Introduction To Electronic Data Interchange

A Primer

INFORMATION SERVICES

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A Primer

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INFORMATION SERVICES

General Electric Information Services Company

"Technology has in it the power to liberate humankind from its drudgery and from a lot of work that need not be done"

Tariq Ali

'Computing' 9th May 1985

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This booklet was originally prepared by Clive Akerman, in the GEISCO Ltd. operation in England. Its purpose is to provide an overview of the concept of EDI (Electronic Data Interchange), and to give examples of the differing kinds of EDI systems appearing. It also discusses some of the concerns regarding data communications, security, use of standards, and even more importantly, how users should go about setting up the project teams and management techniques required to have a successful EDI implementation. It shows how use of a 'third party supplier' can be used to get a rapid, relatively easy start into EDI.

My contribution has been to add references and discussion that are more applicable to the U.S. environment, such as the appearance of ANSI X.12 standards. I have also provided the discussion on costs and benefits from the grocery industry experience with UCS. I made numerous other more minor changes, mainly to fit the document more closely to what we see happening in America (athough the problems, environment and methods of solution seem remarkably similar worldwide). While I was at it I also 'Americanized' most of the spelling.

GEISCO, as a worldwide organization, has considerable understanding of the entire EDI process. The SMMT system which Clive references operates on the GEISCO service, as well as the 'just-in-time' inventory system described herein. There are a number of Trade Associations in the U.S. that serve as prototypes to the discussion of Clearing Houses in this booklet, such as MEMA (Motor Equipment Manufacturers Association) and NEDA (National Electronic Distributors Association), all of whom operate EDI systems on the GEISCO service. GEISCO has been in the forefront in the establishment of 'Trade Clusters', and a number of these clusters are now beginning operation using the GEISCO service.

Regarding the 'don't re-invent the wheel' philosophy described within this booklet, GEISCO has developed a number of product offerings that serve as elements in the EDI process. These include:

— The EDI*EXPRESS™ System—This is the 'public' Clearing House mailbox system which serves as the heart of most EDI applications.

— The EDI*PC™ System—This is a PC based workstation that allows users to start EDI activities with a simple, low cost approach.

— The TRADE*EXPRESS™ System—This system is being designed to address the needs of the international trade community. It includes a specialized PC workstation, as well as trade document control and tracking capabilities needed in trade clusters.

— The EMC*EXPRESS™ System—This is the GEISCO system that is a leader in the Electronic Medical Claims business.

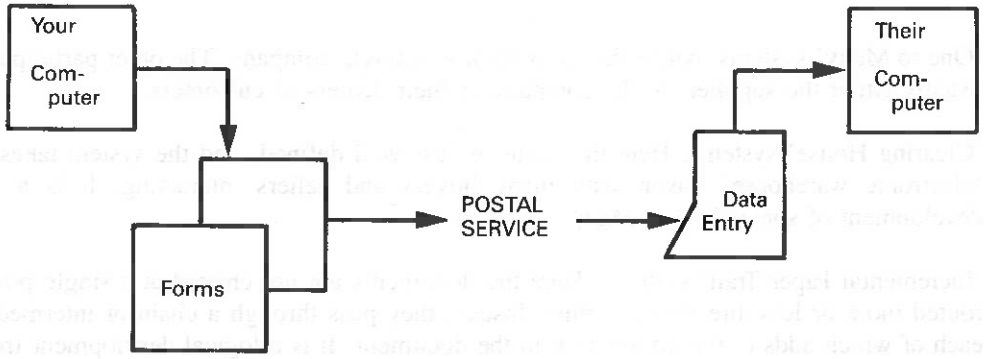
We feel this combination of commitment by our company, our worldwide network and communications capability, our technical skills, our product offerings, and most importantly, the experience of our people, put GEISCO in an ideal position to assist you in making Electronic Data Interchange a reality for your company.

William G. Cafiero
Senior EDI Consultant
General Electric Information Services Company

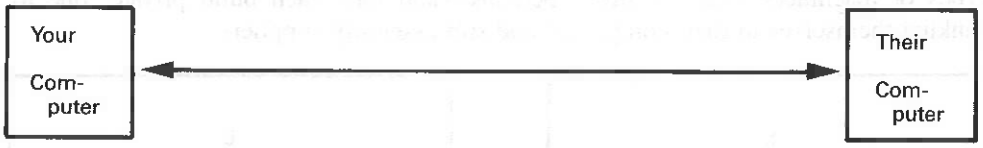
The usual, textbook, definition of Electronic Data Interchange (EDI) is:

"The direct computer-to-computer exchange of standard business forms"

Put simply, this means that if you prepare business forms—such as orders, invoices, remittance advices, etc—in a computer, and your trading partners copy the information into their computers for processing, then we can replace this:



with this:



Even at this elementary level, we see three immediate benefits arising from the use of EDI; they all stem from a reduction in complexity:

— It saves time. Your order or invoice or whatever is delivered more or less instantaneously, instead of taking anywhere up to a week. Your orders can, at least in principle, be shipped the same day you submit them.

— You are no longer at the mercy of a system able to mis-route, delay or lose your forms without an immediate means of control you can exercise. At EVERY step in the conventional path your form can—and sometimes does—get mutilated or lost. EDI gives you the ability to quickly verify delivery in a direct path mode.

— Your trading partner no longer has to key your transaction into his computer—with the consequent risk, and occasional eventuality, of transcription error. By eliminating this step, EDI improves accuracy (and completeness).

We can summarize these by saying that, with Electronic Data Interchange, you can get better service from your suppliers, give better service to your customers, become more competitive and save real money. And, of course, everyone involved can share in these benefits.

TYPES OF APPLICATION

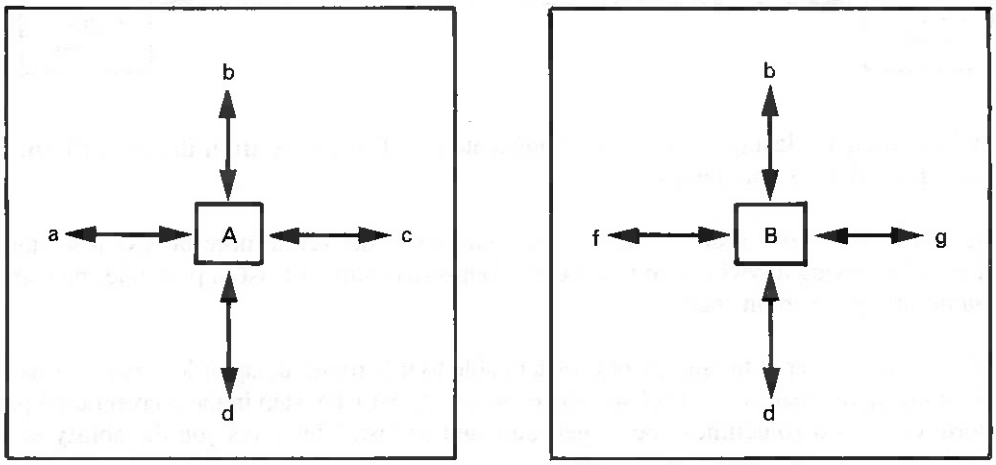
In practice, there are many types of EDI systems, which may be roughly classified according to the types and roles of the participants. In the following Sections we explore three general classes in more detail:

— 'One to Many' systems, where the focal point is a single company. The other participants are usually either the suppliers to the company or their dealers or customers.

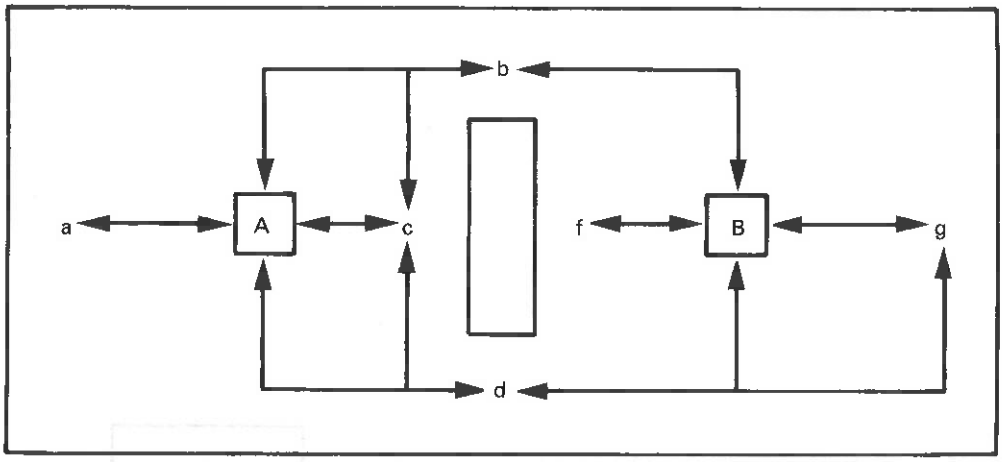
— 'Clearing House' systems. Here the center is less well defined, and the system takes on an 'electronic warehouse' flavor, with many buyers and sellers interacting. It is a logical development of some 'One-to-Many' systems.

— 'Incremental Paper Trail' systems. Here the documents are not created at a single point and routed more or less directly to another. Instead they pass through a chain of intermediaries, each of which adds to the information in the document. It is a logical development from the Clearing House system.

The ways in which systems develop and merge are easily illustrated. Suppose two organizations build similar types of machinery—cars or ships, perhaps—and they each build private 'one to many' systems linking themselves to their component and sub-assembly suppliers:



Then in virtually every such case, the assemblers 'A' and 'B' will have some common suppliers—'b' and 'd' in this case. In addition, if these two supply 'low level' goods, such as paint or nuts and bolts, then they probably also supply the sub-assemblers to 'A' and 'B', and we have a set-up like this:



The two 'independent' EDI systems have grown into something of a Clearing House, which can also extend to dealers, agents and after-sales service organizations who will themselves use 'b' and 'd' as sources of spare parts.

