe Bull (F);
- Siemens-Nixdorf (D);
- ICL (UK).

ODAC is developing a toolkit to support the three ISP's: ISO ISP 10610 [11] FOD11, ISO ISP 11181 [12] FOD26 and ISO ISP 11182 [13] FOD36. An introduction to the ODAC API was presented in Europe during the EWOS/EG ODA meeting in April 1992. The toolkit has been announced for the second quarter of 1993.

Apple has developed a toolkit named **WOPODA** (**W**ord-**P**rocessor for **ODA).**

Commercial ODA converters for the most popular word-processor's proprietary formats are available from BULL, DIGITAL, EPILOG, KEYWORD Office Technologies, and UPC.

BULL provides a RTF/ODA converter. The DAP supported is Q112. Rich Text Format (RTF) is a Microsoft public format to represent documents with text and graphics. All the Microsoft WP systems (e.g. WinWord) support this format.

DIGITAL supports ODA (Q112) conversion in its CDA (Digital's proprietary format) gateway. Using this gateway it is possible to convert other file format (like MacPaint, IBM DCA, etc.) first into CDA ,and then to ODA.

EPILOG's ODA converter supports the FOD11 and FOD26 profiles. It converts from: RTF, IBM DCA, WordPerfect V.5 and Windows Write.

KEYWORD OFFICE TECHNOLOGIES Ltd provides a product named KEYPAK that enables fully revisable document interchange between many word-processing systems. As an option, an ODA conversion is available. Currently, only FOD11 is supported, but it will be upgraded to FOD26.

UPC (**U**niversitad **P**olitecnica de **C**atalunya) has developed an ODA converter that support FOD11 and FOD26. The conversion is to/from MS-Word 4.0 and WordStar 4.0 for FOD 11, and WordPerfect 5.1 for FOD26. A support for RTF is also announced.

The **WordPerfect Corporation** (US) has announced (in May 1992) the development of a converter tool between their proprietary format and ODA. The tool will be based on the profiles FOD26 and Q112.

At the moment, common defects of the converters are the loss of information (mainly in graphics content) and the great increment of the file-size after the conversion to ODIF. Another problem is that some advanced Word Processor features such as tables, automatic table of content generation and style-sheet are converted (or ignored) in different ways. These defects result in a loss of a real interoperability.

Two influential proprietary offerings are:

- the Digital's Compound Document Architecture (CDA);
- the IBM's Mixed Object Document Compound Architecture (MO:DCA).

Both suppliers claim to have ODA extensions (e.g. they include spreadsheet data). The specification of their document architecture is publicly available. The companies policy on the relationship between these formats and ODA is unclear.

11.2 Conformance testers

Also important for the acceptance of ODA services on the market are conformance testing products that check the interoperability of ODA implementations to make sure they are able to interchange documents without loss of information. This subclause gives an overview of existing ODA conformance testing products.

Conformance testers according to the ISO methodology, are available from the CTS-ODA II consortium: NCC (UK), SEMA GROUP BELGIUM and POLIMATICA (Italy). These testers do not support the ODL format. Profiles supported are FOD11, FOD26, Q111 and Q112.

The above testers, contain debugging tools with clear text representation of document constituents, attributes and values.

DANET (Germany) has developed an ODIF tester (OSITEST-ODA) that checks the data-stream conformance to FOD11, FOD26 and Q112.

As pointed out in Clause 7, conformance to these conformance testing products does not guarantee interoperability between implementations, mainly because many DAP-features are optional.

11.3 Communication platform implementations

Clause 8 addressed the status of standardisation of a number of standards on which a communication platform for exchanging ODA based documents can be developed. The relevant standards are the CCITT X.400 series of Recommendations, 1984 [29] and 1988 [30], DTAM (CCITT Recommendations T.430 to T.433 [46]), FTAM (ISO 8571 [19]), DFR (ISO 10166 [39]) and Facsimile. In addition, the interworking of MHS and DTAM has been considered. The market survey addressed this topic by asking suppliers who are currently marketing or developing ODA products about the communication platform they use or intend to use for the (electronic) interchange of the ODA/ODIF documents.

Twenty five suppliers, of whom twenty are marketing or developing ODA products, responded to the question about which communication platform they used or intended to use for document interchange. The results are obtained from a survey carried out by the ODA survey 1990. The results are provided in table 5.

Table 5: Communication platforms used for ODA document interchange

Standardised Communication platform based on:	% of the 25 suppliers who support specified platform
X.400-'84	52 %
File transfer (FTP, FTAM)	32 %
X.400-'88	20 %
DTAM	8 %
Group 4 facsimile	4 %
NOTE: A number of suppliers mentioned more than one platform. The 25 respondents came up with 40 platforms in total. The response of "Group 4 facsimile" shall be seen in conjunction with the Group 4 facsimile service (only formatted documents containing raster graphics) and not as a communication subsystem for any ODA document. At the time when the survey was carried out (1990), the DFR standard was not stable enough for implementation. Therefore, DFR was not mentioned.	

In addition, a number of other platforms were mentioned once, e.g. Teletex, DIA (IBM's Document Interchange Architecture) and XModem. Furthermore, FTAM was not specifically asked for. Instead the term 'file transfer' was used, being more general and including the relatively popular File Transfer Protocol (FTP) for file exchange.

11.3.1 Analysis and tendency

In general, the supplier's support for communication platforms reflects the user's choice in that most of them are committed to X.400 for document interchange. The 1984 and 1988 versions of X.400 together can count upon the support of more than 70 % of the suppliers who responded. The second most mentioned platform was file transfer, mainly using FTP. FTAM suffers from a lack of implementations available at the moment. The other platforms were only mentioned one or two times.

It is not very surprising that most suppliers currently support MHS and File Transfer protocols for document interchange, as there have already been stable products in these areas for some years. Moreover, they fulfil a world-wide possibility of document interchange in a standard way (X.400 networks and Internet). However, the protocols of both platforms do not offer the possibility to negotiate the level of interchange between the sender and the receiver of an ODA document. At the time the survey was carried out, few suppliers supported protocols offering possibilities to negotiate an accepted interchange level probably because of the lack of stable standards (e.g. DTAM). The standardisation activities in MHS/DTAM inter working and DFR have just begun or are not stable so that no products have been available at the time when the survey was carried out.

11.4 ISDN products, applications and commitments

Due to the scope of this ETR (specifically ISDN as the basis for the network), the market study also included some questions dealing with ISDN. From the supplier viewpoint, the questions were about ISDN products available and the supplier's commitment to ISDN, also taking into account the possibility of new

ODA services using ISDN. Few answers have been obtained from the market survey addressing this topic. Therefore, input from other sources has been used in addition, mainly from the ISDN Atlas [3].

One interesting response on the market survey was from a supplier who is marketing/developing ODA products. The company stated that making their products available over ISDN is a job for the system integrators. The company's position towards ISDN is, therefore, that they do not see it as a topic for themselves, it is left to the builders and vendors of communication solutions. Of course, when ISDN becomes available, their products should be able to use it as an underlying network. This also includes their ODA products.

11.4.1 ISDN products

In order to be able to implement new ODA services which use the ISDN as a network it is interesting to know which ISDN products are already available and consequently can be used to base ODA services on. The ISDN Atlas [3] gives an overview of the types of ISDN products currently available. They are categorised in the following classes.

a) ISDN-PBX.
These provide companies with ISDN services internally in their private telecommunications environment. There are both basic rate access (2B+D) and primary rate access (30B+D) ISDN-PBX available.

b) PC-cards + additional software application(s).
Currently, a lot of ISDN PC-cards are already available. They can be seen as a key driver for the early uptake of ISDN. At present their price ranges from 750 ECU up to 2 600 ECUs. Most cards are already below 1 000 ECUs especially in Germany.

c) Terminal adaptors, for adapting existing equipment to the ISDN.

d) Group 4 FAX cards.
These are mainly PC-based, and provide for relatively cheap Group 4 FAX based document interchange. They can be seen as a major driver for both Group 4 FAX and ISDN. Prices are about 1 000 ECUs for the software.

The most important products in relation to new ODA services are the ISDN PC-cards as they provide both users and application developers with general access to ISDN and it's services.

11.4.2 ISDN applications

With ISDN becoming available in Europe, a number of initial ISDN applications has been implemented already. The ISDN Atlas [3] gives descriptions of those ISDN applications being used or planned. Some of these first real ISDN applications are more or less connected to ODA also. These are listed in the following table:

Table 6: ODA related ISDN applications

ODA related ISDN applications identified:
Computer based training
Document image transfer
PC desktop conferencing
Picture transfer
Teleworking
Interchange of standards
NOTE: As the uptake of ISDN in Europe is still at an early stage, most of the mentioned applications were developed in partnership with public network providers, in order to promote the use of ISDN.

For almost all the listed applications, the main reason to implement them on top of the ISDN was the key benefit of the higher bandwidth of 64 kbit/s provided by the ISDN. Additional supplementary services

provided by the ISDN were seen as of much less importance. Some additional benefits were mentioned, like commercial benefits, short connection build-up times and reliability of the connection.

The relation of the above mentioned ISDN applications to ODA is straightforward. All applications can be combined with ODA to provide for ODA based interchange of documents as part of the application. The exchange of standards is an example where ODA is already included in the application. Part of that application, currently being implemented by the RISE consortium, consists of the exchange of documents in ODA format over ISDN.

