OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

This document has been produced without formal United Nations editing. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations Industrial Development Organization (UNIDO) concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries, or its economic system or degree of development. Designations such as "developed", "industrialized" and "developing" are intended for statistical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. Mention of firm names or commercial products does not constitute an endorsement by UNIDO.

FAIR USE POLICY

Any part of this publication may be quoted and referenced for educational and research purposes without additional permission from UNIDO. However, those who make use of quoting and referencing this publication are requested to follow the Fair Use Policy of giving due credit to UNIDO.

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

21850

EMERGING TECHNOLOGY SERIES

3/1996

Information Technology

EMERGING TECHNOLOGY SERIES

INFORMATION TECHNOLOGY
3/1996

CONTENTS

TO OUR READERS

This issue of **Information Technology** brings a cover paper on intranets. Intranets, although they originated as offspring of the Internet, are being introduced for essentially different purposes. They are for organizing cooperative work and are therefore profoundly changing interactions in the organizations that use them. For users of the Internet, it is not too difficult to adopt and utilize intranets. What intranets are, and what they are not, is discussed in the paper.

Generally speaking, intranets can be considered as a possible response a company may adopt in order to maintain its position in an ever more competitive environment. It is not, however, an universal and omnipotent solution leading automatically to a company's success once it is adopted. As all other solutions offered in the past by information technology, and perhaps all solutions to be offered by IT in future, intranets also, as well as the results they can bring, depend on the human factor. Only people at every level of the organization or enterprise can transform what IT offers into success. Nevertheless, the adoption of an intranet by itself invokes changes both in procedures and structures of an organization, which when properly maintained, proves profitable to the organization.

From the beginning of the 1980s, when I became a scientific editor of this publication, I maintained the opinion that the mix of opportunities which information technology offers, in spite of several negative effects they render, generally increase the prospective relative advantage of developing countries. Especially recently, information technology offers developing countries the access to information platforms which, when properly used, put companies from the developing countries on a more equal footing with those from developed countries than ever before. Intranets are one of those platforms. Their potential should not be overlooked by developing nations.

On a subject that is becoming increasingly important in UNIDO's work, namely networking, the Organization has recently taken steps to improve such activities in Africa so as to ensure that new networking capabilities offered by modern information technology are not bypassing the continent. Access to information and effective networking are crucial to successful business, in particular to small-and medium-sized enterprises. The Organization is undertaking national assessment studies on information networking for business in 18 of the least developing countries in Africa, within the framework of the recently set up Alliance for Africa's Industrialization. These studies are to be expanded to cover other least developed countries in Africa, as well as those in Asia and the Pacific regions. The outcome of these studies will pave the way towards establishing a self-reliant national information services network in each country.

I am also pleased to inform readers that a new investment partnership scheme has recently come into being, namely a $1000 million window of opportunity for British investment and technology. The new two-year project between UNIDO and NIMTECH (the UK's leading private-sector technology transfer network) represents a major step towards helping private firms in developing countries meet new business partners in the United Kingdom. The project will build on the success of an initial cooperative arrangement between UNIDO and NIMTECH, and aims to sharpen the focus of commercialization of new and emerging technologies to which viable markets have been identified. Emphasis so far has been on cleaner production techniques, biotechnology and nanotechnology.

For readers who may be interested in the globalization of industry and the implications for developing countries beyond the year 2000, UNIDO has published a paper that assesses recent developments in the world economy while highighting the measures taken by UNIDO in response. In particular the paper addresses the growing concern that increasing globalization poses a potential threat to developing countries as a result of the liberalization of world trade. The paper, entitled **The Globalization of Industry: Implications for Developing Countries Beyond 2000**, may be had free of charge and on request from UNIDO's Documents Distribution.

Konrad Fialkowski
Scientific Editor

CONTENTS

CONTENTS *(continued)*

CONTENTS *(continued)*

A. SPECIAL ARTICLE

TOWARDS INTRANETS

M. Muraszkiewicz [1]

Abstract

The corporate world has recently discovered that the Internet technology can also be used for rapidly establishing low-cost and efficient internal systems, i.e. the systems working inside companies and organizations. Such systems are called intranets. There are three major reasons for setting up an intranet: (i) to provide efficient individual and group information management, which encompasses access, collaborative authoring, and distribution; (ii) to provide cost-effective document management; and (iii) to ensure administrative control. This paper is intended to explain the basic notions related to intranets, to discuss their key features and benefits, and to provide the main rules governing their design and architecture. It seems that intranets, owing to their relative simplicity, low costs and significant potential, are an attractive option for building an information infrastructure of organizations, including those in developing countries. The paper is addressed at both executives and information technology officers in order to provide them with a general understanding of intranets and the role they can play in companies.