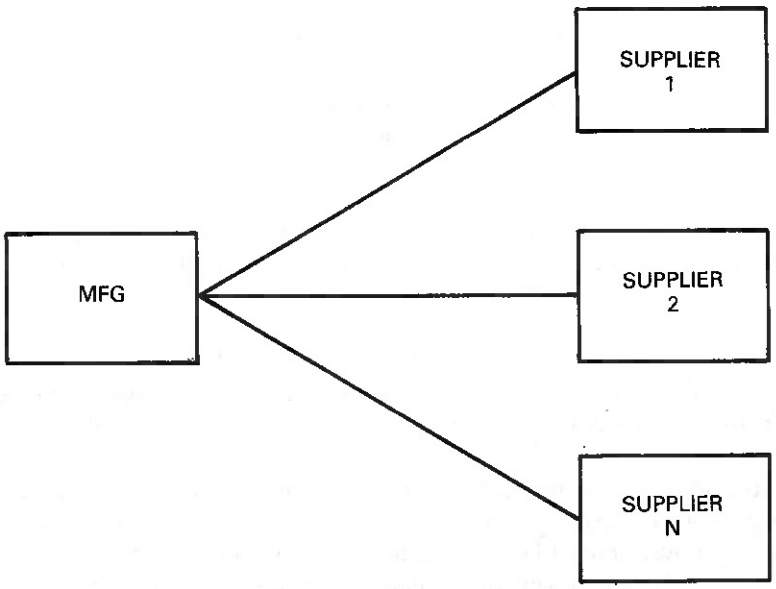
If, as is likely, 'A' and 'B' export at least some of their output, then additional links to embrace freight forwarders, shippers and banks will extend the Clearing House in the direction of International Trade Clusters.

Ultimately, then, even very modest systems have the potential to develop into dense networks of connections between all the players in entire industries, overlap from industry to industry, and develop communication paths into 'external' service industries, both at home and abroad.

Later on we explore some of the implications of these systems—which will ultimately impinge upon virtually every aspect of a company's operations. In the meantime it is important to remember that there is nothing essentially novel about EDI—the same forms and transactions traditionally transferred on paper will still be passed from company to company. The transactions will need the same approvals and authorizations, and will have the same effects. The sole difference is that they will no longer be on paper, which could allow us to make pompous statements about 'The Paper-less Office'. To my mind a more constructive aspect is that we will no longer be copying information from paper to paper, and from paper to computer, and will no longer have to live with the errors of omission and transcription which these processes imply. We will move towards 'The ERROR-FREE Office'.

The impact will be tremendous—it is estimated, for example, that American automotive manufacturers ALONE will save around two BILLION dollars a year, simply by removing the sources of error and delay inherent in current systems.

Section 2. ONE TO MANY SYSTEMS



TYPICAL ONE TO MANY CONFIGURATION
may be either closed or part of an open system

THE BUSINESS ENVIRONMENT

During the last decade or so the business environment has changed very considerably. For example, the development of the EEC and the wider trend towards the reduction of trade barriers have led to a remarkable 'internationalization' of business, to the extent that it is becoming difficult to think of anything which does not contain imported elements or get sold on a purely local basis. This growth in marketplaces has led in turn to increased competition, particularly from countries which have moved from being agrarian economies to manufacturing economies in a very short time. These competitors have entered the world market with two important advantages over more traditional American and European firms:

— No inherited investment in labor-intensive procedure and older equipment.

— An ability to readily adopt the latest and most efficient manufacturing techniques.

The effect is plain to all—a motor manufacturer in the Far East can build a car and ship it half way around the world for an estimated $2500 LESS than the factory gate cost of an equivalent vehicle in the U.S.

'JUST IN TIME'

Manufacturers in the USA and more recently in Europe have responded by adopting the 'Just In Time' philosophy. This is based on the idea of ordering supplies of parts in small batches, for delivery more or less directly to the production line as and when they are needed. The manufacturer benefits in two ways. To begin with there is a considerable reduction of stocks of components and sub-assemblies, with their related financial and operational overheads. More important is the increased flexibility of product mix, to the extent that some medium to high volume motor assemblers can make EVERY car 'to order', in a reasonable time scale. This gives improved responsiveness to customer demand, and, given adequate quality and design features, a competitive edge over imports.

The suppliers gain similar benefits, in that they too do not need to carry large stocks of parts—finished, and hence high value, goods in particular. Their clients are also often willing to pay for their components on an accelerated basis, so adding a cash flow benefit—which forms a powerful incentive to help make 'Just In Time' work.

'Just In Time' obviously carries some penalties! There is a growth in volume of intercompany paperwork, which can quadruple if the assembler moves from a monthly to a weekly cycle. And there is an absolute necessity for replenishment orders to be delivered to the suppliers quickly, reliably and accurately. Postal delays, transcription errors and general muddle are simply not permissable when stock-in-hand by the production line is enough for just a few day's work!

The solution of course, involves the use of Electronic Data Interchange.

2. ONE TO MANY SYSTEMS

COMPUTER TO COMPUTER LINKS

Several major manufacturers have installed direct links between their own computers and those of their most important suppliers to satisfy the need for fast and accurate order and invoice exchange. Other organizations have started from their dealer networks and are beginning to introduce mechanized links to improve the customer service aspect of their businesses. The micro-computer industry is a leader here, with 'Dealer Support Systems' able to accept orders quickly, able to distribute software and documentation electronically, and providing direct electronic links between dealer staff and specialist support personnel to give faster and more effective resolution of technical and commercial queries.

Both supplier and dealer systems usually begin as 'One To Many' systems, with the assembler being the prime mover, forging outward links from his computer to those of the satellite companies.

STEPS IN THE PROCESS

It is worth taking a little time to explore these link-ups in some detail, highlighting some of the difficulties which have to be overcome. The underlying principles are simple:

A—At the assemblers' computer site, the replenishment orders are written to a computer file instead of being printed.

B—At some mutually agreed time this computer is connected by telephone line—either leased or dial-up—to a clearinghouse/processing function and then to the suppliers' machines, and, after some sort of initial 'handshake' routine which establishes the identities of the two machines, the relevant order(s) are processed and forwarded to the supplier.

C—The supplier processes the order and may optionally send an acknowledgement through the clearinghouse. He produces packing notes and allied documentation for his warehouse and transportation company.

D—The supplier produces his invoices as a computer file and sends them to the manufacturer.

E—The manufacturer sends his remittance advices electronically and pays the bills through the clearinghouse which may itself process the payment through the Bank Clearing System.

[While we have used the assembler-supplier relationship as an example, clearly a very similar set of words would describe a Dealer Support System]

Now let us look more closely at these steps

A—There is no special problem in writing orders to a computer file. But if there are around 25000 suppliers—typical of the motor industry, for example—then there is an intractable problem in dealing with 25000 files! There is also a need to print conventional orders for suppliers not yet hooked into the EDI system, and the need for an administrative procedure to manage the change-over from paper to EDI as suppliers become ready. There is often a one-time difficulty in scheduling the design and programming creation resources of the Computer Department, since they are often busy with the latest changes to the Payroll system.....

B—Time-slots have to be agreed upon with each electronic correspondent. Each has to fit the transmission session(s) into his computer's workload. Experience has shown that while it is easy to deal with a handful of such links, it verges on the impossible to deal with dozens, let alone hundreds of individual communication sessions.

Once the scheduling problem has been solved, the two computers have to be able to 'talk' one to the other. As in many competitive industries, each major computer manufacturer has developed its own proprietary procedures. Some international standards for intercomputer communications have been agreed upon but there is a wide range of transmission speeds and a variety of ways of structuring the conversation (how the data is packaged, how good/bad data is acknowledged, how bad or damaged data is repaired or retransmitted, etc). Clearly every pair of machines involved in the EDI system have to have some elements in common—yet the trading partners have all made their computer procurement decisions long before EDI was thought of, and have equipment suited to their private needs. It is VERY likely that VERY few of these computer to computer links are actually feasible without investment of both money and other resources.

Even if one manufacturer is able to arrange links with a few suppliers, the latter will no doubt face taxing problems when they try to deal with other manufacturers in other EDI links. So, even at this early stage in our discussion we have reached a serious problem. Let us look for another one.

C—Now the supplier has a computer file containing the order. All he needs is to be able to read it! Human readers can find the necessary bits of information from paper orders, almost irrespective of the layout. Computers are not nearly as clever, so either, in the ideal case, every member of an EDI network needs to adopt identical formats and always transmit standard format documents, or each partner needs to know the formats of everything he receives, so that he can translate incoming documents to his own internal formats. As before, the problems are solvable if there are only a few sets of format to worry about....

We need not delve into the other two steps—they show the same symptoms.

OVERCOMING THE DIFFICULTIES

This tale of woe has been presented to show that, even in organizationally simple EDI systems, there are serious non-trivial problems to be solved. At minimum, the implementation of the EDI system must be approached as a major project. Indeed it has some things in common with the build-up to the production of a new product range, with the same group of companies having to get a very complex act co-ordinated.

In Section 5 we shall see how the Standards problems may be approached, and discover that, against all expectations, there are solutions already available. We shall also find that, if we look outside the 'head-on' approach, the organizational and logistical difficulties may be reduced to manageable, and soluble, proportions.

In both cases the solution revolves around a simple idea---palm off the problems onto a third party! Most of the difficulties are rooted in the fact that every company has made its computer procurement decisions, and has designed and created its computer programs to satisfy its own internal needs. Certain outside agencies, called Remote Computer Service vendors, on the other hand, have built up their not inconsiderable businesses starting from the premise that their clients have, between them, virtually every make and model of computer known to man. They have, accordingly, built into their systems the interfaces and computer power needed to perform translations, and use communication systems able to 'talk' in all standard computer languages. RCS vendors also have very large numbers of communication ports, enabling hundreds, or even thousands of users to work simultaneously—and thereby bypass the scheduling problem.

By providing a 'buffer' between suppliers and assemblers, the third party vendors also enable builders of EDI systems to bypass 'political' problems. The vendors are financially and managerially independent from the user companies—who are therefore not placed in the position of becoming too dependent on particular trading partners, or forced into conflicts of interest with commercial competitors.

Since we have shown that the problems of implementing EDI systems are surmountable, it is now appropriate to look at some real-life examples of One to Many EDI systems.

A SUPPLIER NETWORK

The prime mover in this example is a major American and European manufacturer of industrial trucks. Their reaction to competition from the Orient was to simplify their products and operations and move towards Just In Time inventory replenishment policies. The products are moderately complicated, with a range of about 30,000 purchased components from some six hundred suppliers. The components are used at thirteen factories and three parts depots; they represent nearly 70% of the product cost.

When this company first tried to implement their new ideas they ran into many of the problems outlined in the previous Section. A particular local difficulty was that, while THEY could see benefits from 'J I T', their suppliers were unwilling to go to a lot of trouble unless they could share in the benefits (!) What actually happened was that the manufacturer began to work with their suppliers to help them plan their production and in turn implement their own 'J I T' systems.

The communication problems were turned over to an outside Remote Computer Services vendor.

The anticipated payoff will be a considerable increase in cash flow, with an estimated 15-20 day reduction in the cash cycle. The suppliers are paid by return, and thus also see a cash advantage. Overall, it is believed that the new methods will cut overall administrative costs by no less than 50%.

A DEALER NETWORK

This organization is an important manufacturer of micro-computers, distributed by an extensive chain of dealers in the USA and elsewhere. The micro business is fiercely competitive, and one of the keys to success is excellent service to the dealers in the provision both of goods and of information.