11.4.3 Commitments to ISDN

Because of ISDN being a possible strong driver for new ODA services it is interesting to know to what extent ISDN is adopted by suppliers at the moment. Supplier's commitment towards ISDN products and implementation of ISDN applications is influenced by two conflicting concerns:

- suppliers see the commercial benefits of ISDN products in that it gives them new market opportunities to provide their customers with numerous new services or enhanced existing services over the ISDN, including ODA services;

- however, they fear that market acceptance of ISDN products will suffer from the current lack of uniform standards and from high initial costs for ISDN connections.

Therefore, suppliers have been somewhat reluctant to commit themselves to ISDN products for some years. But as ISDN is now becoming available in more and more European countries and the Euro-ISDN standards nears completion, suppliers become eager to enter the ISDN market. The best example is given by the countries that adopted ISDN at an early stage, Germany and France. Currently, the number of ISDN connections in use in these countries already exceeds the predictions made in the ISDN Atlas [3] for the end of 1992. Other countries follow at a more moderate pace, but the growth is evident.

The main drivers who initially opened the European ISDN market are the Telecommunication Operators. They, together with their suppliers of switching equipment, show the strongest commitment towards ISDN at the moment. Most of the Telecommunication Operators have launched special programmes to support users who want to implement applications based on ISDN. Currently their main effort is directed towards the provision of Euro-ISDN in every country of the European Community by the end of 1993. The adoption of one ISDN-standard throughout the European Community will solve the problems of interoperability between ISDN equipment of different countries. Consequently, ISDN will be widely accepted and used in the near future, providing a sound base for numerous new services including ODA services.

PART D: ODA scenarios, conclusions and recommendations

12 ODA application scenarios

12.1 Introduction

This Clause outlines a number of possible ways to implement an ODA service. In subclauses 12.2, 12.3 and 12.4 three general scenarios are presented in which ODA applications can be of help. They strongly interrelate, but are presented in distinct sections to put emphasis on the different ways in which an ODA service can be utilised.

The general scenarios will serve for drawing up guidelines for more specific ways of filling in ODA services. The scenarios put their own specific constraints on the choices for filling in the service, which mainly reflect in the choice for the most suitable communication protocol to be used. The guidelines are presented as recommendations for new ODA services in Clause 13.

Subclause 12.5 gives a short description of two existing ODA services which are currently being implemented as part of EC-funded projects, RISE and FODATEC.

12.2 Document interchange

The common scenario for ODA applications is the one in which documents are interchanged in an open environment.

This common scenario is depicted in figure 7:

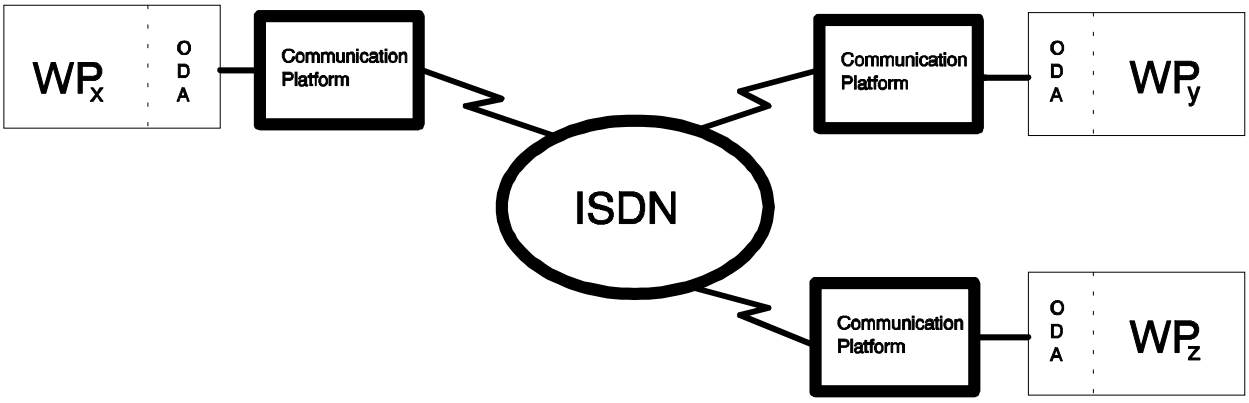


Figure 7: Document interchange scenario

Explanation: documents are interchanged between different types of word processors (WPx, WPy, WPz). Therefore, they need an ODA interface to the outside world (i.e., some ODA converters). At the local sites, documents can be stored in whatever format the local users like. The actual interchange takes place via the public network and a communication platform. In the context of this ETR, we assume the public network to be ISDN. The involved parties in an interchange shall all use the same communication protocol. The possible communication protocols are MHS (see also MHS in relation to ISDN in subclause 8.5.1), DTAM, FTAM (for the main purpose of FTAM, see subclause 12.3) and the combination of MHS and DTAM.

Two main interchange types can be distinguished in this scenario:

1) from one WP-system to another WP-system (end to end communication);
2) from a single WP system to other systems (broadcast communication).

12.3 Storage and retrieval of documents

The second general scenario focuses on the storage and retrieval of documents in an open environment. Essential to this scenario is the presence of a document filestore. The scenario is depicted in figure 8:

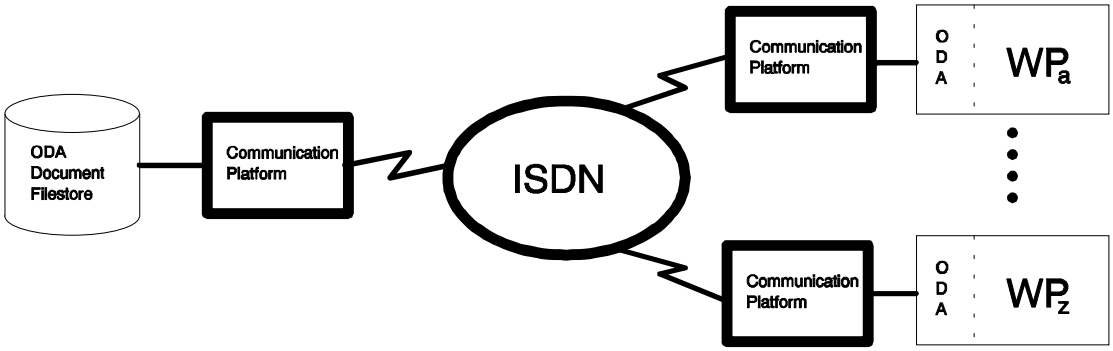


Figure 8: Storage and retrieval scenario

Explanation: typical for this type of applications is the presence of a document filestore which can be accessed by different users, both locally and remotely. Unlike the first scenario, where users were able to locally store their documents in whatever format they liked, using the shared document filestore demands storage of the documents in a standard format, e.g. ODA. Documents are stored on or retrieved from the document filestore by the different word processors. Therefore, they need, like in scenario 1, an ODA interface (some converter). In addition, they need to have access to the (remote) document store. This extra functionality shall has to be provided by the communication platform. So in this scenario the communication protocol shall not only provide for the interchange of documents, but also for the access to the filestore. Possible communication protocols are MHS for non-interactive storage/retrieval and FTAM or DFR for interactive storage/retrieval.

The main interchange type in this scenario is that from a WP system to/from the document filestore system (local or remote storage/retrieval).[1)] The document filestore may include facilities for remote document browsing, full text search/retrieval, etc. The storage or retrieval can take place either in interactive mode or in non-interactive mode. An example of the latter is the non-interactive request for retrieval of a document, by forwarding the request as a message.

12.4 Remote manipulation of documents

The third general scenario is about remote manipulation of documents or parts of documents. See also figure 9 for the scenario.

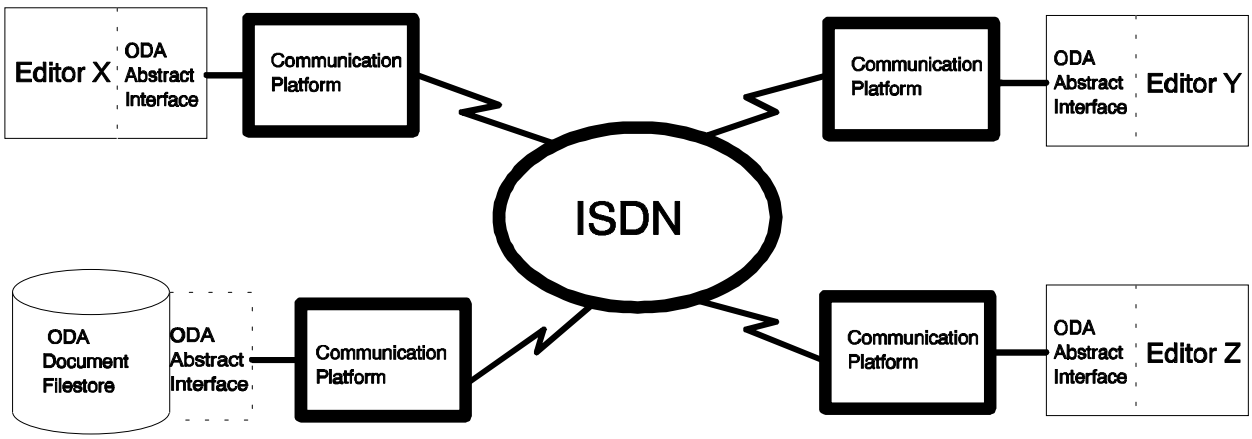


Figure 9: Remote manipulation scenario

Explanation: users do not only have the need for access to a document filestore to store documents on or retrieve them from. They shall also be able to edit documents or parts of documents that reside on the filestore, either on their own or in co-operation (joint editing). Therefore, not only those documents need to be stored in a standard (ODA) format, but also the word processing systems at the different sites need to have an ODA abstract interface that is able to interact with the ODA documents. Moreover, joint editing

---

1) Of course in most cases the functionalities of scenarios 1 and 2 will be combined within the same service

should take place in real-time. This puts both extra requirements on the editing system (the word-processing system may have to be a "native" ODA editor) and on the protocol used for communication. The most applicable protocol is DTAM in combination with DFR which is supported by CCITT and ISO (see Clause 9).