1. Introduction

There are good reasons for calling 1995 the "Year of the Internet" [LEV96]. This is mainly because the Internet is changing world culture everywhere that it plays a part in society. In particular, during 1995 the ubiquitous Internet instantly became an important part of thousands of companies and organizations throughout the world, bringing new opportunities and profit (see for instance Special Report "Making Money on the Net" [BWE96]). Recently, the corporate world has discovered that the Internet technology can also be used to rapidly establish low-cost and efficient internal systems, i.e. the systems working inside companies and organizations. Such systems are called *intranets*. "The intranet has broken down the walls within corporations", says Steven P. Jobs, CEO of NeXT Computer Inc. This is one of the main reasons why intranets are being set up in so many companies and organizations these days. John Whiteside, head of IBM's Global Network, says "Every single one of our customers is asking for something in terms of an intranet". Having said that, we can legitimately baptize the year 1996 as the "Year of the Intranet". This paper is also about intranets.

Undoubtedly, awareness of the Internet, in particular of the *World Wide Web* (the Web, or WWW), which is the most dynamic and appealing part of the Internet, is almost commonplace among business people in developed countries and fairly good in developing countries. Today, there is only one answer to the question whether one can really run a business on the Internet: one cannot afford not to. However, intranets are still a kind of *terra incognita* for many entrepreneurs in both developed and developing countries. This paper is addressed to them, with the intention of explaining basic notions related to intranets, discussing their key features and benefits, and providing the

main rules governing their design and architecture. It seems that intranets, owing to their relative simplicity, low cost and significant potential, are an attractive option for building information infrastructures of organizations in developing countries.

2. Definitions

What is the intranet ?

There is no single definition of intranet; there are many, depending on one's background or business interest. Let us take a look at some of them. The first one was already coined above, where it was stated that an intranet was a system based on the Internet technology working inside a company or organization. On the cover page of the book "Intranet Working" [ECK96], which is entirely devoted to intranets, one can find the following definition: "Intranet—1. A combination of the technology of an area network and the Internet that is utilized within a large company. 2. A model of the Internet on a smaller scale that exists within the communication confines of a business". A narrower meaning of the intranet, limited to the Web, is given in the paper [MCC96] that reads "The use of the Web for employee information and communication is called the intranet".

For us the term "intranet" refers to the use of Internet technology (WWW servers, browsers, home pages, search engines and hyperlinks, file transfer facilities, management tools, etc.) within an organization. Rather than using these tools to connect to the outside world via the Internet, an intranet uses them for intra-company communications. A very similar understanding of intranets is presented in [HIN96]: "An Intranet is an internal information system based on Internet technology, Web services, TCP/IP and

[1] The author is a professor at the Institute for Theoretical and Applied Computer Science of the Polish Acadamy of Sciences and a partner at the Institute for Computer & Information Engineering, Warsaw, Poland. He can be reached by e-mail *mietek@mimuw.edu.pl*

HTTP communication protocols, and HTML publishing. The Intranet is a technology that permits your organization to define itself as a whole entity, a group, a family, where everyone knows their roles, and everyone is working on the improvement and health of the organization... How do they do this?—by identifying and communicating missions, goals, processes, relationships, interactions, infrastructure, projects, schedules, budgets and culture on-line, in a single interface everyone uses and can add value back to. In a word, an Intranet represents your organization's intelligence". We might add to this: it can represent the intelligence of the organization in an intelligent and simple manner.

Forrester Research, Inc. in the report "Full Service Intranet" [FSI96] underlines that the intranet is a TCP/IP network inside a company that links the company's people and information in a way that makes people more productive, information more accessible, and navigation through all the resources and applications of the company's computing environment more seamless than ever before. The intranets offer new options for more effective coordination of organizational activities in a distributed decision-making environment. In practical terms the intranets allow companies, *inter alia*, to deploy cross-platform applications quickly and easily at low cost.

The white paper [HUM96] gives the following general definition of intranet: "Application of Internet and Web technologies as enterprise information management and collaborative computing technologies is just being discovered. The technologies of cyberspace are now being viewed as a foundation for developing enterprise-wide information systems. These new enterprise information systems are called intranets, and represent the beginning of a new computing paradigm ... Intranets represent a new model for internal information management, distribution and collaborative computing, and offer a simplistic but powerful implementation of client/server computing".

Of course, there are many other formulations regarding intranets. Those readers with Web access may take a look at the sites *http://www.strom.com/pubwork/ intranet.html;http://www.infoweb.com.au/intralnk.htm,*and *http://www.lochnet.com/client/smart/intranet.htm,* where pointers to the places keeping information about intranets are given. One can also find useful permanently updated information on intranet issues in *The Intranet Journal (http://www.brill.com/intranet/index.htm)*. The only moderated intranet newsgroup can be found in *http://www. intranetjournal. com/ijx/.*

To conclude: a common denominator of the majority of intranet definitions can be expressed by the following key-words—corporate network, management, collaborative work, intra-company communication, Internet technology, open system (platform/vendor independent), cost-efficiency.

What the intranet is not

As a supplement to the intranet definition, it is good to mention and discuss some incorrect views occasionally divulged about the intranets.