The first phase of the EDI system will involve up to 2000 dealers and distributors, with more to follow. Dealers will be able to communicate with central support staff using an electronic mailbox facility, and to interrogate databases of technical and commercial information. Thus right from the start the manufacturer will benefit by being able to contain the growth of dealer support telephone staff, and by having direct information paths from headquarters staff to dealers. The dealers benefit by having local access to most of the information hitherto obtained by calling a distant 'service desk' and, where necessary, direct access to specialists.

Extensions to the basic system will provide remote order entry for dealer replenishment requests and electronic distribution of software updates, documentation and suchlike. Ultimately it is expected that virtually all 'normal' communications, worldwide, between the manufacturer and their dealers—and possibly their larger corporate users—will be electronic.

This application is unusual in that all of the dealers have immediate access to identical computers, so that the software elements of the system could be 'packaged' for local use—once! (And updates can be distributed automatically and electronically!)

INTERNAL TRADE

This example shows how the internal efficiency of a very large and complex multinational company may be improved using EDI. They manufacture and trade in many countries and there is a very large amount of trade between the various components of the company, as well as with external suppliers and customers. The aim was to simplify the trading process.

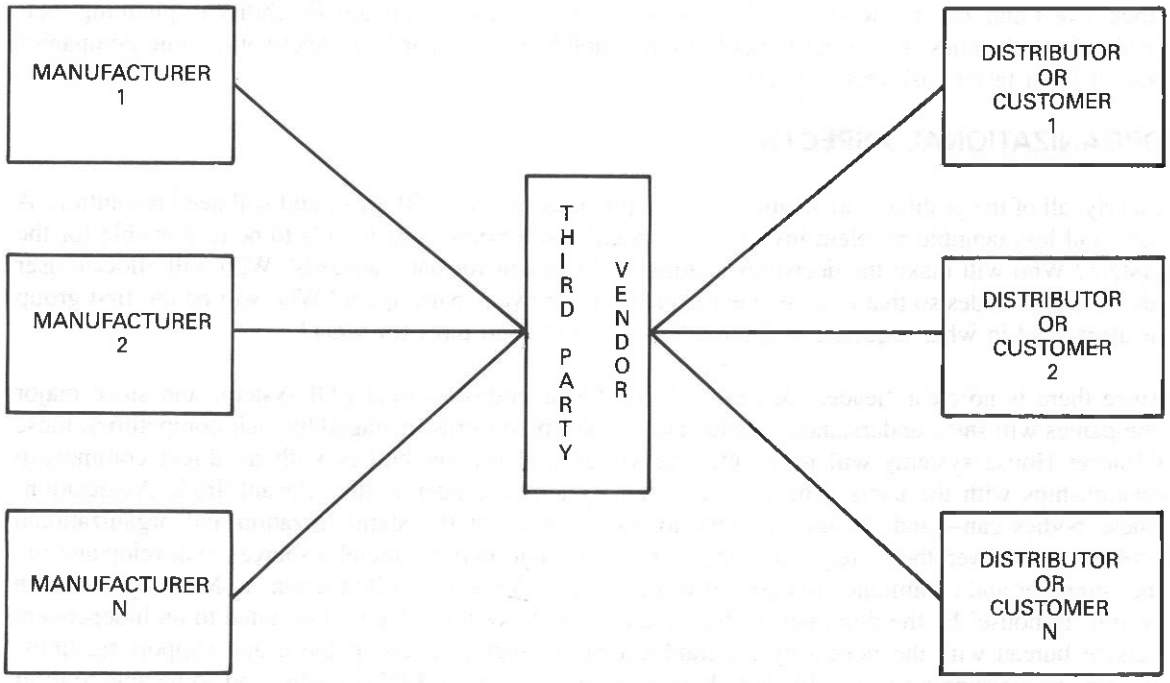
The solution was to set up what is, in effect, a private, internal Bank. This handles all intercomponent financial transactions, foreign exchange transactions, export credits and supplier payments. The Bank, or, more accurately, 'Re-Invoicing Company' was set up in Holland to take advantage of the favorable tax and banking regulations there.

The system involves electronic collection, on a daily basis, of the invoice registers of each subsidiary. These are analyzed and processed to give the management of the 'Bank' a comprehensive picture of the current foreign exchange, currency, investment and due payment situations at the beginning of each working day. Instructions are then transmitted—in many cases electronically—to the various banks in Holland or elsewhere, and confirmations of actions and resulting balances received in return.

The topology of the system is like that of the manufacturer described in our first example—except that here the 'suppliers' include the various components of the company and its bankers, and the 'goods' shifted to and fro are just money.

The benefits, too, resemble those of the manufacturer and their suppliers. The components have greatly simplified procedures and smaller accounting departments; these in turn issue far fewer instructions to banks, and thereby control bank charges. The operating units are no longer concerned with the mysteries of foreign exchange dealing. The Company is able to take a full OVERALL view of its foreign exchange—and customer—risks; it is able to reduce its liability to certain forms of taxation; it is able to forecast net needs for various types of money and make near-optimum provisions. Spare cash can be held in the most advantageous manner, and a netting facility in fact leads to substantially reduced cross-border cash flows.

The 'Internal Bank' has a minute staff, who work almost entirely electronically, yet who make a very large positive contribution to the financial health of the Company as a whole.



TYPICAL MANY TO MANY CLEARINGHOUSE SYSTEM CONFIGURATION
may be either closed (within an industry) or part of an open system

3. THE ELECTRONIC CLEARING HOUSE

While the definitions of types of EDI system are blurred at the edges, and simple systems rapidly grow or overlap into more complex systems, there is a distinct style of system suited to some organizations which can best be described as a 'Clearing House'.

These systems START OUT with a group of companies, involving more than one major assembler, their suppliers, and perhaps dealer networks and after-market chains, banding together into an electronic document interchange network for their common benefit. The simplest difference from One to Many systems is that the major companies, while very likely to be the prime movers, are not acting from purely selfish motives. Right from the start they will, to some extent, be co-operating with their competitors, for the good of the industry of which they form a part.

As we have seen in earlier sections, everyone benefits. Most if not all participants see a reduction in stock levels and are able to offer better customer service through greater flexibility in planning their production schedules. Everyone benefits from simplified and error-free paperwork; some companies benefit from faster cash recovery cycles.

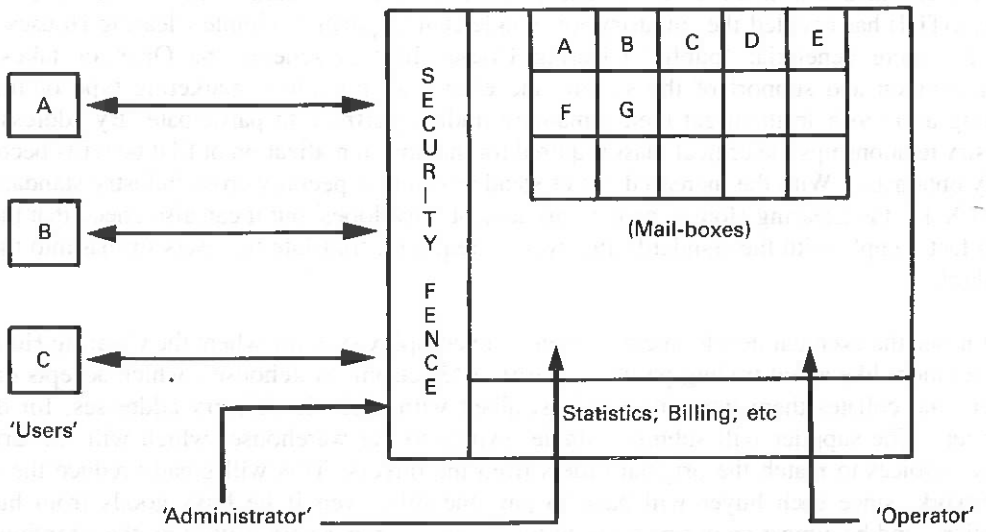
ORGANIZATIONAL ASPECTS

Clearly, all of the problems we examined in the previous Section still arise, and still need resolution. A new, and less tangible problem involves the operational aspect—just who is to be responsible for the system? Who will make the decisions relating to document format standards? Who will allocate user identification codes so that there is one unique code for every participant? Who will be the first group of users, and in what sequence will the others join in? Who pays for what?

Since there is no clear 'leader' or central focus for an industry-wide EDI system, and since major companies will show understandable reluctance to accept systems managed by their competitors, these Clearing House systems will most often be set up and run by bodies with no direct commercial relationships with the users. The most common system manager is the relevant Trade Association. These bodies can—and should—be able to resolve most of the standardization and organizational problems. However, they rarely have the expertise, inclination or financial resources to develop and run the computer and communication aspects of the system. So, even while the One to Many systems can be run 'in-house' by the dominant partner, industry-wide systems seem best suited to an independent outside bureau with the necessary geographical reach, technical competence and support facilities. Such a service supplier is also likely to have experience of major EDI systems, and so be able to offer invaluable advice at the planning and preparatory stages.

HOW IT WORKS

First of all, let us take a closer look at the nature of a 'Clearing House'. Like most of the ideas we have seen thus far, in its most fundamental state the Clearing House is very simple. The Clearing House is like an old fashioned pigeonhole mail rack. Each protagonist has a labelled pigeonhole fitted with a security device—like a lock—to prevent unauthorized EXTRACTION of documents. However, subject to more or less stringent sets of rules, anyone able to get into the mail room can deposit items in any of the boxes. Diagramatically it looks like this:



When User 'A' attaches his computer to the Clearing House, he first has to satisfy the 'Security Fence' that he is in fact authorized to use it. Then he is able to gain access to his own pigeonhole or mailbox, and extract incoming documents—orders, invoices, confirmations, etc. During the same communications session, 'A' can deposit his outgoing transactions in the mailboxes owned by his trading partners. He can probably also determine whether previously deposited documents have been extracted, and obtain other audit and status reports from the system.

The outgoing transactions are usually 'cleared' to the recipients' mailboxes within a few seconds. While this level of immediacy doesn't confer any special business benefits, it does ensure that there are no piles of forms left lying round unprocessed—and liable to accidental erasure—and that when a user extracts his incoming transactions he has EVERYTHING available.

The Clearing House will maintain statistics showing the level of activity for each user, and, at some predetermined frequency, use these to prepare bills according to whatever criteria have been agreed upon. The Clearing House 'Operator' will look after these overhead jobs. The Operator may also be the 'Administrator', whose main task is to maintain the Security Fence, and arrange for new users to be added and defunct users to be deleted. We will look at these functions in more detail later.