The edit-instructions are communicated over the public network. The communication protocol used by a remote user to send his editing instructions shall also be supported by the system where the ODA document is actually stored. In the case of joint editing, that system shall also handle the inter working between the different editors.

A further application is the joint production of documents by modifying/updating parts of a document in ODA representation (Conferencing). Two or more users have identical copies of a document and are exchanging parts of the document in terms of operation. A co-ordinator is responsible for the integrity of the application (not shown in figure 9). Conferencing is only applicable if it takes place in real-time. The applications at the different sites need to have an ODA abstract interface. The communication protocol most applicable is DTAM.

12.5 Existing ODA applications

As stated in the introduction, the guidelines for new ODA services, based on the above general scenarios, can be found in Clause 13. In this subclause two ODA applications currently being implemented are briefly described. They are derived from descriptions of the projects RISE and FODATEC.

RISE

The aim of the RISE project (ENS E2012) is to establish retrieval and interchange of standards in Europe. For interchange and storage/retrieval the ODA format will be used. A number of pilots are defined, in which documents will be interchanged over public networks to national standardisation bodies. Furthermore, a "virtual standards library" will be built up which will allow for remote retrieval of standards. So this application is a specific implementation of the first two general scenarios in subclauses 12.2 and 12.3. For conversion to ODA format the RISE project shall use existing converters, which are mainly based on DAP Q112, the predecessor of FOD26. Communication shall take place over ISDN, X.25 and VSAT (broadcast of documents over satellite). Possible communication protocols are MHS, DTAM, VSAT, etc. A more detailed description of the RISE project can be found in the "RISE" (ESPRIT project E2012) Presentation brochure" [4].

FODATEC

The FODATEC project (ESPRIT 5402) aims to demonstrate the feasibility of the ODA standard combined with standards for the production of technical documents. It aims to develop ODA conversion tools for conversion of technical documents, including 3D graphics (through a special graphic converter) to ODA format. The documents are to be interchanged between heterogeneous environments, stored in ODA format and retrieved either as a whole or in parts, remotely or locally. Furthermore, remote manipulation of ODA documents, or parts of ODA documents, are to be supported. So this specific application includes elements from all three general scenarios. The structure of the ODA documents, and consequently also the converters, shall conform at least to DAP Q112 (FOD26). The communications module shall be a standard OSI tower. For distributed communication the base is to be ROSE (interactive) or X.400 (non-interactive). On top of ROSE, protocols like DFR and DTAM shall be used. For more details of FODATEC see the FODATEC document E5402/TN/UPC/45 [5].

13 Conclusions and recommendations

After investigating the actual situation on the ODA market concerning users, suppliers and the standardisation activities, it is the main task of this Clause to link these topics together. New ODA services over ISDN are recommended and the need for standardisation activities highlighted.

13.1 ODA services over ISDN

In Clause 12 three general scenarios were presented which described where new ODA services can be put into place. They also pointed out that new ODA services shall include support for one or more DAPs, one or more communication protocols and an underlying network. The underlying network is the ISDN in

the scope of this study. Although in the end each application will have it's own very special demands, some guidelines for the best suited DAP and protocol can be given.

The choice for a specific DAP is not, to a great extent related to a specific type of scenario in which an ODA service is useful but depends largely on the kind of documents that are involved in the ODA service. The best choices are FOD26 for ODA services involving document types such as letters or simple reports and FOD36 for ODA services involving document types with higher requirements such as reports with more complex logical and layout structures. The FODs are the best choices because they are available as International Standardised Profiles (ISPs) and much effort has been put in them to remove ambiguities and faults. Moreover, a growing amount of converter products already supports the FODs, as will the ODAC API that is currently being defined. From the lack of products currently supporting FOD36 it can be concluded that at the moment FOD26 is more accepted by the market. However, user demands go beyond FOD26 and require FOD36, or even higher functionality, for a number of document types. New DAPs should be aligned to the FODs.

This leaves the choice for a communication protocol to complete the outline of useful new ODA services over ISDN. The choice for the right protocol depends to a great extent on the type of scenario in which the ODA service is to be used. Taking into account the different scenarios identified in Clause 12 the following recommendations can be given:

1. In the **document interchange scenario** DTAM is the most suitable protocol to be used over ISDN. Taking into account that mixed content documents request high data-rates, the choice of DTAM based on ISDN represents the most acceptable solution for the user in terms of transmission times. An additional advantage of DTAM is the possibility of negotiating document characteristics before sending the document. The other well suited protocol for document interchange is MHS. However, because of the store and forward principle it specifically addresses non-interactive transfer without real time constraints. On the other hand, MHS profits from the acceptance by both users and suppliers and there are already a lot of products available on the market. MHS is especially useful for broadcasting of documents. As the 1988 version of the CCITT X.400 series of Recommendations [30] offers the most functionality and guarantees inter working with earlier implementations it is the most appropriate version to base implementations on.

2. In the **document storage and retrieval scenario** the most well suited communication platform is DFR. The other possibility would be FTAM. DFR is preferable over FTAM because DFR and ODA are fully aligned. Moreover DFR is specifically developed as the standard for storage and retrieval of documents, where FTAM is the general OSI file service.

3. In the **remote document manipulation scenario** the appropriate communication platform is formed by DTAM in combination with the ODA Abstract Interface. If there is a remote document access to an ODA document filestore the communication shall be based on DTAM and DFR. DFR is needed for the remote access to the document and DTAM is needed for the transfer and manipulation of parts of documents.

For the moment, most new ODA service implementations will probably match more or less the combination of the first two scenarios. Applications addressing the third scenario have a longer timescale of implementation (though new application areas like workflow management and concurrent engineering may quicken the adoption of services according to this scenario).

Therefore, it can be concluded that new ODA services over ISDN in general should be based on FOD 26 (FOD36 in the future) combined with a communication platform based on DTAM or MHS (the 1988 version of the CCITT X.400 series of Recommendations [30]) for interchange, and on DFR for storage and retrieval. Full support for these guidelines will create real market acceptance for ODA services, with the prerequisite that the problems with the ODA standard and the DAPs as described below are solved.

It is important that service definitions and terminal characteristics for these types of ODA services are developed soon. An interesting topic in this context is the inter working of DTAM and MHS, currently being considered by CCITT. It combines the services of the two most suited protocols for ODA document interchange applications. Another possibility is to provide users with an API to use either DTAM or MHS depending on the service needed.

13.2 Problems of interoperability

The problems of interoperability of ODA applications seems to be a key restriction to the acceptance of ODA by the market. The problems may be categorised into three different items:

1) problems because of the increasing number of DAPs;
2) problems of interoperability of real ODA implementations;
3) problems of the same layout of documents of sender and receiver.

1) Different standardisation organisations were involved in the definition of DAPs which led to different DAPs with nearly the same functionality. Therefore, suppliers of ODA products have not wanted to commit themselves to a specific DAP. This problem is solved with the alignment of ODA DAPs by PAGODA. Still there exist a lot of DAPs with different functionality. This will lead to problems of interchange of ODA documents if the same DAPs are not implemented by many vendors. On the other hand, it is not possible to define only one DAP that covers all the functionality necessary in different applications. A main aspect of the support of new DAPs should be that new profiles shall be applied by a large number of users. It is recommended that the enhancements of ODA identified in this report shall be incorporated in new versions of the FODs.

2) The second item deals with the interoperabiltiy of real ODA implementations that claim conformance to a specific DAP. These problems are reflected in the definition of IRS-Ps where no common view of an acceptable level of functionality has yet been achieved. The problems arising in the definition of IRS-Ps may be solved by the definition of different classes of conformance to a given DAP where, in each class, all features are mandatory. The classes differ from low guaranteed level of functionality to a very high level of functionality where nearly all permissible features of a given DAP are supported by an implementation.

3) The third item deals with the demand of users (mainly in the government and financial sector) for guaranteed interchange of the document layout structure. At present, the layout process for ODA documents is not standardised but only a reference model. Therefore the layout process of different ODA implementations may lead to a different layout structure of the same ODA document. The standardisation of the document layout process shall guarantee that sender and receiver have the same layout structure of the document.

13.3 Extensions of the ODA standard identified by user requirements

An international standard and derived applications shall only be accepted by the market if it mainly fulfils the requirements of the users. Therefore this study first looked at the users to identify their needs.