- A frequent illusion is that an intranet is limited to Web browsers and servers. The hope that it is enough to plug a browser front-end into the organizational network, along with some Web servers at the back end, in order to set up a useful and productive intranet, is entirely false. An intranet is much more than that. Similarly, the view that intranets are simply more sophisticated e-mail systems is equally

wrong. The requisite building blocks of an intranet are presented in section 5.
- Another misleading view, somehow related to the previous one, is that because
(i) Intranets are based on the open system paradigm, and are generically less sophisticated than proprietary solutions; and that
(ii) A great deal of the intranet software can be obtained from the Internet either for nothing, or for a few dollars,

the design and implementation of intranets is easy, fast and extremely cheap, and therefore highly competent staff is not necessary to set them up. Moreover, that the capital needed is low ("anyway, everybody knows how to install a browser and to surf on the Web; almost everybody knows how to download public domain or shareware software from the Internet sites"). The truth, however, is that it is usually easier and faster to set up an intranet than a proprietary system, but it is by no means smooth and easy, or could be done by amateurs. Next, the fully open-standards intranet is a nice theory (or a dream) that will not soon come true. The desire to set up a list of products that best suit the needs, get them from the Internet sites or shops, and put them together in order to have a seamlessly integrated intranet, is definitely over optimistic. "We are still a long way from widely adopted standards that allow a mix-and-match system that works", says B. Roberts in [ROB96].

- Another error is to consider the Internet and intranets as the same entities, differing in size only. This is because an intranet is quite a different environment from the Internet, even though it may employ the same technologies. The Internet and the Web were developed largely to carry out research and scientific activities, along with the hope of saving a few dollars on telecommunication costs, and perhaps to a certain extent, for recreation and entertainment. The essence of the Web is searching and surfing, whereas intranets are focused on organizing collaborative work and distributing documents. Indeed, corporate users have a radically different set of application requirements. The Internet technologies can actually be very useful in an organizational setting, but they must be integrated in a way that observes organizational requirements and constraints.

- Intranets are sometimes considered to be groupware. There are basically two understandings of the term "groupware". The first assumes that groupware is any set of software for running and managing workgroup tasks. Undoubtedly, according to this general definition, intranets belong to the class of groupware tools. Another approach, probably more popular, says that groupware is an integrated collection of software products coming from one company offering specific functions that operate well together. A classic example of such groupware is Lotus Notes; others are LinkWorks, Microsoft Exchange, and Novell GroupWise. This definition of groupware excludes intranets. Usually, this type of groupware is complex and expensive, labour- and time-consuming to install, manage, and train users on, and not always easy to scale up. Such groupware is proprietary and still tends to be locked into its own

application, although efforts have been made to provide interfaces from groupware kits to the Web servers [GIL96]. As of today, groupware is more powerful and better structured than intranet tools. Jamie Lewis, president of the Burton Group, a network consulting company in Salt Lake City, USA, says "You can take it as given that a Web-based Intranet this year will do about 75 per cent of what Lotus Notes can do". A broad discussion on groupware versus solutions based on open systems (intranets) can be found in [ROB96].

• Sometimes Local Area Networks (LAN) or Wide Area Networks (WAN) installed in corporations are considered to be intranets. This is wrong, since one should remember that LANs or WANs are platforms where one can run various things. In particular, these can be proprietary systems based on, say, Lotus Notes or LinkWorks, or open systems based on the intranet philosophy. Incidentally, a combination of both is also possible.

• The intranet enthusiasm sometimes results in statements that intranets are a kind of Swiss Army knife —good for any occasion. This is false, not only because, in general, there are no omnipotent tools, but also because many tools for setting up comprehensive intranets are still missing or in beta versions (see the paper [ROB96]).

Some cases

Netscape Communication Corp. claims that 90 per cent of Fortune 1000 companies already have an intranet up and running, and that the ratio of intranet servers to Internet servers in these organizations already exceeds 50 to 1. Forrester Research, Inc. predicts that the intranet server business will hit US$ 1 billion by the year 2000. Among the companies using intranets one can find: Boeing, where hundreds of intranets are operational; NASA, which uses intranets for planning large projects to help meet distributed team collaboration needs; Ford Motor Co., where an intranet links design centres in Asia, Europe and the USA to help engineers craft the 1996 Taurus. Federal Express, where customers can track packages on-line (saving an estimated US$ 2 million annually); Sandia National Laboratories, which uses an intranet for conference room scheduling, serving financial management queries, keeping an official airline guide and subscription services; Sun, which has 1,000 internal servers, 250,000 pages and other items such as manuals, customer newsletters, product catalogues, field repair data, developer newsletter, price books; the intranets are also used for employee communications, reports distribution and customer service and support. Probably the largest and most comprehensive world-wide intranet system for the not-for-profit sector was set up by the American Red Cross and HLC.internet, Inc. The system allows for information and ideas to be securely exchanged via the Internet between any of the more than 1.4 million American Red Cross volunteer and paid staff who have access to a personal computer.