In a simple Clearing House each transaction is handled separately, though a large number of documents may be sent or retrieved during one access to the system. By 'separately' we mean that the Clearing House sees just 'forms in envelopes', and is concerned SOLELY with the correct processing of the envelopes; it has no concern with their contents. (Although presumably, as with the ordinary postal system, pornographic or seditious material should not be transmitted!) This clear distinction between 'envelope' and 'contents' is obviously a matter of importance if the contents contain materials such as instructions relating to the transfer of money.

3. THE ELECTRONIC CLEARING HOUSE

The current advances in the establishment and use of Data Standards (such as ANSI X.12, TDCC, UCS, GTDI) has enabled the 'industry' or 'single central partner' simple Clearing Houses to expand into the more beneficial 'public' Clearing House. In this scheme the Operator takes over the administration and support of the system and even may provide a marketing type of function for existing users to help them get their remaining trading partners to participate. By addressing cross-industry relationships the critical mass required for maximum realization of EDI benefits becomes more easily obtainable. With the increased use of standards, and especially cross-industry standards such as ANSI X.12, the Clearing House can not only look at 'envelopes' but it can also check that the contents do in fact comply with the standards and even, if required, translate the users format into the required standard.

We foresee the eventual development of even more complex systems where the Clearing House does in fact act more like a real trading partner—a sort of 'electronic warehouse', which accepts orders from buyers and collates them into single orders, albeit with multiple delivery addresses, for delivery to suppliers. The supplier will submit a single invoice to the warehouse, which will, in turn, prepare single invoices to match the original orders from the buyers. This will greatly reduce the amount of paperwork, since each buyer will have to pay one bill, even if he buys goods from hundreds of suppliers, and be almost an overreaction to the growth in paperwork caused by the adoption of Just In Time inventory policies.

THE OPERATORS

Let us return to the basic concept and look at the responsibilities of the Clearing House 'operators'—as distinct from those of the users:

— They will be responsible for allocating mailboxes and maintaining the security procedures which restrict access to properly authorized users.

— They will be responsible for the physical availability and security of the computer systems and the information stored in it. In a multinational situation optimum use would suggest that the system be available round the clock, as would the communications network by which users send and retrieve their documents. (An optimal network would be extensive enough to allow most, if not all users to be able to access the Clearing House at the expense of a local telephone call.) Obviously the computer rooms should be physically secure, and equipped with uninterruptible power supplies and sufficient duplicated equipment to account for user access when needed.

— They will be responsible for recovery when things go wrong. The Clearing House is just another computer program, and, while the hardware and software should be as reliable as reasonable human endeavor can achieve, machines do break down; data does get damaged or destroyed; telephone connections do get severed—and everything else which can go wrong probably will! The software or the operators MUST be able to recognize that something has gone awry, identify the cause and the exact effects, work out the state of the data files at the moment of dislocation, and either get them back to the state they were in immediately prior to that moment, or to some predefined previous time. They must ensure that everyone affected by the problem is aware of what has happened and the impact, if any, on their data.

  In practice the most common difficulty is corruption of data during transmission, and this can frequently be recognized quite automatically. Normally the system can destroy the corrupt information and replace it without trouble. If the telephone connection is severed it is usual to restart the session from the beginning. Other problems come in various degrees of difficulty, and, to the extent feasible, the systems should be designed to 'fail safe', since it might be quite burdensome for documents to be lost, duplicated or arrive in a damaged state with any degree of regularity.

— They will be responsible for tracking usage and preparing invoices according to established criteria. The usage may be charged in a variety of ways including 'by connected hour', or 'per thousand characters transmitted', or by counting various types of document, each charged on a 'per document' basis.

  The same records could also be used to provide an audit trail, with a summary of what happened to every document, so that in the event of a dispute, the operators can provide objective evidence of when and by whom every document was processed.

— Finally, the operators could record usage under various headings to enable them to plan for future capacity requirements, to validate the charging structure and as the basis for designing improved versions of the software to match the changing needs of users.

In the more advanced form of Clearing House, which is really an electronic warehouse, the operators could operate as full service trading partners and bear appropriate legal and financial responsibilities.

We have looked through this list of problems and difficulties, not to discourage potential users, but to demonstrate the achievements of those groups—and their operators—who are already active. The problems ARE soluble, and the pioneers are gaining considerable commercial benefit to reward their efforts.

3. THE ELECTRONIC CLEARING HOUSE

THE BRITISH MOTOR TRADE

Many of the British Motor Manufacturers and their suppliers, under the aegis of their Trade Association—the Society of Motor Manufacturers and Traders—are participating in a simple Clearing House called MOTORNET. In its initial form it enables companies to exchange invoices, call-off schedules (orders) and remittance advices.

Perhaps unsurprisingly, the major difficulties have been in the project management of the installation. The user group has a potential membership of around two thousand organizations, with large, medium, small or nonexistent computer systems. The first ten users between them had machines from four suppliers, and included eight different machine ranges. In spite of this, their chosen solution has in fact proved to be sufficiently flexible to allow the different machines to talk one to another with very little difficulty. They have embraced some document standards based on internationally agreed upon formats for intercompany trading. Their early experiences have been very encouraging, and form part of the motivation for this booklet, which aims to make potential users of EDI systems aware of the difficulties, yet also aware that they are soluble.

'Forewarned being forearmed' should help other trade groups to prepare the way for rapid and efficient implementation.

This third type of Electronic Data Interchange system has one important difference from the previous two. Thus far the 'sender' has created his document in its entirety, and the remainder of the system has been concerned with transferring it to the addressee, recording its passage and issuing invoices to agreed upon criteria.

In 'incremental' systems the initiator starts the document, but it is not complete. It passes to a second party, who add a little, and on to a third, and a fourth.... At many stages during the process, individual parties, either within the chain or external to it, may extract elements or summaries from the document, until it reaches its final destination(s).

THE TRANSPORTATION INDUSTRY

The most common example of incremental documentation occurs in the transportation industry. There are a multitude of various documents and parties involved in the shipment of a consignment from an exporter to an importer in another country. There are also many variations on this theme, depending on the shipping method and the countries involved. However, it is normal to have some FORTY different pieces of paper, many in multitudinous copies.

This complex paperwork process has two important attributes:

— It is very time-consuming, leading to consignments, or even entire ships, being held up while the papers are completed.

— It is extremely prone to error; each 'new' document is created by copying some or all of its predecessors and adding new information. These transcriptions are usually done manually, and each is therefore open to errors of various types.

SITPRO—the UK Government's Standardization of International Trade Procedures Board—has worked with Midland Bank International plc on a major survey of errors in Letters of Credit. No fewer than 50% of the Letters of Credit presented during the survey periods were rejected on first presentation, mostly due directly or indirectly to some form of transcription error or information loss, somewhere in the export process. It is inconceivable that any normal industrial or commercial process would be permitted such an error rate. The cost is frightening—of the 70,000 million pound annual value of UK exports, no less than 1,000 million pounds represent the cost of paperwork, including the insertion of errors and their subsequent correction.

Not surprisingly, Electronic Data Interchange provides a mechanism for attacking this problem. The concept remains simple—though differs from that described in previous sections. It relies on the fact that, even in the worst case, all these export documents between them contain less than about 200 distinct pieces of information, each with a clearly defined source. Every document is an assemblage of some subset of these two hundred basic facts, presented in some pre-defined format.

By adding these two basic ideas—that all of the documents are extended variants of their predecessors, and that there is a limited number of 'facts', each added by its originator—we can discern a better way. We keep a 'top copy' of the information in a central computer, and allow anyone with a proper interest to extract those portions of the whole to which they have a right, and to add those new items which they alone are in a position to originate. Thus the computer-stored 'document' represents the current, most up to date, version of the consignment's status.

BENEFITS OF EDI

The EDI process has several advantages:

— It is simple! There is ONE copy of each item of information; all interested parties know where it is; all normal sources of delay and confusion are eliminated.

— It is accurate. Each item of information is added by the person best qualified to do so; thereafter it is never transcribed, just copied electronically—so a prime source of errors is eliminated. Never more will 'Send reinforcements, we are going to advance' turn into 'Send three and four pence, we are going to dance'.

— It is flexible. While the commercial world struggles towards standardized document formats, the computer is able to rearrange the items to any sequence desired; participants are not forced to radically change their internal systems as a prerequisite to adopting EDI; those participants willing and able to receive copies of documents on a computer-to-computer basis are able to do so.

— It is quick. The information, and hence any formatted document, is available where it is needed, within a few seconds of the necessary information being added to the central computer file. (This is particularly important to the air freight business, where the plane is the fastest conventional way of document transfer, and it is quite common for the goods to precede the paperwork.)

— It is safe. The system is designed to permit access only by authorized users; information to be added is checked for the authorization of its sources; audit trails will be added to maintain a record of who did what, from where and when. The ability for persons of malicious intent to change or damage the information will be limited, and the system will be designed to leave a record of their activities.

In addition, the central computers will be programmed to replace information lost by accidental operator action, or by failure of the computers or associated equipment.

As with the conceptually simpler one-to-many and clearing house forms of EDI, there is an organizational problem inherent in an international trade system. Many parties may be involved, and, unlike the simpler systems, there is no clear leader. In addition, the trading partners come from entirely disparate industries, and in practically no case is the proportion of business coming from a particular trading partner any but a small proportion of the whole. Thus a Shipping Agent, or a Freight Forwarder or a Bank, will deal with many exporters with no common intermediaries. Finally, 'service' agencies with no direct interest in particular shipments—Customs Agencies, for example—may have neither the will nor the desire to become involved.

However, representatives of every agency involved are beginning to pay lip service to the idea of, and benefits stemming from the introduction of, Electronic Data Interchange. Some are feeling their way forwards, and a number of experimental systems have been developed, involving Banks, Port Authorities, Customs Agencies, etc. Some of the latter are happy to accept magnetic tapes rather than paper, most Banks have some experience of electronic transfer of funds, and so on. Organizations such as SITPRO have been working with a broad spectrum of prospective users and their standardization activities are gaining acceptance both nationally and internationally.

'The Stage is set....'

GEISCO has been working with several groups of companies with significant trade interdependence, and is helping them to form 'Trade Cluster' partnerships. In the first three such situations, the effective lead has come from different types of companies:

— A group of companies based in New York includes a major American exporter, a freight forwarder and a Bank. The Bank has taken the lead role.

— A group based in San Francisco includes a freight forwarder, a shipping line and a bank. In this case the forwarder, who specializes in 'Project Oriented' business—all US exports to a harbor construction project, for example—has taken the lead.

— A Norwegian group is based around a shipping line, and will later embrace their regular clients and service agencies.