The market research of this report shows clearly that, at present, the focus of attention is in the document interchange in the office automation environment. The most significant problem reported by the users is the document interchange between different word processing systems.

Currently, the access to ODA is characterised by converters to existing word processing systems. Although the DAPs FOD26 and FOD36 have been developed to cover the functionality of word processing systems, there are still some features users want to see included in the ODA base standard and relevant DAPs. There is particularly a strong user demand for **tables** and **list generation** (e.g. table of contents). It is recommended to incorporate this functionality in the standards in order to match better the functionality offered in existing word processing systems.

NOTE 1: PAGODA is already considering to integrate extensions of the second version of the base standard (e.g. security and colour) and as well requirements for new functionalities (e.g. list generation) into the existing DAPs FOD11, FOD26 and FOD36 thus forming new versions of the DAPs. ISO/IEC JTC1/SC18 has proposed an amendment to the base standard that deals with data in documents. Currently, the status of the new version of the DAPs is Committee Draft.

However, ODA is not restricted to the use of converters to word processing systems. Advanced users want to integrate their applications in the office environment and even support a wider range of applications than pure office systems like financial applications or applications in the manufacturing sector. This implies new standardisation activities. Users show strong support for **data** and **spreadsheets** in ODA applications. Generally it can be concluded that in the future users want to integrate additional content types in an document. This also includes voice and hypertext to support multimedia documents. It

is recommended that data and spreadsheets shall be incorporated in the ODA standard as these content types are of most interest to the users.

NOTE 2: ISO/IEC JTC1/SC18 WG 5 has already proposed the amendments "data in documents" and CCITT SG VIII, Q27 and ISO/IEC JTC1/SC18 WG 3 "HyperODA" in their work programme. Voice and spreadsheets in ODA documents is already on ISO/CCITT work item.

13.4 Conclusion

ODA has been developed for the interchange, storage and retrieval of standardised documents in an open environment. As shown above, there are still inconsistencies in the standard. In the past standardisation activities have concentrated on the improvement of the standard to meet the objectives of an open document interchange (e.g. alignment of DAPs, work on conformance testing). It is obvious that the standard is far from complete and work has been carried out to define extensions (e.g. security, colour) to meet user requirements found in common office applications.

At present, the main standardisation work in CCITT and ISO may be distinguished in two areas. One deals with the enhancement of ODA for multimedia applications and the other one deals with ODA in distributed applications.

New content architectures are required by the user. The work on audio, tables, spreadsheets and data in documents has already started. The work that is carried out on the ODA abstract interface and HyperODA may support ODA in distributed applications.

All the above mentioned extensions of the ODA standard should be finalised.

Furthermore, user requirements that have been identified in this ETR and which are not covered by existing standardisation activities should be integrated in the ODA standard and the relevant DAPs.

The communication protocols which support ODA services for document interchange, filing or retrieval are already stable standards and several products exist. For the future it may be important to support the inter working of different communication protocols. An important issue is the inter working between telematic terminals based on DTAM and MHS systems.

Annex A: Questionnaire

This annex contains the questionnaire that has been used to carry out the market survey.

QUESTIONNAIRE ABOUT

ELECTRONIC DOCUMENT INTERCHANGE

This questionnaire is about electronic document interchange formats, ODA (Open Document Architecture) in particular.

1. What is your organisation's current position towards electronic document interchange? (please read the following list)

. (1) Implementing or have implemented a strategy
. (2) Committed and formulating a strategy
. (3) Considering a strategy
. (4) Not interested in document interchange
. (5) Unfamiliar with document interchange

If your reply is (1) or (2) or (3), please answer in accordance with the different parts of the questionnaire relating to your organisation. An overview of Part A (Users) and Part B (Suppliers) is given below. Relevant detailed questions can be found in pages 2 to 8 for Part A, and 9 to 10 for Part B.

- **Part A entitled "Questionnaire: Users needs" deals with:**
  - Existing office automation systems in your organisation
  - Needs of your organisation for production and interchange of documents
  - Needs of your organisation for storage and retrieval
  - Specific questions addressing the ODA standard
  - Communication platforms used or intended to use for document interchange in your organisation
  - Need for your organisation for Applications dealing with interactive mode of operations

- **Part B entitled "Questionnaire: Suppliers"**
  - Involvement of your organisation in ODA
  - Products developed and currently under development
  - Document application profiles supported
  - Extensions of ODA
  - Involvement in communication subsystems for interchange of documents

Part A: QUESTIONNAIRE: "*USERS NEEDS*"

1 - OVERVIEW OF THE EXISTING OFFICE AUTOMATION SYSTEMS IN YOUR ORGANISATION

1.1 Does your organisation need to interchange documents within any of the following computer applications?

. (1) Production planning
. (2) Manufacturing
. (3) CAD
. (4) Order processing
. (5) Customer transactions
. (6) Reservation
. (7) Stock control
. (8) Electronic mail
. (9) Office automation
. (10) Financial/accounting
. (11) Payroll/personnel
. (12) Information retrieval/storage
. (13) Others (please specify)

1.2 What are the three most widely used office software packages in your organisation?

. (1) Word processing
. (2) Spreadsheet
. (3) Document Archival
. (4) Electronic Mail
. (5) Desktop Publishing
. (6) Graphics tools
. (7) Others (please specify)

1.3 Can you qualify the problems you met with your office automation system?

. (1) Moving documents between different word processing systems
. (2) Using documents with the same office software package but at different levels of versions
. (3) Storage/Retrieval of documents (link to (2))
. (4) Integrating different kinds of contents within a document (text, drawings, photographs, ...)
. (5) Layout of documents different in the sender and the receiver sides

1.4 Who are the three primary suppliers of office software in your organisation?:

.....
.....
.....

1.5 Who are the prime users of the office software?

. (1) Secretary
. (2) Professional (Engineer, ...)
. (3) Others (please specify)

2 - EVALUATION OF THE USERS NEEDS

2.1 Needs for production and interchange

2.1.a In what areas do you see the need for document interchange in your organisation?:
. (1) Internal to your organisation
. (2) External to your organisation
. (3) Both internal and external to your organisation

2.1.b What kinds of documents do you want to interchange electronically (indicate the proportion)?
. (1) Letters
. (2) Reports
. (3) Memos
. (4) Technical specifications
. (5) Forms
. (6) Invoices
. (7) Others (please specify)

2.1.c What kinds of document contents does your organisation want to interchange?
. (1) Text
. (2) Drawing
. (3) Photographs/charts
. (4) Logos
. (5) Formulae
. (6) Voice
. (7) Spreadsheets
. (8) Data
. (9) Colour
. (10) Multimedia (combinations of above)
. (11) Others (please specify)

2.1.d When you need to interchange documents what type of information about the contents is involved?
. (1) Structural information of a logical nature i.e.: chapters, sections, paragraphs, footnotes etc.
. (2) Layout information i.e.: pages, blocks etc.
. (3) Both types of information

2.1.e For interchange purpose, are you prepared to loose structural information?

2.1.f Which are the frequency of interchange internally or/and externally?

. **Internally**: . (1) Daily	**Externally**: . (1) Daily
. (2) Weekly	. (2) Weekly
. (3) Monthly	. (3) Monthly

2.1.g When do you think that there will be a real need for standardisation of document interchange in your organisation?

2.1.h Which are the formats you expect to use for interchange/archival of documents?
. (1) ODA
. (2) SGML
. (3) RTF
. (4) DCA (IBMs Document Architecture)
. (5) CDA (DECs Document Architecture)
. (6) TIF (for image)
. (7) CGM or IGES (for graphics)
. (8) Others (please specify)

2.1.i For each category of document, indicate the percentage of interchange

. (1) Text only with a fixed (non-changeable) structure . . . %
. (2) Text only, but easy to edit and modify . . . %
. (3) Text and other kinds of contents with a fixed structure . . . %
. (4) Text and other kinds of contents but easy to edit and modify . . . %

2.2 Needs for security

What are your organisation's needs for security features when documents are interchanged?

. (1) Confidentiality (unauthorised persons cannot read a document)
. (2) Integrity (the document can not be modified by an unauthorised person)
. (3) Authority (electronic signature)

2.3 Needs for Storage/Retrieval

Is there a need to store/retrieve your documents in a standardised format?

If you have heard about the ODA, please answer to the following questions:

2.4 Are you going to adopt ODA

. (1) If yes, please specify time scale: 1, 2, 3 years
. (2) If no, please give reasons

2.5 What problems do you expect when installing ODA?

. (1) Loss of functionality in converting from proprietary document structure to ODA
. (2) Negotiating the right level of interchange and fallbacks for the different applications and parties involved
. (3) Training the users
. (4) Deciding on the final layout of the reviewed document
. (5) Locating responsibility for problems i.e. sender, receiver, network etc.
. (6) Establishing which users should be able to interchange documents
. (7) Security
. (8) Other (please specify)

3 - COMMUNICATION PLATFORMS

To be able to interchange documents electronically, some kind of communication platform and underlying network have to be available.