3. *Business context*

New management patterns

One of the key paradigms of contemporary management is to shift from central decision-making to central coordination within organizations. Another is to make strategic planning a daily part of managerial activities

in companies. After more than a decade of shrinking to raise productivity and efficiency, after restructuring, downsizing and re-engineering, strategic planning is back in companies. But it is back with a difference. Gone are the major symbols of the old strategic planning models, such as the top-down approach, experience curves, or value chains. Files of bound-in-vinyl reports definitely do not accompany the strategic planning game as it is played today. Nowadays, companies are advised to identify their "core competencies", or corporate skills, and based on these skills and the development of others to define their *strategic intent*, which is a definition of a point of view about their future. They are encouraged to follow the *co-evolution* principle, which assumes the democratization of the planning process by handing it over to working teams and staff managers from different disciplines. Co-evolution insists on maintaining close interaction with key customers, suppliers and competitors. G. Hamel, one of the top strategy consultants, says "It is imagination and not resources that is scarce. So we have to involve hundreds, if not thousands, of new voices in the strategy process if we want to increase the odds of seeing the future" [BYR96]. The gurus of strategy speak about, and their followers act towards, creating a *business ecosystem*, which is a set of networks of relationships between a company and its customers, suppliers, rivals, and consumers organizations to gain greater competitive advantage. James F. Moore, a strategy guru in high demand, claims "The new paradigm requires thinking in terms of whole systems. Seeing your business as part of a wider environment" [BYR96]. This means that one has to look at business opportunities not only from the solo player standpoint, but as one actor among many others, each co-evolving with the others. Later on, we shall see how intranets may help materialize this new philosophy.

The life of companies, whatever their size and field of activities, is becoming more and more complex and dependent on the whole business environment these days. Survival and growth require a mobilization of efforts and talents. Continuity of business is not guaranteed automatically. One of the reactions to this fact is that the corporate world opens up, and looks for new information resources and communication channels. It also aims, as we mentioned above, at new management patterns. Towards this end, the Internet turned out to be a perfect platform. It is everywhere, it is cheap, and it is, above all, open. "For the price of a dinner for two a month, a company can now reach the world through a virtual shopfront on the Internet that will look just as impressive as the one used by General Motors" [ECO96]. Widely available, inexpensive global data communication on the Internet will shape the next century business as much as the telephone did in the 20th century. Not only does the Internet address the needs of contemporary companies. Its spin-off, or to be more pathetic, its younger brother, the intranet, has turned out to be a relevant tool as well.

Typical information problems of corporations

Many corporations suffer from problems caused by their incomplete, obsolete and/or user-unfriendly information infrastructures. The problems are usually involved in the management of information, processing, authoring, and delivering. Some of them are mentioned below:

• Obsolete (out-of-date) information stored in legacy information systems;

• Difficult to search and access important business data;

- Redundancy and inconsistency of data across a corporate network;
- Incompatible, proprietary file formats, and different retrieval languages;
- Non-intuitive and incompatible interfaces, especially in terms of viewing tools;
- Complicated access rights and security facilities;
- Poor intra-company communication and unreliable workflow;
- Frequent upgrading of hardware, and application software, in particular publishing and viewing tools, which forces frequent re-training of staff;
- Massive budgets to print under-utilized documents (e.g. manuals, orientation materials, etc.);
- Constantly growing budgets for running companies' information shops (numerous staff; overburdened network administrators and programmers; never-ending maintenance; user's help desk, etc.).

Uses of Intranets

The use of intranets is limited by experience and imagination only. Indeed, intranets can be applied to supporting electronic publishing and project management systems, document management systems and human resources applications, for ensuring reliable and instant customer support and help desk applications. They are ideal sales cycle automation tools, they can assist decision making processes, financial systems, and on-line applications processing (OLAP). One can use them also for financial trading floor systems, procurement and business-to-business commerce applications. The list goes on and on and virtually has no limit.

According to the US firm Zona Research, the most common use for today's intranets is as an electronic publishing system. Distributing frequently changing information on Web pages, such as copies of company reports, 'phone books and policies, can cut costs. The survey conducted by Zona Research, which targeted US Webmasters, found that 40 per cent of intranets are used to access manuals and procedures, 38 per cent to access product and marketing data and post personal Web pages, 30 per cent to post internal job offerings, 27 per cent to revise and approve documents, and 4 per cent to access employee information. In the report "The Intranet" prepared by Forrester Research, Inc. Paul Callahan said, "Typical intranet applications let employees check their [superannuation] balances, schedule meetings, study the latest compensation plan, or apply for a new internal job".

Benefits of Intranets

The main potential and strength of an intranet comes from addressing management issues within organizations. Nowadays, the most common mantra of companies is: management, management, management. Here comes the intranet. There are three major reasons for setting up intranets, namely:
- To provide efficient individual and group information management, which encompasses access, collaborative authoring, and distribution;
- To provide cost-effective document management;
- To ensure administrative control.