Each of these three examples have started small, with just a trio or quartet of founder members with a sufficient volume of joint business to make the experiments worthwhile. In each case it is expected that the 'leader'—or any other member of the 'Cluster'—will recruit new participants, either by extending the number of links in the chain joining exporter and consignee, or by adding other companies who have a need for parallel chains.

Section 5. THE ROLE OF STANDARDS

In our descriptions of the various 'flavors' of Electronic Data Interchange we have made several mentions of Standards.

The need is obvious. Suppose that I send you an invoice. It will contain, at minimum:

My Name & Address	My Ref No	The Date
Your Name & Address	Yr Ref No	An Invoice Reference No
Either an order number reference or an itemized list of goods		
Material prices, VAT or Sales Tax, Discounts if relevant		
The Total Payable, possibly with a further discount for speed		

The LAYOUT of my invoice follows my historical conventions—or the whims of the creator of my latest 'House Style'. Either way it is unlikely to bear more than a superficial resemblance to one of your invoices—or to the format expected by your Accounts Payable computer system. Computers are unimpressed by fancy print, and expect a string of facts and figures in the correct SEQUENCE, and in the correct FORMAT. The latter covers such things as lengths of fields and their basic content—all digits, all letters, 'like a date', etc.

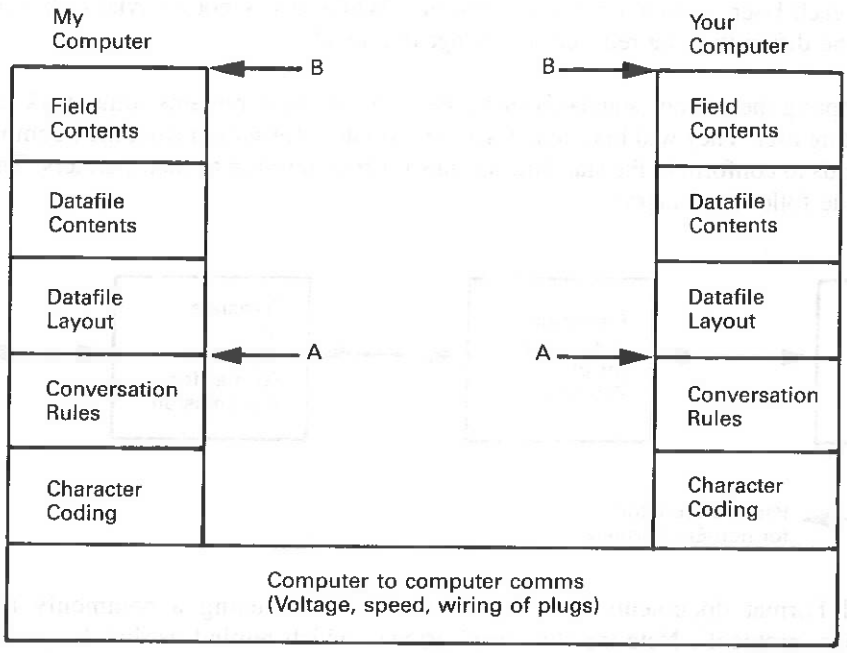
Our two computers also need to agree about Reference Numbers. If MY Reference Number for your company is, say, F5567, then your machine must recognize that that is my way of saying 'you'. Similarly, my machine will probably need to understand what is meant by your reference number.

We also need to agree to more general layout standards—how to identify the start and end of an invoice, how the fields are to be separated (are they to be of fixed length, or to be delimited in some way) and suchlike.

COMPUTER LEVEL STANDARDS

When our computers begin to talk one to the other, they need to have an agreed computer variant of the 'control' words used by radio operators—to identify themselves, to ask for garbled text to be repeated, to pass control to the partner and to terminate the conversation. Computers store text in a 'binary coded decimal' form—a sort of computerized Morse Code. There are several different ways of encoding the normal alphanumeric character set; obviously, even if our machines use different internal codings, they must agree to use a common standard for transfer of documents.

Most of these problems have been with us for many years, and apply whatever the application; they have been, up to a point, resolved. Computer folk have developed a 'model' of a communications system, which in a simplified form contains a number of 'layers':



The elements below 'A' are completely defined, and if I manage to push a file of information down past 'my' 'A', it will reappear in identical form in your machine above your 'A'. Naturally, depending upon your requirements, you will choose the most appropriate from a selection of 'sub-A' standards!

The Datafile Layout standard is roughly equivalent to the 'wrapper' for your information—the gross physical characteristics of the document and its envelope, including the addressing format. The File Contents describe the sequence, size and any similar characteristics of the data fields within the file, and the final layer covers remaining items such as the 'meaning' of data fields.

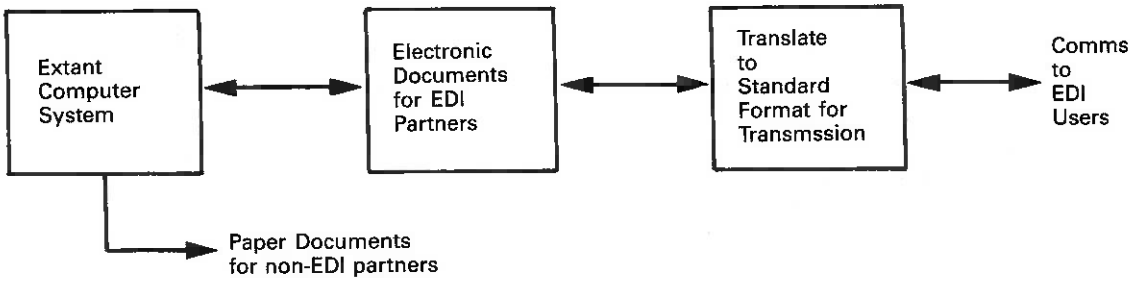
DOCUMENT CONTENT STANDARDS

The 'American National Standards Institute' (ANSI) has been working on the area between 'A' and 'B' in our diagram, and have defined some five hundred different data elements with model layouts for about three hundred different record segments. These specifications are gradually meeting acceptance by various standardization groups and user communities, and will, hopefully, eventually become accepted as useful cross-industry standards.

5. THE ROLE OF STANDARDS

Since it is perfectly obvious that datafile and document formats must necessarily be understood by all prties to an EDI system, GEISCO has backed the ANSI X.12 standards, and many GEISCO-based EDI systems use these standards, or suitable subsets thereof, giving the Users of the various systems a considerably more tractable task. Users have to define elements at the highest level, such as unique identifiers for each User, common part numbers, etc. While this is not a trivial task, our experience suggests that the difficulties are reduced to manageable levels.

Even after adopting the various standards mentioned above, there remains some work to be done by each participating user. They will have to extract appropriate information from their computer files and arrange the fields to conform to the standard formats for transmission to their partners. These steps are illustrated in the following diagram:



The Standard Format documents must then be transmitted using a commonly accepted data communications 'protocol'. Note the 'two way' arrows, which remind us that the process has to be reversed for documents which we receive from other EDI Users.

We have noted the leadership role in standardization taken by ANSI. A particularly important 'outside' group of people have also been working in this area—the various EEC and USA Customs and Excise Departments. They too see the benefit of receiving bulky declarations from major shippers or importers in a computer-readable form, and are moving towards acceptance of standard formats for relevant documents. Noteworthy experimental schemes have been set up in the USA and in Holland.

We mentioned earlier that the computer people have developed and agreed upon standards for inter-computer communications. While it is necessary that any EDI system specifies WHICH of the various standards should be used, the choice has little impact on the general running of the EDI System, so we shall not expatiate on the various options and their benefits and relative costs in this booklet.

We have looked at a selection of EDI Systems, and it is noticeable that, notwithstanding their wide diversity of memberships, the users gain—or expect to gain—a remarkably uniform group of benefits. The decision making process which led to the adoption of an EDI solution has differed, and in this Section we explore some of the special considerations relevant to different user communities.

Whatever the formal decision making process, most extant EDI systems have been sponsored by one or more large organizations able to foresee major benefits to themselves. Large organizations tend to have the resources to take active roles in Trade Associations and similar voluntary bodies, and, are, accordingly, already in a position to promote EDI concepts within their industry. This has been particularly important in Clearing House systems, where the system itself has no clearly defined 'focus'. Even the perpetrators of 'One to many' systems may well use their Trade Association to leverage the acceptance of what are basically in-house EDI systems within their trading partners.

Whatever the exact form of the EDI system, it is a step towards more efficient business practices, with the ultimate aim of making its users more competitive in the marketplace. We have seen that, even when existing standards are accepted, there is still some work to be done to change not only the principal's internal systems, but also those of each participating trading partner. One effect of this is to introduce a considerable time lag between an initial decision in principle to move towards electronic document interchange, and having a comprehensive system in regular daily use. The following list shows some of the 'executive level' steps along the path towards EDI:

— Acceptance that existing mechanisms need improvement or replacement.

— Consideration of options; development of a detailed 'where do we want to go' statement of intent.

— Preliminary discussions with selected trading partners (suppliers of goods or services, or customers) to seek endorsement of the EDI principle.

— Preliminary specification of what the system is to do, and how it might work.

These steps are at a conceptual level. The next iteration gives an opportunity to flesh out the ideas to the point where the practicality and costs of a 'real' system can be understood:

— Consideration of options—in particular an evaluation of the costs and benefits, and, indeed, the physical possibility, of creating the system using in-house staff, computers and communications expertise. If necessary resources are not available, or if an in-house system would be difficult to 'sell' to trading partners for 'political' reasons, then the possibility of using a third party supplier should be considered. Any suppliers who already have experience of implementing EDI systems in your industry might be approached.

— What, if any, "quid pro quo's" should be incorporated. The basic motivation for most systems has been major benefits to the system's main sponsor. Yet much of the work will be done by his trading partners. The effort might be quantified, and the amount of help or other inducements should be considered. (Several system sponsors offer improved payment terms to their EDI partners, for example). Trading Partners may also need assistance with planning new paperwork systems, with changes to their computer systems, with internal training and suchlike.

— Assuming that all is going well, an Implementation Team must be appointed. This will report to a Project Manager, who will be, in name if not in day to day actuality, a SENIOR executive, with full responsibility for the proposed system. His team should include full or part-time representatives of every operational department involved, from the computer department to the warehouse, and including your PR team, who will need to create materials and perhaps seminars to promote your system to your trading partners.

— Taking into account the needs and aspirations of everyone involved, define the technical aspects of the system; try it out on a representative selection of potential users, and build lists of activities and problems to be solved. At this stage the system exists only on paper, so changes can be incorporated without undue effort or cost.

— If the 'make versus buy' decision has not already been made, now is the time to determine whether the proposed system is to be built and operated internally, or whether an outside vendor should be used.

— If you are making the system internally, order any necessary new computers, upgraded communications hardware, additional telephone lines, and other hardware.

Otherwise, select your vendor. We shall return to this option later.