3.1 Which kind of computer system does your organisation want to use for document interchange?

. (1) PC
. (2) PC's in a LAN, who is the supplier of the LAN?
. (3) Workstation
. (4) Workstations in a LAN, who is the supplier of the LAN?
. (5) Other (please specify)

3.2 What protocol is used for communication within your organisation?

- OSI protocols:
  - . (1) X.400
  - . (2) FTAM
  - . (3) G4 FAX
  - . (4) DTAM

- Other communication protocols
  - . (5) Which ones?
  - . (6) Will you migrate to OSI-protocol(s) in the future? If yes, which one(s)?

3.3 Which underlying network is used for the communication?

. (1) Circuit Switched Data Network (Public Switch Telephone Network, ...)
. (2) Packet Switched Data Network (X.25, ...)
. (3) Integrated Services Digital Network (ISDN)
. (4) Other (please specify)

3.4 Do you already use ISDN in your organisation?

. (1) If yes, which application(s) is/are based on it?
. (2) If no, do you plan to use ISDN in the future?

3.5 Is there any preferenced communication protocol for the document interchange?

. (1) X.400
. (2) FTAM
. (3) G4 Fax
. (4) DTAM
. (5) Other (please specify)

3.6 The following are features of the document transfer. Please rank them as High, Medium or Low priority for your organisation:

. (1) Security
. (2) Low transmission costs
. (3) Low transmission times
. (4) Continuous availability of receiving party
. (5) Other (please specify)

4 - INTERACTIVE MODE OF OPERATIONS

This questions relate to the manipulation of documents in an open environment.

4.1 Is there any need in your organisation not only to transfer whole documents between two users but to be able to create, transfer, edit and manipulate parts of documents by groups of users?

. (1) No
. (2) Yes (continue in 4.2)

4.2 The following are different scenarios of document manipulation in an open environment. Please rank them as High, Medium or Low priority in your organisation:

. (1) One or more users want to read parts of documents that are not stored in the local environment.
. (2) Remote Editing: one or more users edit a document that is not stored in their local environment. The document is read and updated by exchanging operations.
. (3) Conferencing: two or more users possess identical copies of a document and are exchanging updates on parts of the document. This may include screen sharing, interchange of screen control etc.
. (4) Other (please specify)

Part B: QUESTIONNAIRE: "*SUPPLIERS"*

1. Is your organisation currently developing and/or marketing products involving or supporting ODA?

. (1) Yes
. (2) No (finish)

2. If "yes", please indicate the type of products:

. (1) ODA toolkit
. (2) ODA editor
. (3) ODA validation suite
. (4) Filter/converter
to which editor or application?
.....
. (5) Document database
. (6) Other (please specify):
.....
.....

3. If your organisation is currently developing ODA products, please also list products by name, with a brief description of scope and application area, and expected release time. (Use separate sheet if necessary)

.....
.....
.....
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.....
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.....
.....
.....
.....

4. Which document application profile do you support?

. (1) Q.111
. (2) Q.112
. (3) Q.113
. (4) PM-11
. (5) PM-26
. (6) PM-36
. (7) FOD 11
. (8) FOD 26
. (9) FOD 36
. (10) T.501
. (11) T.503
. (12) T.504
. (13) Other (please specify)

5. Which extensions of ODA would you like to implement in your products?

. (1) Colour
. (2) Table and table layout
. (3) Voice content
. (4) Annotations
. (5) Data

. (6) Spreadsheets
. (7) Hypermedia
. (8) Security
. (9) Other (please specify):
.....

6. Is your organisation currently marketing or developing products to interchange documents? Which communication subsystem is used?

. (1) X.400(1984)
. (2) X.400 (1988)
. (3) FTAM
. (4) DTAM
. (5) G4 FAX
. (6) Other (please specify):
.....
.....
.....

7. If "yes", is your organisation putting any effort in making those products available over ISDN?

. (1) Yes, please specify
.....
.....
. (2) No, will you do so in the future?

8. What is your organisation's position with regards to ISDN and what Market are you addressing?

.....
.....
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Annex B: Extended market survey on Workflow Management and Concurrent Engineering

Summary

The work in this annex is an extension of the original market survey undertaken for PT40. The extension was commissioned in order to clarify the relationship between ODA and ISDN and the new applications of Workflow Management and Concurrent Engineering.

This ETR provides a description of the two applications of interest in the context of supporting applications for Total Quality Management (TQM). It is shown that the market for both applications will grow rapidly in the next few years before reaching saturation towards the end of the decade. Key aspects for the growth of the market are considered, and it is shown that support for Document Image Processing is the key to Workflow Management whilst the provision of complex multi-media teleconferencing is key to success of Concurrent Engineering. It is shown that the above aspects are significant in the link between the use of ODA over ISDN.

Further work on classifying TQM applications according to their multi-media requirements and their need for ISDN and Broadband ISDN (B-ISDN) is suggested.

B.1 Introduction

B.1.1 Background

The task given to the Project Team involved the identification of required terminal characteristics over Integrated Services Digital Networks (ISDN) for ODA applications. The approach taken by the Project Team is explained in PART A of this ETR and is summarised below.

It was decided to conduct a market survey of users and suppliers with a view to establishing the key trends in the development of ODA applications and the likely impact on requirements for ISDN. As a first step the Project Team drafted a questionnaire designed to clarify certain key features and then considered what process should be employed to extract valid results for the use of the next stage of the work. After due consideration had been given to the options at their disposal, it was decided to proceed by analysing relevant market research data held by a company called OVUM. Accordingly, OVUM was commissioned to provide answers to the questionnaire (included as Annex A) through an analysis of data which it had collected through its own extensive market surveys in the ODA area. The results of this analysis are included, in summary form, in PART A of the main report and are analysed further in PART C which considers the requirements against an overview of available products.

In summary, the market survey established that although there are barriers for users to overcome in the adoption of ODA as a standard for document interchange, and, although there were difficulties for suppliers in the development of products to meet users' needs, the market for ODA was growing significantly, particularly in Europe. The survey found that ODA had an important part to play in the drive towards the "Computer Integrated Company" in which the key business processes would be automated and would communicate with each other and with their counterparts in other companies. The survey found that the drive towards the "Computer Integrated Company" would reinforce the current drive towards open systems in the user community and that this would act as an incentive to employ an open document standard such as ODA.

The survey found that the full benefits of ODA could not be realised without strong communications systems capable of supporting the need for both internal (to the company) and external communications. It was clear that internal communications were generally well supported by existing or planned PC/LAN installations, but the position was less clear in regard to external communications. In considering user needs for external communications or Wide Area Networks (WAN) attention was given to the following:

- geographic reach;
- performance for interactive applications and file transfer;
- security;
- standards for inter company communications;
- cost.

In the past users have generally considered X.400/X.25 appropriate for EDI and ODA applications where the traffic is relatively light and performance may not be an issue. This remains the case for many of the planned ODA applications, but the survey found that in the drive towards the "Computer Integrated Company" there were two important areas of development which would influence both the growth in ODA and the requirements for high performance wide area networking as may be provided by ISDN.

These areas of development are known as Workflow Management and Concurrent Engineering and, because of their importance to the task assigned to the Project Team, a recommendation was made that the market research work should be extended in order to clarify their importance to the link between ODA and ISDN and the task of the Project Team. The results of this work are the subject of this annex.

B.1.2 The extended survey

In making the recommendation for further work on the market survey the following sub-tasks were proposed:

a) to analyse existing market research on Concurrent Engineering and Workflow Management;

b) to discuss findings with research authors and to interview additional users to clarify findings regarding ODA and ISDN;

c) to analyse results with reference to:

- growth of applications;
- performance requirements;
- link with ODA;
- link with ISDN; and

d) to complete a report on the above.

The principal sources used in analysing existing market research on concurrent engineering and Workflow Management are reports by OVUM. On Workflow Management the OVUM report entitled "Workflow Management Software: the Business Opportunity" [44] published in 1991 was used extensively, and on Concurrent Engineering a similar report by OVUM available in pre-publication draft form (September 1992) entitled "Concurrent Engineering; the market opportunity [45], provided much of the information cited in this annex. Both reports were discussed with the authors in order to clarify certain points relating to the Project Team's task.

Although it had been intended to conduct a small independent market survey to clarify certain findings direct with specially selected users, the timescale related to approval of the extended market survey and the deadline to finalise this ETR did not allow this separate market survey to be undertaken. Although the additional survey might have revealed new data of relevance to the Project Team's task, it is believed that the results presented here are valid in their own right as they are based on an extensive market survey conducted by a well established, reputable, independent market research company.

B.1.3 The report

Clause B.2 of this annex describes the new applications of Workflow Management and Concurrent Engineering in the light of moves towards the "Computer Integrated Company". Clause B.3 considers key aspects of the development of these applications and discusses how these relate to the use of ISDN to act as a network for ODA based applications. Clause B.4 presents market forecasts for ODA, Workflow Management and Concurrent Engineering and Clause B.5 discusses the results and provides conclusions for the work of the extended market survey. Finally, Clause B.6 offers some suggestions for further work.

B.2 The Computer Integrated Company and the new applications of Workflow Management and Concurrent Engineering

B.2.1 Computer Integrated Company

B.2.1.1 IT and business

In order to understand the significance of the drive towards the "Computer Integrated Company", it is necessary to consider the history of IT as a servant of business. In the 1960s, commercially available computers initially found application in scientific and engineering research but then rapidly transferred to the commercial sector where their capacity to improve productivity in a range of administrative tasks became evident. As an example, the finance sector made early use of data processing in the late 1960s to automate routine accounting tasks and to provide a fast and efficient process to convert a mass of paper based input (e.g. paper credits, debits, etc.) to a mass of paper based output (e.g. account status).