Intranets allow corporations to benefit in several ways. Some of the benefits are listed below.
- Intranets are more timely and less expensive in terms of operating costs than classic paper-based information systems. In particular, they dramatically reduce the amount and cost of paper and storage

space used within a corporation since all the documents (e.g. huge manuals, product specs, lists of dealers and sales contacts) are always available in their latest versions electronically to any employee.
- Intranets are relatively inexpensive to start, especially if compared with proprietary solutions; they require much less investment in money and infrastructure. In addition, they are scaleable and open, so one can start small and build as needs/ requirements change. They can be quickly deployed and assembled, since in many cases the basic software components have been around for a long time. Noteworthy, an average client/server project time line is six to nine months, whereas an average intranet project time line is only two to four months.
- The administration, maintenance and periodical enhancements of intranets are simpler and cheaper than their counterparts implemented as proprietary solutions, especially those based on mainframes.
- Intranets follow the principle of distributed computing strategy in an open heterogeneous hardware/ software environment, thus use computing resources more effectively.
- Intranets can be seamlessly linked to legacy information sources such as relational databases, word processing documents, spreadsheets, graphics, groupware databases, etc. [VAR96]. And unlike traditional groupware software, intranet technologies can fit into existing data structures on both the back end, where the data is stored and maintained, and the front end, where users define their tasks such as retrieval or generation of reports.
- Very little training of staff on the use of intranets is required. Actually, users familiar with link metaphor from the Web surfing experiences are immediately ready to make use of the basic functionality of intranets; those who are not, need only to learn how to point and click on interesting topics. Learning how to carry out more advanced activities is also within easy reach of an average employee.
- Employees can generate, publish and control their own content, reducing the time consuming activities of sorting and evaluating.
- Intranets provide more than just point-to-point intra-company communications; they can be used for tracking conversations or used for group collaborations. Also, they help the company manage its work flows, discussions and conferences, as well as keeping track of its work product of documents, spreadsheets and presentations.
- As a result of introducing intranets, the staff, partners and customers become more integrated, co-evolving towards a business ecosystem, which leads to better performance, productivity and satisfaction.

It is a pretty impressive list. To be methodologically fair let us ask the question: What are the deficiencies of intranets? Not very many. First, they are new, which means not fully tested. Second, intranet standards have not been entirely established. Third, they miss some functionality, for instance replication (immediate update of information replicas spread throughout the net), and reliable and comprehensive security. Fourth, Web technology is still not suited for "mission-critical" applications, such as order processing or accounting. But in the high-speed world of intranet development, that may not be true for long. It seems that the risk related to the implementation of intranets in typical environments is rather limited, and will

decrease as intensive work on intranet tools carried out by leading world software/hardware vendors brings upgraded solutions.

4. Computing context

Inflation of computer revolutions

There is no doubt that computers progress in a revolutionary manner. However, it is sometimes said that computer users suffer from too many revolutions affecting computer hardware, software and engineering of computer applications. The inflation of technological revolutions is certainly a good thing for technologists, manufacturers, vendors and savvy consultants, but for the end users and consumers of information technology who want to follow the novelties, it implies additional investments on equipment, training, staff, etc. Yet, as experience shows, all who do not follow changes are likely to be at a significant competitive disadvantage, or even not see the next revolution, simply because they will be out of business when it comes up. The alternatives for computer-dependent organizations are binary, either to develop the ability to absorb new technologies seamlessly, or to perish.

We have already witnessed the revolution in data processing caused by the introduction of mainframes; a combination of mainframes with telecommunication facilities was another big change that gave us geographically distributed networks; the advent of personal computers transformed our understanding of the role of computers not only in business but in society as a whole; local area networks and a client-server architecture along with object-oriented methodologies provided completely new patterns of computing and new levels of efficiency; and recently the emergence of the Internet, in particular of its multimedia wing, the Web, made computing as common as driving a car or making a telephone call. How important is the Internet and how large is its potential is shown by the fact that Microsoft, the most powerful software company ever, has reorganized its entire company and product line around Internet functionality.

Although the origins of the Internet go back to the 'sixties, from the non-computer world point of view, it has appeared practically overnight and became an ubiquitous facility. It was made possible by the convergence of three technological developments: the massive quantity of personal computers and local area networks in organizations; the steady and significant decrease in telecommunication costs; and the appearance of the Web. Technically, the power of the Web originates from two sources: HTML and HTTP. The *HTML language* (Hyper Text Mark-up Language), the *lingua franca* of the Internet, is a platform independent tongue for defining Web documents, understood just as readily in the Windows and Macintosh worlds as by Unix workstations; *HTTP* (Hyper Text Transport Protocol) is a lightweight networking protocol that uses minimal network bandwidth. Now, the slogan that the network is the computer has finally materialized.

Despite its recognized shortcomings, the Web, which is a kind of global (planetary) operating system, is a great platform for educational, social, business and entertainment activities, to mention only a few. J. Udell gives four reasons why the Web is essential for business [UDL96]:

- It is open: the Web platform is neutral and global, and Web browsers function as universal clients;
- It is resourceful: using the Web, one can update the look and capabilities of legacy applications;

- It is efficient: Web-server applications are becoming simpler to create and faster to use;
- It is dynamic: Java and ActiveX can help one quickly build information-rich and customizable client applications.

We can add another reason to this list that puts emphasis on the fact that the Web has become an efficient and easy tool for carrying out full-text searching on a planetary scale. A simple experiment with the search engines provided by AltaVista (http://altavista.digital.com/) or other good services that one can find on the Internet proves how efficient global full-text searching can be. This asset is not being rejected by alert business people.