— While the system is being built decide on the details of the 'roll-out' to other participants. Most people begin with a 'Pilot Group' of just a few users, then extend the membership according to pre-determined criteria. Agree with the Pilot Group, on behalf of the full ultimate membership, on the administrative arrangements, such as the responsibility for allocating user identifiers and for defining any new standards which might become necessary.

— The Pilot or Trial system is used on the one hand to check that the implemented EDI System actually works and on the other to prove that the promised benefits are attainable. While it is in progress, begin to 'sell' the system to the next group of users. Ensure that they know what will be expected of them and what they in turn will gain. Make sure that they are able to get any help they need, and that, once they join the 'Club', they are not demoralized by minor difficulties.

Introducing a new EDI system is hard work, and can be very expensive. A successful system will meet its objectives, be they stated as cash benefits or increased internal efficiency or whatever. It is certain that success is much more likely to be achieved on time and and within budget if users recognize the magnitude of the exercise right from the beginning. It is sometimes helpful to approach the introduction of EDI in the way one might approach a major product upgrade, with every participant informed and involved and working together.

CLEARING HOUSE SYSTEMS

We mentioned in an earlier Section that the Clearing House model is distinctive in that there is usually no single organization 'in charge', and hence in a position to force decisions and actions. The nominal focus is often a Trade Association or similar body, embracing most if not all of the interested parties. However, as a general rule, these organizations rarely have the objectives, let alone the resources, to launch Clearing House systems. Typically they have two roles—one as a lobbying and publicity group, working on behalf of the industry to seek favorable treatment by legislators—and the other as sponsor for exhibitions and conferences, mostly for the benefit of smaller members. Trade Associations rarely have a business presence and are not in a position to undertake the planning and implementation of EDI systems for their Members. Nonetheless, in their roles as politically 'neutral' platforms for their industries, they do have the power to recommend EDI systems as efficiency aids for their Memberships, and can develop the expertise and authority to set document standards and to administer systems once they have been created.

Our experience is that Trade Associations have a valuable role to play in promoting EDI systems by selling the concepts and benefits to their Members. A positive recommendation by a Trade Association carries the implication both that the EDI concept is worthwhile and that the chosen solution is the best for the industry. Their level of independence is also reassuring to smaller companies, who understandably wish to avoid being too closely connected to a particular major company.

The Trade Cluster is in some ways similar to a Clearing House, but has a simpler organization, since it may realistically start with very few members, with a 'kernel' consisting of one major partner and its most prolific trading partners. In this respect there is a similarity to One to Many systems.

Whatever the organization and decision making process, it is necessary to choose a supplier of the system. We noted in earlier Sections that the implementation can be complex, and involves considerable investment in communications equipment and computers. We believe that most companies are simply not in a position to implement systems of any considerable size, and would be mis-using their resources if they were. The tendency for even simple systems to grow in complexity and become wide-spread networks of partners also suggests that it would usually be inappropriate for individual companies to 'own' the system, since at some stage there will almost certainly be conflicts of interests with their competitors. We believe—our own vested interest apart—that EDI systems truly belong in the 'Buy' rather than 'Make' category.

6. DECISION MAKING

DEFINITION OF RULES

In Section 3 we discussed some of the responsibilities of the Clearing House 'operator'. Now we must distinguish three parties:

— USERS—the companies who exchange documents through the EDI system.

— The OPERATOR, who administers the system, allocates user codes, may define standards and generally looks after the system on a day to day basis. The OPERATOR is the prime contact for the Users, and may well take a lead in promoting and marketing the system to prospective Users.

— The SUPPLIER provides the computer power and communications facilities. Their responsibilities cover the technical work in creating the EDI software and in connecting Users' computers. Some Suppliers may also be able to supply the local hardware and software needed by individual Users, and will probably offer a degree of training.

The Supplier's role includes implementing safeguards to maintain system availability as well as data recovery capability; while the Operator will most likely allocate User Codes and Passwords, the Supplier will create and maintain the security systems which protect Users' information from unauthorized access.

The Operator may often be the sponsor and main user of One to Many EDI Systemss while other types of system are frequently operated by Trade Associations or similar independent bodies.

It is entirely possible and feasible for a Supplier to also be the Operator of the system. In the establishment of 'Public' systems that present the opportunity to serve a large portion of the trading community this is quite an advantageous arrangement as the Supplier/Operator then can manage and administer the complete system, including the support and maintenance of standards (not an inconsiderable job!) and helping new trading partners become members of the group.

SUPPLIER SELECTION

So, what decision criteria should be involved when choosing a Supplier or Supplier/Operator? The following list is not exhaustive, but gives a few guidelines which may suggest other criteria relevant to a specific application.

— Obviously the Supplier should be financially stable and have the staff and financial resources to develop and run the proposed system, both in its embryonic form and in its fully developed, and possibly VERY large form. (The UK SMMT Data Clearing House began with half a dozen users; it may ultimately involve nearly two thousand, possibly in DAILY contact!)

The Supplier's management philosophy should include a commitment to having computer and communications equipment in advance of present needs, so that system growth is not likely to be restricted due to lack of Supplier capacity. (The costs involved can be very large indeed)

— The Supplier must have the geographical spread to cover the proposed catchment area. Almost certainly this will involve most European countries as systems develop—and an international trade system will normally require access and local support in at least two continents.

The Supplier should not only have some means of communicating between remote computers and the central system, they should also have a physical presence wherever possible. The more remote users may have the same, or even greater, needs in terms of support and assistance as those nearest the center.

Even modest systems are very likely to include some foreign users, and while senior professionals in most countries have at least some command of English, clerical and operational staff rarely have. A multi-national supplier should be able to give help in the local language.

— The Supplier should be committed to offering a SECURE and RELIABLE service. This involves many things, ranging from physically secure computer rooms, uninterruptable power supplies, duplicated equipment and data transmission paths through to on-going investment in new procedures and processes to minimize fraudulent or vandalistic activities by unauthorized Users.

The service will need to be available more or less around the clock—as soon as the User community spreads outside the U.S. the service will be wanted during our evenings and wee small hours.

— The Supplier should be helpful and be prepared to help—if necessary at a cost—users to specify and implement whatever changes are needed to their in-house computer systems; they should offer training in at least those aspects of the system for which they have responsiblity; they should offer 'hot line' telephone or electronic mail services to help users with urgent operational problems.

— The supplier should not impose unreasonable restrictions on users—their communications network should be able to 'talk' to all commonly installed computers, using any of the industry standard communications methods.

— And, of course, a potential supplier is that much more credible if he can show a stable of contented users who are happy to recommend him!

One simple test should always be made. If your prospective supplier says 'YES' to everything, and doesn't point out potential problems and pitfalls then perhaps he is not speaking from experience. You will need help and a thoroughly professional approach from your supplier.

Section 7. IMPLEMENTATION PLANNING

As we have said before, installing an EDI system is a major project. It requires commitment and effort by all concerned. Lack of recognition of this simple fact is a sure recipe for failure, and possibly disaster.

So implementation will require a DO-ABLE Plan. A wise buyer will request that this Plan, or at the minimum an outline of its content and a description of the planning process, as an integral part of Tender Documents or Proposals requested from potential Suppliers. Naturally every case is different, so this Section cannot be a complete guide. We outline a few common elements.

THE SCALE OF THE TASK

First let us look at the scale of an EDI system. We have mentioned the UK Motor Trade several times. We have four major assemblers, supplied by some 1500—2000 makers of components and sub-assemblies. Some of the latter supply one another. In addition there are maybe up to one hundred assemblers of speciality vehicles, with much the same set of suppliers. On the customer side there is a vast array of dealers in new and used vehicles, and thousands of purveyors of spares and add-ons, again supplied by the same component manufacturers. So a comprehensive UK Motor Trade system could ultimately embrace perhaps ten thousand or more companies, with communications 'every which way'. (Since the component suppliers also deal with Continental assemblers, and there is a large market in Continental vehicles in the UK, the system could grow to cover perhaps four or five times as many companies across Europe; the Far East comes in somewhere as well!)

The documents passed between trading partners will start at the 'easy' end—orders or call-off schedules going in one direction and invoices in the other. The users will develop the desire to add more types of document until virtually every FORM, including Parts and Price Lists, are exchanged electronically. At a more sophisticated level we can add the exchange of drawings, component specifications, 'programs' for computer controlled machine tools and all of the engineering documentation needed to specify a new vehicle. This would result in immense cost savings, and greatly ease the introduction of new designs as well as simplifying the on-going process of vehicle modification and enhancement. Alongside these areas we might foresee the introduction of links to Banking Systems, with automatic delivery of payment instructions. Exporters would also expect to be able to use the same processes for the delivery of shipping documents, customs declarations and all the other paperwork connected with trans-border shipment of goods.

We may summarize the potential size of an EDI system as being BIG!

HOW TO START

So, where do we start? To begin with it must be established that an EDI system is not just yet another good idea—the system MUST bring tangible benefits to ALL of its users, preferably from Day One. In practice the initial justification and motive force tends to come from a major organization—be it a Bank or a Manufacturer or whatever—and they will initiate the search for a system and supplier.

At this point a Project Manager should be appointed. While (s)he will probably work for and within the initiating company to begin with, some form of embryonic Steering Committee, representing a broad cross-section of potential users could well be the nominal owner of the Project and employer of the Manager. In some cases the Trade Association will take this latter role.

SCOPE OF THE PROJECT

The EDI System is not an end in itself. It is an important part of a drive for greater efficiency and competitiveness. It will in some cases be clearly and closely linked with other organizational changes—such as a move towards 'Just In Time' inventory policies. So, quite clearly, the initial group of users will be those able to and willing to make the dual move—towards whatever the 'big picture' change prescribes, and, within that, towards computer-to-computer document transmission. These considerations will of their own accord put some limits on the scope of the initial implementation, and these should be written down and agreed by all concerned. You might include considerations such as:

— The most useful documents to be exchanged.

— Preliminary ideas on the organization and administration of the system (who should do what).

— Outline of the role of the computer aspects of the system, and any initial ideas about its 'necessary' and 'desirable' features.

— Preliminary, and revisable, list of up to a dozen potential users.

— The nature and perhaps size of benefits these early users might expect, and thus a way of measuring your success.

By this time there will probably be a nominated supplier—or at least a list of possibles. Share the Project Scope document with them, and have them appoint Project Managers, preferably with experience in implementing EDI systems, to help you foresee and avoid dangers. These supplier Project Managers may seem expensive, but if their experience enables you to avoid just one serious pitfall, their seemingly high fees will be paid for!

THE DETAILED PLAN

The pair of Project Managers—one from the User Group and one from the Supplier—should work together on a second iteration of the Plan, and begin to list specific activities and name those responsible. The sort of work to be done at this stage includes:

— Detailed specifications of the computer program(s) to be written.