Further improvements in productivity were gained in the 1970s as users became proficient in automating an increasing number of administrative tasks associated with the business, but the most significant advance in commercial data processing was that associated with networking. The provision of reliable networking protocols such as IBM's SNA allowed users to build large, manageable data networks which brought data input and output closer to the point of use. Data networking improved the useability of the central mainframe computer as an information source and thereby extended its applicability to business. However, notwithstanding the networking advances in the 1970s, there was little direct exchange of data outside the enterprise; data processing was used to attack the large computational tasks in a business process and did not, in general, provide a complete cycle of automation for the entire business process.

As users made further steps to automate business processes suppliers competed in the provision of usable cost effective tools. In the early 1980s these tools tended to be proprietary and users were obliged either to use a single computer manufacturer or to accept that without extensive development work of their own there would be islands of automation in the business between which there would be no effective communication. However, the demands of business were such that this state of affairs tended to be accepted by pragmatic business managers. The reasons for this are discussed below.

The importance of IT to the business was recognised by most enterprises in the 1970s and accordingly large IT departments were set up to serve the demands of the business. These departments became expert in building mainframe applications to automate manual processes and to deliver service through a corporate network. The time taken to develop and test mainframe based solutions for the business seldom satisfied business managers who believed that the requirements would change before the solution could be used. The approach adopted by many enterprises was to allow or even encourage business managers to install package based solutions on PCs or mini-computers. In this way business was able to find timely solutions to its problems without the need to incorporate the IT component into its mainstream IT strategy.

The growth of economic PC/LAN solutions for office automation reinforced the trend towards fragmented IT solutions to suit the ever changing needs of a business enterprise but two developments in the late 1980s caused a move back to a more orderly central control of corporate IT: firstly, the drive towards Standards and open systems provided opportunities for networking applications; and, secondly the development of applications, such as EDI, designed to automate the full business process and to allow data interchange between enterprises created a powerful incentive for business to consider IT solutions within a corporate strategic framework. It is within this context that the drive towards the "Computer Integrated Company" should be considered.

B.2.1.2 The Computer Integrated Company

For the purposes of this ETR, the "Computer Integrated Company" is defined as a company in which all its business processes internal and external to the organisation are fully supported by computer applications that are able to communicate with each other. A "Computer Integrated Company" might use Computer Aided Design (CAD), Computer Aided Manufacturing (CAM), Electronic Data Interchange (EDI), Workflow Management and Concurrent Engineering within its suite of supporting computer applications.

The significant aspects to this definition are that it refers to communicating applications and communications internal and external to the business. In a "Computer Integrated Company" there should be no islands of office automation requiring manual processes for data entry or sorting and arranging output since all applications designed for a particular business process would have the ability to communicate with all other relevant applications. In a "Computer Integrated Company" data is held in one format and in one place (unless relocated for reasons of performance or resilience or in association with a well defined client server architecture). Fundamental to the "Computer Integrated Company" is the use of open systems and compliance with all applicable Standards.

The drive towards the "Computer Integrated Company" is led by productivity and efficiency as in the early days of automation, but is supported increasingly by the discipline of TQM. TQM is related to productivity but concentrates the provision of an error free environment and the effective co-ordination of complex processes to manage change within an organisation so that, at all times, it retains its competitive edge. Workflow Management is concerned with the orderly flow of information in a (normally) stable business process, and is designed to create speed and efficiency in an error free manner, whilst Concurrent Engineering techniques are introduced generally to remove the barriers to change and innovation in a well structured corporation. These two applications are thought to be highly significant in support of the "Computer Integrated Company" and are described in the subclauses B.2.2 and B.2.3.

B.2.2 Workflow management

B.2.2.1 Description

For the purposes of this ETR, Workflow Management is defined as a methodology designed to support business processes within an organisation in order to achieve higher productivity and improved quality. It has its origins in integrated office systems and document image processing. Workflow Management allows office workers in a multinational company with a number of separate divisions to co-operate efficiently within a single business process. Workflow Management may also be used to support complex interaction between enterprises and achieve overall quality and efficiency.

An important aspect of Workflow Management is that it is proactive by nature, forcing participants to work through the application and effectively preventing bypass by reluctant users of IT systems. It seeks to human and system participants together with appropriate data resources to achieve well defined business objectives.

At the heart of a Workflow Management system is a script which is intended to model and control the business process. The script is responsible for accessing internal information, for giving instructions to users and for collecting information external to the system. The development of the script to provide an accurate model of the business process and to allow for all variations of state and input is crucial to the effective installation of Workflow Management and for achieving the benefits it is intended to bring to the business.

Although Workflow Management is a relatively immature technology (which is largely as a result of the difficulties users have experienced in creating the right IT environment) there are a number of terms in common use today which define key aspects of the system. These are described briefly below.

A "business process" is a logical procedure from which the business objectives are achieved. A "procedure" is defined as a series of tasks allocated to participants in the system. "Data" is defined as any item of information supplied to, calculated, or retrieved by a procedure. A "participant" is defined as an entity that contributes to a procedure and may be a human user or another application.

Workflow Management is designed to manage a business process effectively. Deadlines are set for all tasks on the system, and, if a deadline is not met, a default action is taken which normally involves referral to a responsible managerial participant. As in all efficient businesses, Workflow Management works through deputies if the responsible manager is not available on the system at the time of interest.

Most administrative processes for which Workflow Management provides an effective solution require specific authority before actions such as paying an invoice, placing an order or approving a change request on a computer system can be arranged. Workflow Management is designed to operate in this way and to provide an electronic audit trail for later use.

Workflow Management, as described above, may be seen as having very general application to administrative processes, such as handling expenses claims, supporting the purchasing and accounting functions and supporting an IT service through a help desk. It is fair to say that many computer applications are in use today (some described as enhancements to EDI) which are not thought of specifically as Workflow Management. The term Workflow Management should be seen as embracing these older applications, but, as a discipline, Workflow Management is, a component of the "Computer Integrated Company" and therefore requires compliance with applicable Standards/open systems to ensure full interoperability with other with other supporting applications.

B.2.2.2 Current practice

Most Workflow Management Software installed today is in the US and the UK where three suppliers, namely Filenet, FCMC and Workhorse dominate the marketplace, either through direct sales or through OEM arrangements. There are signs that the use of Workflow Management is set for expansion in Europe and that this may be stimulated by large purchases in the public sector. For example, the Netherlands Department of Social Security has recently begun the installation of a 4000-seat system. It has been suggested that there may be a reaction against Workflow Management in certain European countries where it may be seen as being too formal and acting so as to restrict freedom of action which can support the business, but it is reasonable to suppose that such attitudes will eventually be overcome when the full benefits of Workflow Management are realised.

Workflow Management is generally applicable to business but the finance and government sectors have dominated its use in the early stages of market development. Typical applications include the following:

a) procurement systems;

b) allocation of routine tasks to a pool of staff;

c) tracking of long term activities;

d) mortgage and conveyancing systems;

e) financial investigation systems;

f) customer service systems.

In implementing Workflow Management techniques users have tended to rely on external consultants to assist them with their first installations or at least to assist them to set up teams of implementers within their own IT departments. This has generally proved to be successful by comparison with attempts to install Workflow Management by relying totally on the supplier. This reinforces the view that building the "Computer Integrated Company" is a Systems Integration task with a strong element of customisation required to ensure effective matching to business problems.

B.2.2.3 Benefits

The principal benefits of Workflow Management may be summarised as follows:

1) increased productivity;

2) faster response;

3) greater control;

4) improved staff morale.

In the market survey conducted by OVUM each of these four benefits was reported to a greater or lesser extent. Increased productivity has generally been apparent in labour intensive areas of customer support where the presence of workable support systems has resulted in reducing staff loads by up to 33% (or alternatively in keeping staffing levels constant while increasing the workload by a similar amount). There is evidence that the quality of service offered by customer service departments can be improved by speeding up the response to customer queries (Barclays Registrars is cited by OVUM as an example) whilst the escalation and control features of Workflow Management may also be seen as improving service to customers. Finally the ability to reward staff for efficient working in the presence of heavy workloads is seen by one US bank cited by OVUM as a means of improving staff morale.

B.2.2.4 Problems

It is fair to say that the introduction of Workflow Management has not created enormous problems for users, but, where they have arisen, they have been related to the following:

- lack of managerial participation in the system;

- difficulties with the business modelling process.

The first problem will be familiar to many users of office automation system from which certain levels of management are allowed to abstain. The result is inevitably that the automation process is incomplete because decision makers are absent from the system. Most users who are considering Workflow Management systems will have experienced this problem and are unlikely to repeat their mistakes.

The second problem arises when users regard the Workflow Management software as a solution in its own right instead of a framework within which the business may be made more efficient. There is in these circumstances a tendency to underestimate the work required in modelling the business process and the full benefits of the system cannot then be realised.