The way users presently interact with computer systems and applications by means of Graphic User Interfaces (GUI), such as those available under Windows, is dramatically different to what we remember from the DOS prompt epoch when each piece of dialog had to be written down from the keyboard by the user. That was a slow process, prone to errors. Now, a computer mouse has become an indispensable part of computer hardware, equally important to a keyboard, and the words "pointing" and "clicking" have been added to the computer lingo. Personal computers along with the GUI revolution, have made computers accessible to ordinary people with little knowledge of computing.

New paradigm: Document-centric computing

The present proliferation of the Web has shown that GUI icons have not exhausted the notion of user-friendly interfaces. What the Web offers, and what is so much appreciated by Web surfers, is a hypertext-type navigation that allows instant jumping from one document to another placed anyway around the world by clicking on a fragment of text or a picture that refers to the target document. In fact, this is the way people have been working with paper documents for centuries; the main difference is that it has been a very inefficient process. Well, the Internet seems to have a magical ability to make the old new again. In this context it is appropriate to quote Umberto Eco's statement: "We have to learn the Internet in order to teach people how to read books" [ECC96].

Notice that all objects we can see when browsing Web sites are pages that to a great extent look like their classic counterparts in books, reports, or questionnaires. The pages are written in the HTML language, and the only thing we need in order to see the pages are Wweb browsers that are relatively simple programs, which are widely available, sometimes free-of-charge. The pages are multimedia entities that can contain text, graphics, sound, and various types of interaction facilities such as radio buttons, top-down lists, and multiline text boxes, where the users can write down texts and send them out to the owners of the pages.

The next step was software to make pages more interactive and versatile. Nowadays, small programs (so-called *applets*, written for instance in the Java programming language), can be associated with the pages and executed to perform some simple jobs such as on-line generation of the company's latest financial results. What is important is that Web surfers might even not be aware that when they click on the text/icon to get the job done, a corresponding applet hidden behind the clicked item is invoked. Also, non-Web related conventional programs or applications, for example database management systems, can be activated while interacting with the HTML pages.

The data can be transferred between the applications and these pages. All this means that software, as a standalone product representing the whole computing machinery in front of the user, is fading away. It is now largely distributed and hidden in content, and the user comfortably does not worry about it any more.

So, the question arises: is an HTML page a document or an application ? The answer is: both, or even more. The HTML pages are active documents playing various roles, depending on a particular context and user's intent. Therefore, when it comes to the Web, one can legitimately speak about a document-centric environment. It might be interesting to note that at the infancy stage of computing, the focus was entirely put on a program, whereas data occupied a secondary position. That was the era of program-centric computing. Later on, when big IBM mainframes seized the computing niche and the term "data processing" entered the language, attention was directed at the data. As a result of this Copernican revolution in the area of computing, we had the era of data-centric computing. Now, with the explosion of the Web, where the main object is an HTML document, we move in the period of document-centric computing. This is the essence of the current revolution. Users are dealing only with the documents, using a single interface (the browser), whereas the processing power is placed behind content and not visible to them.

Shortcomings of HTML

It is beyond the scope of this paper to discuss the shortcomings of HTML; however, one should realize that HTML, which is actually a simple subset of a more general language *SGML* (Standard Generalized Mark-up Language), describes a logical structure of a document only; it is hardly concerned with its format. The final appearance of the document, i.e. how it is seen on the screen, is created by the user's browser. This means that the same document can be presented in somewhat different ways by different browsers, or even by the same browser running in windows of different sizes. Another problem is that as the Web accepts the HTML documents only, the problem of putting an organization's legacy documents on the Web arises. The conversion to HTML might be expensive and labour intensive, and since it does not maintain the original appearance of the document, the original layout is lost (an additional problem is to preserve graphics and images while converting). Although HTML is a highly Web friendly language, it is definitely unfriendly to the users, therefore authoring documents directly in HTML as a practical option in a company has to be rejected. One of the solutions, already available, can be to create the documents by means of widely accepted tools, e.g. MS Word, and automatically convert them into HTML. Towards this end, Microsoft has given away thousands of copies of Internet Assistant, a program that converts Word documents to HTML, and has updated its Microsoft Office with a built-in HTML authoring facility. Another example is PageMill, an HTML-authoring tool offered by an electronic publishing pioneer, Adobe Systems. The user unfriendliness explains why the collaborative capabilities of HTML are limited. The next problem with HTML documents is that large collections of them are difficult to manage and archive.

The conclusion drawn from the above is that generic limitations of HTML have to be taken into account when designing the architecture of an intranet, and planning training for the staff. It may be interesting to know that the shortcomings of HTML stimulate an interest in Adobe's

Portable Electronic Document formats that preserve the original layout of a document, are Web friendly, allow hyperlinking to HTML and, in addition, are platform independent.