— Detailed specification of data formats to be exchanged (and, by implication, a description of the preparatory work to be done by the ultimate users)—or—confirmation of the elements, segments and documents from the standard which will be used.

— Specification of the communications mechanisms to be used; characteristics of communications hardware which users may need to acquire.

— Detailed specification of User Identifiers, and nomination of people to devise and allocate them.

— Specification of Billing procedures and any back-up statistical reports.

— Detailed specification of security procedures, including the allocation of passwords, definition of audit trails, definition of access rights for various classes of user, etc.

THE PILOT USER GROUP

Alongside this technical work the first group of users can be appointed. This is not necessarily a trivial task, since everyone involved will have different ideas of the 'best' people to invite. The supplier will no doubt want high volume users, the major companies will have private lists, some minor companies might be already users of another EDI system and anxious to get rid of as much paperwork as possible. Some desirable early users may not be able to change their computer or administrative systems in time; some may be frightened of taking a leadership role; some may even perceive the proposed system as some kind of threat. So the selection process will be a combination of logic, salesmanship and promotion of benefits—such as promises of fast payment of electronic invoices—to overcome various degrees of concern or hesitation.

One aspect of selection which is easy to overlook is the differing perceptions of the implications of any form of change by the different parties involved in making the change. It is moderately easy to convince a Chief Executive that EDI can bring him financial and operational benefits. It is an entirely different matter to convince the Accountants, Computer Department, Warehouse and Production Managers and all the other groups who will have to do the work that the necessary activities are both sensible and able to be done reasonably, quickly and easily.

Each organization which agrees to become involved—at any stage in the development of the overall system—should, of course, appoint a Project Manager. So we slowly grow a sort of Club of people committed to making the system work. (Sometimes these people will formalize their brotherhood by creating a formal User's Group with the joint aims of helping one another and bullying the system Operator and Supplier). In each case the User Project Manager should be the prime point of contact between his company and the other organizations involved. This latter brings two benefits:

— Projects run by well-informed people who hold all of the reins, leading to a marked reduction in chaos.

— Cash savings. It is part of the nature of things that, given a group of companies, the majority are very likely to have IBM computers, and the remainder use models or makes from one or other of the other major manufacturers. This implies that, while every company is different, the problems inherent in making their computer 'talk' to the EDI system will normally

ALREADY HAVE BEEN SOLVED. So a coherent Project Manager Club can adopt extant solutions and avoid expensive and tedious 'reinvention of the wheel'.

In practice, of course, your supplier should be able to provide off-the-shelf answers to many of the problems. They will have been in the computer-to-computer communications business for years, and could well have been selected partly on the basis of their record in this area.

ELECTRONIC MAIL

Your supplier may also be able to help solve another problem. It is remarkably difficult to share expertise between people in different companies if they have no simple way of getting in touch one with another. Your supplier should offer, right from the start, some form of electronic mailbox system to the Project Manager 'Club'. This will permit—and even encourage—timely communications between people in the User's company, the System Operators and, of course, the Supplier.

We foresee electronic mail as forming a major part of EDI system implementation, with the following being a non-exhaustive list of possible uses:

— Information gathering and dissemination during the initial system design stage.

— Issuing check-lists of on-site activities and preparatory work before a company becomes an active participant in the EDI system.

— Delivery of detailed instructions and response to queries during system installation.

— Resolution of operational problems.

— Distribution of Newsletters, requests for enhancements, exception reports, etc.

— 'Conferencing' between Project Managers.

At the least, an electronic mail system gives users a simple foretaste of electronic communications; at best it makes the introduction and running of an EDI system as nearly as possible painless, and facilitates the creation and encourages the exploitation of a 'corporate body of experience'.

THE USERS PROJECT

The Users' Project Managers will, of course, have roughly similar projects to manage. There are eight major elements:

— Plan the revised flow of paper. What will be different under the new regime? How will this affect staff and their current work patterns? How will your computer know which transactions are to be sent electronically, and which are still to be printed and sent by mail? How will the changeover be initiated and actioned? What hard copy or audit trail should be kept for electronically delivered—or received—transactions?

— Design and implement changes to existing computer systems. The relevant transactions should be extracted from the order or invoice file, converted to EDI format and held ready for transmission. Incoming transactions will need to be converted to internal format and merged with manually entered transactions. Make sure it is possible to neither mislay a file nor to process it twice! Write down the operational procedures to be followed if you accidentally erase an incoming file before it has been processed.

— If necessary, buy the necessary communications hardware for your computer, the modem, and obtain or re-route a telephone line (preferably a direct outside line), with an alternative to use when it is out of action. Buy communications software if necessary. Make it all work.

— When all the bits are ready, make test transmissions; check the error procedures.

— Train all the staff who will be involved; ensure they understand both WHAT they will have to do and WHY the new system is being installed.

— Run the new system in parallel with the existing system for a week or two, until everyone is sure that the new system is working correctly.

— Move over to live transmissions and receptions with participant trading partners.

— Measure the performance of the new system. Compare the promised benefits against reality; review your finding with the Operator and the Supplier—find explanations for major discrepancies, good or bad, between the promise and the performance.

Once the new system is well bedded in and everyone is used to it, look for ways to enhance it or to develop your use of it. We saw some of the ways the UK Motor Industry system might develop—your system too is capable of growth; every user should take an active part in the enhancement process.

Naturally, the Project Manager is not alone. The service Supplier and the Operator will be able to recommend communications hardware and software, provide specifications for standard file formats and supply codes and recommended security and other procedures. Other users will have solved some of the internal organizational problems and be prepared to share their experiences. The electronic mail system will keep you all in touch.

An EDI system is, by its very nature, a co-operative effort. If you are an early user, or even a 'founder member', there will naturally not be a lot of detailed, specific experience for you to draw on. In these cases you have the added responsibility of helping others. Remember that this is not entirely altruistic, since the faster and more easily other users get up and running, the faster everyone can share in the undoubted benefits of Electronic Document Interchange!

COSTS AND BILLING

We have discussed the division of responsibilities under various headings, and have mentioned the Billing procedure in passing. Obviously this will be different for each installed EDI system, though as we saw in Section 1, systems will overlap and perhaps merge. So any single company could eventually exchange all of its trading paperwork through just a single EDI system. So two questions need answers:

— What will it cost

— How will I pay

The second of these is important in the sense that no one wishes for serious dislocation when a new system is introduced; and, given that many companies will be members of more than one EDI system, it will be helpful if they all charge in recognizable ways.

There is no acknowledged standard for charging for EDI systems. However, the owners of many extant systems take the rather sensible attitude that 'change means worse', and try to minimize the effects of new systems by imposing charging schemes which have a familiar 'ring' to them. One commonly accepted method is to charge each party for his own activity. That is, when transmitting the documents to the mailbox there will be a 'mailing' charge to route the documents to the recipients mailbox. Likewise, when receiving documents from the mailbox there will be a 'receiving' charge to the recipient for the service and storage of his documents.

The Supplier or Operator of the system should provide mechanisms to vary this normal 50-50 split depending on specific agreements reached between trading partners.

The actual charges depend on some balance between the cost of providing the service, including various staff and administrative overheads, on the one hand and some combination of 'what the market will bear' and quantifiable benefits on the other. It is probably unreasonable to expect electronic document transfer to cost less than the ordinary mail system. But then EDI is demonstrably 'better' than the postal service, and is hence 'worth' a premium. Now different types of document are of different physical size, and this suggests that, since it costs more to transmit a document of a thousand characters than one of a hundred characters, a 'per document' charge is unfair. The other side of this coin, of course, is that some documents are 'worth' more than others, so a check for a million dollars may contain only a hundred characters, but is obviously of more value to the recipient than a thousand character order for a few thousand nuts and bolts of seventy different types and worth in total not much more than a fiver!

Existing systems have mostly charged directly for volume of data sent. While this is easy to understand, and one could also anticipate that, as usage statistics and 'true costs' are measured and analysed, a whole menu of charges may be developed, with single fixed fees for every type of document. The advantage of such a scheme is that budgeting will be eased, since every User should be able to estimate the number of orders, invoices, remittance advices and so on that they will send in an average month or during the next business year.

8. OTHER CONSIDERATIONS

The Grocery industry in the U.S. has been operating an EDI system since 1981, and some good information on actual costs and savings is starting to become available. This industry processes some 15 million purchase orders per year, with each PO generating an average of 6.4 'messages'. These 'messages' include PO acknowledgements, Bills of Lading, Change Notices, Payment Advices, Invoice Adjustments and the normal telex and telephone traffic for followup and expediting. It has been estimated that these messages cost the participants between $3.90 to $6.50 in direct cost (people, paper, postage, telex and phone charges, etc.) or 0.36 to 0.59 percent of gross sales. Assume (a very reasonable assuption!) that moving to EDI will save 50% of these direct costs, and also assume we can move these messages electronically for significantly less than $1 each (another very reasonable assumption), then we see direct benefits of $1 to $2.50 per message. For the Grocery industry this is $100 to $250 MILLION dollars per year. Even more importantly, the INDIRECT benefits such as reduced inventory costs, improved customer service and increased sales productivity have been estimated at 2 to 4 times as great as the direct benefits.

There will be various 'start-up' costs associated with joining an EDI club. Some are purely internal, such as the acquisition of any necessary additional computer equipment, modifying existing computer programs, obtaining new telephone lines and suchlike. There will be some proportion of the cost of creating the system itself, and an overhead to cover the administration costs, training and copies of any documentation provided by the Operator. If special efforts are needed to connect your computer to the EDI system then you may have to pay for the time and experience of specialist consultants.

Different Operators charge for those elements of the initial costs over which they have control in diffrerent ways, but typically there will be a joining fee of several hundreds of dollars, and an annual subscription of a somewhat lesser amount. In these cases the Subscription might be expected to include the costs of system enhancement—so that as new features become available they are 'free' to existing participants in the EDI system.

The actual source of the usage invoices again depends on the style and relative positions of the Operator and the Supplier. If the Operator takes a low-key role, then the Supplier will probably prepare the invoices from the usage statistics and send copies of both to Users. More robust Operators might accept a single invoice from the supplier, and re-bill Users under their own name, perhaps making a small profit in lieu of charging a subscription fee.

WHEN THINGS GO WRONG

Now let us think about things going wrong. While the sales story describing the EDI system will be full of super benefits and go to great pains to tell you how easy it will all be, the system is a mixture of computers, telephone lines and people. None are perfect. So errors and malfunctions will occur, machines will break down, and previously unknown faults will creep out of 'perfect' computer programs!