B.2.3 Concurrent Engineering

B.2.3.1 Description

The previous subclause on Workflow Management described a technique whereby a business process in a stable environment could be improved in both operational efficiency and in quality of output. This subclause describes a technique whereby a business can implement change (i.e. develop a new product or process) in a safe and timely manner in order to meet the demands of the marketplace. Both applications are related to the concept of TQM but whilst Workflow Management concentrates in the reduction of errors and in overall productivity in a static business environment, Concurrent Engineering concentrates on improving teamwork in a changing and creative environment.

In addition to emphasising the need for error reduction, the introduction of a TQM programme in a company brings out the need for disparate departments, such as sales, marketing, design, manufacturing engineering and finance to work together efficiently towards a common goal. This has become necessary because, as companies grow in size and complexity, departments and divisions tend to become companies within the company and so restrict necessary intra-company communications to a degree which acts against overall company business objectives. As an example, IT Departments in large corporations, which in the 1960s and 1970s had a close relationship with the business planners, grew to such an extent that by the early 1980s they had become companies in their own right with little sympathy for the needs of a dynamic business which they were intended to support (this is discussed further in subclause 2.1.1).

Concurrent Engineering is a set of processes which are designed to give a large and sophisticated company some of the dynamics of a small company where plans can be generated, discussed and amended in the presence of all interested parties in a relatively short period of time. This is achieved through training in matrix management methods and perhaps more importantly in a suite of IT tools designed to support the process of reliable, formal and timely communications.

Concurrent Engineering seeks to remove errors which may arise in the creative process at an early stage and which may later be highly expensive to correct. For example, BMW, interviewed by OVUM in its market survey, reported that an error introduced and uncorrected at the design stage costs a thousand times more to correct after a car has been launched on the market.

In the Concurrent Engineering approach to the management of a change virtual teams are brought together under matrix management disciplines to solve particular problems. In a modern large enterprise neither the people concerned nor the individual supporting computer applications are likely to be co-located and the process must therefore be supported by a variety of communications systems. It is this requirement that links Concurrent Engineering to ODA and to a high quality communications platform such as can be provided by ISDN.

General IT requirements for supporting virtual teams may be summarised as follows:

- a versatile communications infrastructure offering sufficient bandwidth;

- a central data store;

- modelling, testing and development tools;

- technologies to support teleconferencing.

It should be noted that the creation of a perfect IT support infrastructure is unlikely to be possible in a single stage development but instead requires careful planning through many stages. In relation to the above there is evidence which suggests that European companies are approaching Concurrent Engineering with more caution than their American counterparts. For this reason American users are currently in a more advanced stage of development than Europeans, although it is possible that Europeans may catch up as the value of a more carefully planned architecture begins to pay dividends.

B.2.3.2 Current practice

Currently, only large organisations have the ability to make a substantial investment in the myriad of applications and IT support processes which make up Concurrent Engineering. That is not to say that there is no need for Concurrent Engineering in the smaller and medium sized sectors, but it is an indication that investment in a new, and therefore high risk area, will be taken first by those who can carry the risk and benefit most from a successful implementation.

When the larger companies have implemented Concurrent Engineering successfully, they shall be in a position to transfer the technology to their customers and suppliers who will be required to participate in full for their own benefit. In this way the techniques of Concurrent Engineering will spread from successful large companies to the entire spectrum of industrial activity. The spread of Concurrent Engineering will follow EDI, which was originally taken up by a substantial number of companies who then insisted on their suppliers' participation through ready made tools.

B.2.3.3 Benefits

The chief benefit of Concurrent Engineering is the reduction of product development times in order to increase competitiveness. The OVUM study has found that, on average, product development times can be reduced by 33%. Aside from reducing the timescale for development, Concurrent Engineering provides benefits by improving the quality of designs through improved manufacturability, improved documentation and through ensuring that the product is a perfect match to known market requirements. These benefits are difficult to quantify but are nevertheless firmly held by those companies included in the market survey.

B.2.3.4 Problems

There are three main problems in implementing Concurrent Engineering and these are summarised as follows:

a) matching organisational change to the requirements of Concurrent Engineering;

b) integrating information across the enterprise;

c) the difficulty of building an integrated system with immature products.

Problem a) will be familiar to those who have attempted to introduce a computer-aided discipline to the management of a data processing installation through the introduction of problem and change management applications. This should not be seen as preventing implementation but as a barrier over which successful implementers shall cross to achieve a full measure of success with their installation.

Problem b) will be familiar to most IT strategists who have for some time been searching for the ideal solution to this problem. Lack of perfection in this area shall not prevent the uptake of Concurrent engineering but shall slow down its implementation and may reduce the final benefits.

Problem c) is inevitable with an immature technology and should disappear gradually through the efforts of leading edge users and their suppliers.

B.3 Key aspects of development

B.3.1 Introduction

This subclause considers those aspects of Concurrent Engineering and Workflow Management which are most relevant to the use of ODA and ISDN. They are as follows:

a) IT corporate strategies;

b) Document Image Processing;

c) inter-company communications;

d) teleconferencing;

e) data volumes associated with applications.

These aspects are important because they drive a need for open systems, wide area networking and relatively high bandwidth which, taken together, support the need for ODA and ISDN as the communications platform. The five key aspects are discussed in turn.

B.3.2 IT corporate strategies

The brief history of IT in support of the business presented as subclause B.2.1.1 concluded with the statement that there is now a strong move towards open systems and a well defined corporate IT strategy that will support the introduction of relevant Standards for interoperability between communicating applications. Although businesses have in the past disregarded their IT Department in favour of decentralised development led by the business, this is no longer a viable tactic in the complex IT environment associated with the new applications of Workflow Management and Concurrent Engineering.

The modern business demands the type of IT support required by the above mentioned applications and this can be provided well only by a central team of expertise. This in turn adds weight to the requirement for open systems and in particular to ODA for document interchange. This will be particularly pronounced in Europe where IT Departments are generally stronger than their American counterparts and should ensure that ODA emerges as the dominant Standard in this area.

The return of power to the central IT Department shall reinforce the choice of a single public network such as ISDN for a platform on which to carry voice and data communications for the business.

B.3.3 Document Image Processing

The OVUM study on Workflow Management [44] reports that Document Image Processing is the single most important application supported by Workflow Management systems. In fact, Document Image Processing Systems account for over half of the software licences sold for Workflow Management. Workflow Management is a natural user of the ODA standard, and images are included through the standard faster scanned facility allowed in the standard. The relatively high bandwidth requirements of Document Image Processing will necessitate the use of ISDN rather than conventional X.400/X.25 networks, and may in the future give rise to a requirement for B-ISDN for very large systems. This is probably the most important reason for using ISDN as the communications platform for Workflow Management and ODA. This reasoning is backed by the need for wide area networking discussed in the next subclause.

B.3.4 Inter Company Communications

Many companies, and in particular the multinationals, have functions spread over wide geographic areas and therefore have a requirement for wide area communications to make effective use of both Workflow Management and Concurrent Engineering. The need for inter company participation in these new applications may, however, be a more significant factor in the growth of wide area communications in the future. Thus the use of high speed LANs, although very effective for communications restricted to a single premises or campus site will be unable to satisfy all an enterprise's communications demands in the future. These will be met by ISDN and possibly in the future by B-ISDN.

B.3.5 Teleconferencing

As explained in subclause B.2.3, an important requirement for the establishment of Concurrent Engineering is strong teleconferencing facilities to bring together all relevant parties into team meetings. Teleconferencing for Concurrent Engineering shall provide conventional voice and video in addition to a system for document interchange and access to corporate data held in central databases and controlled by appropriate applications.

ISDN is the natural choice to act as a standard communications platform for teleconferencing traffic on the basis that 2 x 64kbit/s bandwidth compressed video is sufficient for meeting purposes. ISDN as an economic means of providing the communications platform (B-ISDN may be economic in the future) will tend to reinforce its association with ODA applications.

B.3.6 Data volumes associated with applications

The development of relational database systems has tended to increase the quantities of data associated with applications and the use of Computer Aided Design within a Concurrent Engineering umbrella will tend to reinforce this trend. The transfer of large amounts of data between locations as required by Concurrent Engineering will therefore require high bandwidth and ISDN, or in future, B-ISDN will be the natural network of choice for most Concurrent Engineering users.

B.4 Market Forecasts

B.4.1 Workflow Management

Table B.1 presents market forecasts for Workflow Management systems as researched by OVUM. The value of the market is given in US dollars for US, Europe and US and Europe combined. The table also gives information on licences, seats (i.e. users on each licence) and other information related to the size of the PC/LAN and Document Image Processing (DIP) markets.

An examination of the combined US and Europe part of the table reveals that between 1992 and 1995 OVUM expects the market to double in size (approximately) each year with the first signs of market saturation (as illustrated on a Gompertz curve) occurring in the growth between 1995 and 1996. An examination of the Document Image Processing market over the same timescale reflects this picture, although in the case of DIP systems the saturation is more marked at the end of the period. This may be explained by accepting that, although Workflow Management is applicable to a large number of business applications, it will be dominated by Document Image Processing in the next few years. The Document Image Processing market will grow exponentially between now and 1995 when it will begin to saturate. During this period the market for Workflow Management will be pulled by the Document Image Processing market, but, as this saturates, Workflow Management will continue to grow (at a slower rate) as more applications are absorbed into the Workflow Management framework.