5. Intranet architecture

Desirable features and functionality

The architecture of complex entities has always been determined by the requested functionality, technical and financial constraints, and the designer's imagination and creativity. From the intranet user standpoint, a wish list of intranet features and functionality might be as follows:

- User-friendliness; users should deal directly with content rather than with programs for manipulating the content (document-centric approach);
- Unified access to applications of different types (seamless application integration), including legacy applications;
- Intuitive user-defined arrangement of resources;
- Easy access and collaboration modes with other users, in particular simple means of sharing documents and files;
- Integration of functions and invisibility of protocols, for instance when browsing one should have the possibility to forward e-mail or download a file within the same session;
- Easy means of authoring and posting documents;
- Fast (on-the-fly) conversion of legacy documents to the HTML format;
- Automatic full-text indexing;
- Powerful and easy full-text and field searching;
- Simple yet powerful programming tools integrated with the working environment;
- Simple and centralized installation and administration;
- Simple and efficient security facilities and access rights mechanism;
- To have a gateway to the Internet, through a firewall that protects the intranet against external intruders;
- Integration with remote access systems, e.g. mainframes already in place;
- An intranet desktop has to have the ability to work off-line.

Now, let us take a closer look at technical aspects of the intranets.

Intranet model-Full Service Intranet

One of the most comprehensive concepts of the intranet has been worked out by Forrester Research, Inc., which has developed the notion of *Full Service Intranet*. The Full Service Intranet is defined as: "A corporate TCP/IP network that delivers reliable, feature-rich applications sharing five core standards-based services— directory, e-mail, file, print, and network management" [FSI96].

Netscape Communication Corp. has successfully adapted this concept and has based its strategy regarding the intranet tools on it [AND96]. As a result, an integrated family of servers, called *Netscape SuiteSpot*, and an enhanced browser augmented by additional tools, called *Netscape Navigator*, have been developed. Netscape Navigator, which defines the client side of the intranet, along with SuiteSpot, which determines the server side of a corporate network, are all the components needed for implementing a Full Service Intranet (see figure). Thus, for

Netscape Communication Corp. the intranet can be symbolically described by an equation
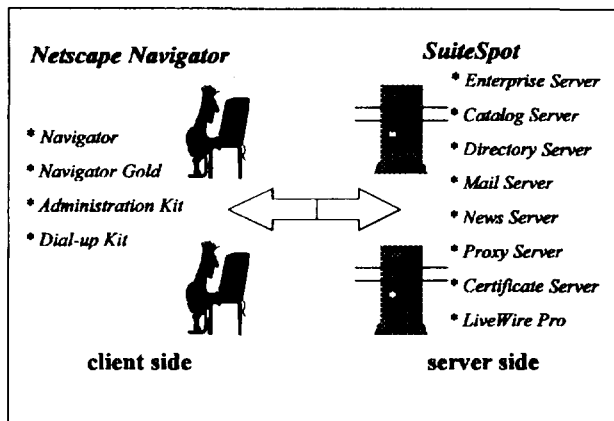
* intranet = Netscape Navigator (client) + Netscape SuiteSpot (server)

Navigator is a universal client for accessing and manipulating all the resources on an intranet. SuiteSpot is a set of "Legoland" building blocks that are specialized servers, and a development environment from which the designer picks up a subset or the whole set of servers and tools in order to establish the software platform of the intranet. The SuiteSpot server components are linked together through a common management architecture, a common directory services architecture, and a common security architecture.

Although the Full Service Intranet is not the only way to see the intranets, we believe that it is an excellent model for explaining their architecture. Let us therefore take a closer look at Navigator and Netscape SuiteSpot. In addition to that, towards the end of this Section, we shall mention a new tendency to enhance intranet tools by various facilities, allowing companies to support commercial activities encompassing their customers and partners.

Client side

Netscape Navigator, which runs on all common operating systems, is a single user interface to an intranet for accessing all the resources stored on the intranet, for sharing information, and for communicating and collaborating with other users. In particular it works as an interface to legacy systems, including databases. The Netscape Navigator client is composed of the following modules: Netscape Navigator, Netscape Navigator Gold, Administration Kit, and Dial-up Kit.

Navigator and Navigator Gold

Netscape Navigator is composed of Navigator and Navigator Gold (there are two versions of each—version 2.0 and 3.0). Navigator is a universal client for publishing, navigation, collaboration and application access; Navigator Gold is the premium Navigator for intranet environments. Navigator contains, *inter alia*, (i) a browser; (i) an e-mail client (SMPT—Simple Mail Transfer Protocol and POP/3—Post Office Protocol); (iii) a discussion group client; (iv) built-in security features, based on the standard Secure Sockets Layer (SSL) security protocol. It should be noted that Navigator Gold includes a set of wizards that help users create their own personalized pages. Having defined the pages the user can post her/his own content on the intranet. So, the net administrators do not need to post

everything themselves, but can delegate this activity to the employees of the company.

Administration kit

The kit provides a cross-platform feature for configuring Navigator within the intranet. The kit is used for customizing and controlling Navigator deployment in an organization. It allows one to specify the Navigator settings, such as proxy configurations, default home pages, customized help menus, and customized directory buttons. It is possible to lock the defined preferences to prevent users from changing these settings on their own.

Dial-up kit

This kit allows organizations to provide remote access to the intranet for their users. The administrator can set up such parameters as 'phone number, user name and password. Having done that the user can connect to the intranet remotely.

Server side

As of this writing Netscape SuiteSpot's server septet, plus a development environment, is composed of the following components: Enterprise Server, Catalog Server, Directory Server, Mail Server, News Server, Proxy Server, Certificate Server, LiveWire Pro. Below we provide more information on each server.