By far the most common problem is corruption of data while it is being transmitted through the telephone network. The various clicks and sizzles we hear during ordinary telephone calls turn into spurious data when computers are talking. Fortunately it is not too hard to train computers to reject polluted data and ask for it to be retransmitted, and we may in fact be close to absolutely sure that your addressee does receive EXACTLY what you send or if not, that you will be notified or the system will retransmit. It is also possible for computers to check simple things such as the sequence number of transmissions, so that users may be warned if a transmission has apparently been lost (they usually do not get sent in the first place).

A more serious, and, to be realistic, rather rare, situation arises when data is destroyed in the central computer—or in the recipient's computer—due to hardware breakdown or operator error. The computer should be able to recognize the problem and alert the operators, if smoke and flames have not already done so. A 'good' service Supplier should have sufficient back-up hardware to allow at least a skeletal service to continue even in the smoke and flames case. In less dramatic situations he should be able to recover the data up to some pre-specified time, such as 01:00hrs this morning. This is done by making copies of all new or changed data files every evening, and storing them away from the computer room (for fear of smoke and flames!). So if a disk drive or a computer processor or program runs amok and destroys all of today's input, the problem is of real concern solely to those Users who have entered new data since the last 'clean-point', and those who have not yet extracted those of their incoming documents inserted during the same period. Users MUST be informed when such a problem arises, and should be able to work out, with the help of such audit logs provided to the Operators on a continuous basis, who needs to do nothing, bar wait, and who has to take positive action.

There are two corollaries to this:

— Users should keep copies of everything they SEND TO the EDI system until it is certain that they will not be required again (e.g. until after a 'clean-point' or until after the intended recipient has acknowledged receipt). They must label such files as having been sent, and be unable to resend them EXCEPT in an emergency.

— Users who manage to damage or destroy their incoming files may relax, providing the central system on the one hand keeps copies of all traffic for a predetermined time after it has apparently been received by the addressee; and on the other is able, in receipt of special instructions, to retransmit nominated files.

(The caveats in these two paragraphs are to allow proper and necessary recovery from accidents while preventing the transmission of duplicate sets of documents. Some of the detailed design work when the system is originally created is invested in mechanisms to provide that exactly ONE copy of EVERY document is received by the intended addresee.)

A more serious level of problem is possible, though unlikely. It IS possible, though of course unlikely, that for one reason or other, documents sent to you do not arrive. The effect on your business depends on your use of EDI. For example, if you are truly dependent on your computer to receive orders and it is subject to a catastrophic accident, you should have contingency plans to revert, no matter how crudely and with whatever difficulty, to a paper-driven system, if only as a short term expedient. And, as a final cover, every User should review the risks he wishes to be covered by his insurers, and ensure that his contractual arrangements with his trading partners and the risks arising from them are in line with his insurance.

CONTRACTS AND COMMITMENTS

It is also advisable to be sure that you understand the contractual arrangements with the EDI Suppliers and Operators. There are two commonly found situations:

— The System Operator (the principal in a one-to-many system; the Trade Association or whatever in a Clearing House system) takes responsibility for the system and its operation; they purchase 'raw' computer power from the Supplier and resell it to Users. Users contract with the Operator and are more or less unaware of the Supplier.

— Each User separately contracts with the Supplier, and the Operator is treated as a rather special User.

It is likely that in the future a third arrangement will arise, with Users forming and jointly owning an independent company set up specifically to run the EDI system. They would contract with this company to provide the service, and the company would purchase the computer power from the Supplier.

Whatever the case in your particular EDI system, the contractual arrangements, and, in particular the responsibilities and extent of liability accepted by the other partners, should be clear from the outset. One anticipates that the creator of a transaction is responsible for its accuracy, for its formatting and correct addressing. Users should be responsible for those aspects of system security under their direct control. The Operator might be responsible for the day to day running of the system and for overall security. The Operator might also be charged with the maintenance of accurate records, audit trails and statistics. The Supplier is responsible for proper transmission, for maintaining the security and integrity of the information carried and for supplying reliable service during agreed upon hours. The Supplier should also be expected to provide for recovery of service and of transactions within a reasonable time-scale and to inform Users of any loss of data.

Note that EVERY participant in an EDI system is responsible for security, and the system should be designed ab initio with security in mind. There are three major aspects to security:

— Physical protection. The computers and other equipment should be protected against intruders, fire and fluctuations in power supply. Service Suppliers have built their reputations and stake their businesses on this type of security.

— Data integrity. Each element of the system should be able to recognise that incoming transactions are complete and not corrupted by extraneous characters, and should monitor that it passes on transactions in the same state. In addition, transactions should be labelled in some way to minimize the risk that they may be lost, duplicated or mis-sequenced.

— Protection against fraud or vandalism.

Let us be perfectly honest—it is virtually impossible to prevent fraud by properly authorized users of the system. So a Purchasing Officer or a Corporate Treasurer cannot easily be stopped from diverting goods or monies to 'unusual' destinations. Two things ARE possible. We can make it extremely difficult for UN-authorized users to enter the system, and we can record, in a tamper-resistant manner, everything which is done in the system. It is a tribute to the security procedures of professional service suppliers that they provide Money Transfer Systems and the like as a matter of course, to the complete satisfaction of the Banks and other principals involved—and are able to claim, with considerable justification, that the electronic systems are in fact safer than traditional paper and telex mechanisms.

This is not the place for a detailed treatise on security, but there are some general points worth making. Most computer systems rely on more or less publicly known identifiers (User Codes, Mailbox addresses and suchlike) used in combination with secret passwords. The security of the system—its accessability to unauthorized users—is dependent upon the secrecy of the passwords, which are usually changeable by the user. Therefore:

— Keep knowledge of the password to the MINIMUM number of staff; don't pencil them on the terminal (not unknown!!); don't leave them lying around on bits of computer printout.

— Change them regularly as a matter of course, and specifically when an authorized user loses the 'need to know'

— Choose passwords at random, rather than using sequences which ex-employees can exploit to work out the next one (parts of the body, names of trees, etc).

Some systems will force users to change passwords from time to time. They can also put additional difficulties in the path of would-be 'intruders' by, for example, protecting key programs and data by 'time-locks', or forcing users to enter through a predefined communications port. At an application level systems can impose restrictions on who can communicate with whom, and on the size or value of transactions.

However, all these restrictions can become self-defeating, in that they can prevent perfectly proper activities. Thus, for example, a 'time-lock' might prohibit users from week-end or evening working, even when it has become an operational necessity. It should also be remembered that complex security measures and very detailed audit reports cost money. System designers have to balance the level of security against the needs of users. So while a Banking application, where the smallest transaction might be worth a million dollars, should have extremely sophisticated security checks, a system concerned with small volumes of nuts and bolts may be adequately safeguarded by simpler means.

Electronic data Interchange is in its infancy. There are a few tens or perhaps hundreds of systems in operation; by and large they are small and restricted to the simplest operations.

However, EDI is arousing great interest in all manner of organizations, since it clearly has the potential for improving the efficiency of business. We have seen that the necessary infrastructure of both standards and suppliers able to provide the necessary computer and communications systems is already available. Even though getting a system operational is a difficult and resource-consuming process, there are 'live' systems, and companies are queuing up to join in systems from which they can benefit. Indeed, the first 'future' is already happening. There is a discernable movement away from major companies trying to encourage their suppliers or dealers to join systems towards suppliers or dealers, having enjoyed their experiences with one system, trying to influence their other customers (or suppliers) to set up or join in EDI systems.

NEW LEGAL FRAMEWORK

We are seeing the birthpangs of 'total industry' systems, where every company in an industry grouping belongs to a single EDI group. In the last section we explored some of the risks involved in electronic data interchange, and took comfort from the fact that they actually offer more security than the systems they will replace. It is a simple fact that the regulatory and legal framework controlling business tends to follow the actuality of the business world—thus the three-part Bill of Exchange withered away during the second decade of this century as the risks which necessitated its invention disappeared. We may be confident in expecting that, as electronic data transfers replace physical Bills of Lading, with the associated delegation of title, then the legal environment will follow business into currently uncharted territory.

NEW USERS

At a simpler level we can foresee that, while current systems tend to attract 'birds of a feather', as they develop the 'obvious' trading partners—such as our over-exposed assembly company and its suppliers—will begin to attract the service companies on whom they all depend. The transactions are financed by Banks, the goods are moved by Carriers, who may in turn be recruited by Forwarders or Agents; the goods are insured during transit, and water and power is consumed in exchange for invoiced payments. All of these extraneous agencies may be imagined as users of the 'public' EDI system.

In fact, of course, many of these service companies already run or belong to EDI systems. Thus Banks often have electronic instruction delivery services, which permit Corporate Treasury departments to pass instructions relating to foreign exchange transactions and paying bills. It is but a small leap of the imagination to integrate a 'materials' based system to include the parallel 'Money' system, and thus on to include the other services involved.

The International Trade Cluster demonstrates another way in which groups of companies, operating in entirely distinct markets, are able to work together to their common benefit. As these systems spread we shall see the beginnings of some form of global marketplace.

WHEN SYSTEMS COLLIDE

This latter example raises a serious underlying problem. As EDI systems grow, they will inevitably 'collide'. Users of one will wish to extend its boundaries so that they embrace trading partners who are already participants in another system. What happens then? In some cases it is likely that the more comprehensive or industry-wide system will swallow up the smaller competitor. The users of the small system will be integrated into the user group of the larger system. In some cases, at least in the short term, people will belong to several systems, and connect to them in sequence.

The longer term solution seems to be the provision of 'gateways' between systems, so that if a large proportion of one's business transactions may be delivered electronically though one system, then the remainder will be able to be passed through a sort of trap-door in one's 'normal' EDI system to others of which one has occasional need. This approach has the realistic capability of leading us towards a genuine 'global market'. The idea is not new—for many years one has been able to be a subscriber to a local (e.g. national) telephone network, yet we are able, with no visible difficulty, to connect to and speak with subscribers to entirely different networks. The EDI inter-system interface will offer EDI users the equivalent of international direct dialing.

CONCLUSION

The ideas underlying Electronic Data Interchange have been expanded to cover many of the previous pages, and we have interpolated many other concepts from current or possible general business practice. We have, perhaps unavoidably, underplayed one central fact:

EDI IS A TOOL, NOT AN END IN ITSELF.

Businesses operate in a cruel and competitive world. Many industries are under great threat from competitors who are able to make things more cheaply or transport them more quickly or otherwise obtain a competitve advantage. Businessmen have developed strategies to combat their competitors; they have defined ways of saving money, of responding more rapidly to fickle clientele, of taking advantage of short-lived fluctuations in their environment. In every case, one small part of the new mechanisms has been the fast and accurate transfer of business documents to regular trading partners. Electronic Data Interchange is the ideal method for making these document transfers.

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