It should be noted that during the period of interest the market for servers and PCs will grow in a similar way to Workflow Management indicating the importance of PC/LAN technology to Workflow Management.

An examination of the data for the US and for Europe reveals that the US was a larger user of Workflow Management than Europe in 1991 and will proceed to dominate Europe in the use of this technology in the future. The OVUM figures show a slower growth rate for Europe over the period of interest so that from providing a little over 40% of the market in 1991 Europe's share will fall to approximately 25% by 1996.

B.4.2 Concurrent Engineering

Market forecasts for Concurrent Engineering are provided in tables B.2 (Europe) and B.3 (US) as researched by OVUM. Figures are supplied in each case for framework software on which users build their own customised systems and for tools which are used for Computer Support for Co-operative Work (CSCW). The tables also indicate the size of the market for those suppliers and system integrators who wish to participate in this growing and complex market.

An examination of the data in table B.2 shows that over a 9 year period the total market in Europe for frameworks and CSCW tools will grow from US dollars 16 million to over US dollars 7 billion by the year 2000 (1 billion = 1000 million) after reaching a peak of US dollars 9,8 billion in 1999. Growth is exponential up to 1996 after which growth slows as the market saturates.

An examination of table B.3 shows a similar picture for the US where the market is expected to peak in 1997 (US dollars 10,2 billion).

A comparison of the two tables shows that the US will dominate the market in the first few years at its ability and desire to take on new technology far outstrips that of Europe. However, after 1996 the markets will be of comparable size.

B.5 Conclusions

The market research contacted by OVUM on Workflow Management and Concurrent Engineering has shown that these two applications will create large and important markets in Europe and the US. In general, the US will lead Europe in these new technologies and, for Workflow Management, will increase its share of the combined market from 60% to 75% over the next five years. In Concurrent Engineering growth will be initially much faster in the US because of the more cautious approach of European companies, but Europe will catch up and provide a market for Concurrent Engineering products of comparable size by the end of the decade.

Both new applications may be seen as supporting applications for the drive towards TQM. Workflow Management will tend to be used to create higher efficiencies and improved service (fewer errors) for stable processes in the business environment. By contrast, Concurrent Engineering represents a series of tools and techniques designed to assist a company compete effectively in a changing environment of new products and services. Both applications could have a significant part to play in the success of European industry in this decade.

IT support is crucial to the successful integration of Workflow Management and Concurrent Engineering in business. Systems will be built with an understanding of future interoperability requirements and Standards shall have an important part to play in the development. Faced with the problem of investing in new systems for which interoperability between applications is significant, businesses will work so as to ensure that the systems are built within an overall IT corporate strategy.

The nature of both applications under consideration is such that both require a standard system of document interchange. In Europe the natural choice for this will be ODA. In both cases systems shall be required to operate over Wide Area Networks, (WAN), and ISDN therefore becomes a candidate for a standard communications platform. Important factors in its choice as the standard shall be the influence of Document Image Processing in the growth of Workflow Management and the need for a high performance network to facilitate the complex teleconferencing requirements of Concurrent Engineering. The precise requirements currently available suggest that ISDN will be adequate for the task but in the future B-ISDN, may be more suitable for large and complex systems that may be developed.

B.6 Suggestions for further work

The ETR has shown the importance of Workflow Management and Concurrent Engineering as applications which will support the drive towards TQM. As such they will have an important part in the future development of industry in Europe. The significance of corporate IT strategies and the availability of suitable communications platforms has been demonstrated. ISDN has been shown to have importance in providing a suitable means for wide area bandwidth for images within an ODA format and for multi-media requirements for teleconferencing in support of Concurrent Engineering. It was noted that ISDN appeared to be a suitable platform for the traffic as it is currently understood, but that B-ISDN may be required to support these and other multi-media applications in the future.

It is perhaps appropriate to study in some depth the communications needs of the applications that are required to support TQM in a European context. The study should analyse the applications and determine those for which multi-media communications are required. These should then be classified in the following way:

- requiring ISDN for the foreseeable future;

- requiring ISDN but with expansion could require B-ISDN;

- requiring B-ISDN.

In each case, the market should be sized for the next 5 years with any significant changes over this timescale recorded.

The output of this study would be of benefit to future Standards work on ISDN and B-ISDN, and could be used as standard ETSI base data for future work in this area.

Table B.1: The installed base and market for packaged workflow licenses - world-wide

US and EUROPE	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**
WFM license installed	1.427	2.678	4.542	7.773	13.313	20.812
Number of seats	23.192	48.370	96.870	187.085	340.335	595.155
Yearly license market (value based on $1k per seat)	7m	25,18m	48,5m	90,21m	167,6m	254,82m
Yearly related PC market (value based on $2k per PC)	7m	25,18m	48,5m	90,21m	167,6m	254,82m
Yearly related server market (value based on $50k)	45m	125,13m	186,4m	323,1m	554m	821,7m
Yearly related DIP h/w and s/w (value based on average $100k per system)	10m	46m	93,6m	182,4m	427,7m	498,6m
Total value market for h/w and s/w per year	**69m**	**221,49m**	**377m**	**685,93m**	**1.316,94m**	**1.829,94m**

US	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**
WFM license installed	769	1.456	2.618	4.844	8.649	14.052
Number of seats	15.637	33.060	67.715	136.215	259.860	440.130
Yearly license market (value based on $1k per seat)	4,37m	17,42m	34,66m	68,5m	123,6m	184,27m
Yearly related PC market (value based on $2k per PC)	4,37m	17,42m	34,66m	68,5m	123,6m	184,27m
Yearly related server market (value based on $50k)	22,5m	68,73m	116,2m	222,6m	380,5m	560,3m
Yearly related DIP h/w and s/w (value based on average $100k per system)	8,5m	40,5m	82,7m	163,8m	294,1m	440,7m
Total value market for h/w and s/w per year	**39,75m**	**144,08m**	**268,21m**	**523,4m**	**922m**	**1.369,54m**

Europe total	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**
WFM license installed	658	1.222	1.924	2.929	4.664	6.760
Number of seats	7.555	15.310	29.155	50.870	80.479	155.025
Yearly license market (value based on $1k per seat)	2,62m	7,76m	13,85m	21,72m	44m	70,55m
Yearly related PC market (value based on $2k per PC)	2,62m	7,76m	13,85m	21,72m	44m	70,55m
Yearly related server market (value based on $50k)	22,5m	56,4m	70,2m	100,500m	174m	261,4m
Yearly related DIP h/w and s/w (value based on average $100k per system)	1,5m	5,5m	10,9m	18,6m	134m	57,9m
Total value market for h/w and s/w per year	**29,25m**	**77,41m**	**108,79m**	**162,53m**	**396m**	**460,4m**

NOTE: Figures in US Dollars (Source OVUM Ltd.)

Table B.2: Concurrent Engineering revenues - Europe

Process Management toolset (Frameworks)	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Systems revenues	4500000	12900000	33300000	51520000	82035000	131556000	198750000	302620000	438400000
Seat revenues	7500000	32250000	11100000	515200000	1230525000	2740750000	4770000000	5447160000	2498880000
Shared application access (LAN-based)	450000	1935000	6938000	25760000	71781000	205556000	397500000	544716000	832960000
Integration Services	3735000	14125000	45371000	177744000	415302000	923358000	1609875000	1888348000	1131072000
Total revenues	**16,2m**	**61,2m**	**196,6m**	**770,2m**	**1799,6m**	**4001,2m**	**6976,1m**	**8182,8m**	**4901,3m**
CSCW Tools									
Shared application access (WAN-based)	174622	2836080	7367685	50360310	114693090	142817580	454624770	763309290	751844760
Full CSCW systems	0	202800	1375500	12482500	35993650	86765875	335336475	814274000	1366615500
Total revenues	**0,17m**	**3,04m**	**8,7m**	**62,84m**	**150,67m**	**2955,84m**	**7899,61m**	**1577,68m**	**2118,5m**

NOTE: Figures in US Dollars (Source OVUM Ltd.)

Table B.3: Concurrent Engineering tools - US

Porcess Management toolset (Frameworks)	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Systems revenues	6900000	21420000	62670000	110940000	170100000	262668000	337500000	474370000	612500000
Seat revenues	11500000	89250000	292460000	1775040000	4252500000	7004480000	60750200000	4506515000	3675000000
Shared application access (LAN-based)	690000	5355000	18279000	88752000	248063000	525336000	759375000	901303000	1225000000
Integration Services	5727000	34808000	112023000	592420000	1401199000	2337745000	2151563000	1764656000	1653750000
Total revenues	**24,82m**	**150,83m**	**485,43m**	**2567,15m**	**6071,86m**	**10130,23m**	**9323,44m**	**7646,84m**	**7166,25m**
CSCW Tools									
Shared application access (WAN-based)	134325	2292975	8672625	46304445	86463855	134225070	376833330	629049510	471581760
Full CSCW systems	0	163500	1537500	11583750	27529700	79102700	279788550	673338400	9236281230
Total revenues	**0,13m**	**2,46m**	**10,21m**	**57,99m**	**114m**	**213,33**	**656,62m**	**1302,39m**	**1395,21m**

NOTE: Figures in US Dollars (Source OVUM Ltd.)

History

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