Enterprise Server

This server is the core of an intranet. It is responsible for HTML publishing, accessing and managing content. In particular, all content managed by this server can be automatically indexed. The indexes are used later on for fast full-text searching. To this end, Enterprise Server includes the Verity Topic full-text search engine. Also, the server allows for document version control, i.e. each time a document is updated, a new version is created, and all old versions are still accessible. Any two versions can be compared, and if needed, one can revert back to a previous version. Version control is especially attractive for a group of people working on the same document. Enterprise Server has an integrated Java run-time engine and JavaScript interpreter. The Java scripts can be embedded in HTML documents and run automatically by the server, making it easy to create dynamic content, customize content to an individual user, or pull data from legacy systems into the document on the fly. It is interesting and important that Enterprise Server can be monitored and managed remotely from anywhere on the network via Navigator. The server fully supports the SSL 3.0 security protocol, including user and server authentication. The network manager can use the server to define access control privileges for users and documents. Moreover, Enterprise Server is a platform for running live content-based applications that can be accessed by Navigator users and linked into legacy systems, including relational databases (see LiveWire Pro environment below).

Catalog Server

Generally speaking, this server is used for finding resources on a network. Catalog Server automatically sets up and maintains a catalogue of documents stored on the servers sitting on the net throughout an organization. The user can define and structure the catalogues according to the needs. It is possible to build many Yahoo-style browsable indices, depending on user interests, as well as to make an entire intranet searchable all at once. For

instance, the user can establish/generate an index for all documents with the keywords "milk" and "New Poland" This is possible thanks to an automated catalogue agent, so-called "robot", which locates documents on a network and automatically generates the catalogue information. This server also offers navigational tools, i.e. for searching and browsing. The search engine, named Verity, allows the user to formulate both full-text and structured relational-style queries against the catalogue. Boolean queries, wild characters, adjacent queries, and thesaurus searches are supported. One can define a personal view of information by defining profiles, for example and/or to modify the look and functionality of catalogue views, with flexible taxonomy, layout and search menu.

Directory Server

This server provides a universal centralized directory service for enterprise-wide management of user, access control and server configuration information. It links together such information as user names, e-mail addresses, security keys and contact information in a searchable, structured directory. As a result, any user and each server automatically knows all information about other users. The directory services are based on the open Internet standard LDAP (Lightweight Directory Access Protocol).

Mail Server

Mail Server is a native open-systems e-mail server that provides scaleable e-mail facility across an intranet, and it can also interoperate with all proprietary legacy e-mail systems that have, or provide gateways for Internet standards such as SMTP.

News Server

This server facilitates the establishment and maintenance of secure groupware-style discussion groups that enable team collaboration and easy information sharing. With News Server, users can set up discussion groups, composed of the employees who carry out remote dialogues by posting and reading messages. Discussion groups support multiple conversations (threads), displaying postings in the context of the prior discussion. Incidentally, News Server accepts news feeds from public Usenet servers.

Proxy Server

The main role of this server is to replicate, to cache frequently accessed documents, and to filter content on demand, which leads to better performance and conserves network bandwidth. Interestingly enough, it reduces the need to expand network infrastructure; analysis of typical customer deployments indicates a return on investment of 200 to 1,200 per cent [AND96]. Proxy Server also enhances network security by providing a central control point for all network traffic.

Certificate Server

This server is used whenever encrypted communication over the intranet is necessary. Certificate server issues digital public-key certificates and security keys for users and servers using an easy-to-use graphical interface. Client certificates permit users to log in once to Navigator, which then automatically presents certificates establishing identity to subsequent servers. Certificates can also be used to validate servers so that one can be sure that the server being used is the genuine one, rather than a deceiver. Certificate Server is based on open standards such as SSL, X.509 v.3, HTML, HTTP and LDAP.

LiveWire Pro

This is a visual development environment for creating live on-line applications using server-side JavaScripts and HTML pages. Completed applications can be deployed on Enterprise Server. In particular, with LiveWire Connectivity Library, programmers can create server-side interfaces to databases such as Ingres, Informix, Oracle and Sybase, and many other databases, including mainframe legacy databases.

Commercial applications

The principle of a business ecosystem presented in Section 3 assumes that companies cooperate closely with their partners and customers. Towards this end, intranets should be equipped with a set of tools for handling various commercial activities. Typically, such tools include:

- *Community platform* (system) that lets users communicate, collaborate and share information in an open, encrypted on-line services environment. For instance, the community system offered by Netscape Communication Corp. includes a chat server, bulletin board server, and mail server;

- *Online publishing systems* that complement existing intranet publishing features in order to support transaction-oriented and commercial-grade publishing environments, in particular, to facilitate registration and billing of customers, and then dissemination of electronic information;

- *Electronic commerce facilities*; the tools of this category are used to sell goods and services on the Internet. Noteworthy, in the context of electronic commerce, at least three issues have to be solved in a satisfactory and widely accepted manner: (i) security; (ii) authentication: so that agents can verify that the electronic currency they receive is real; (iii) anonymity: to assure that consumers, merchants and the transactions themselves remain confidential. At present, there already exist various techniques and tools addressing these issues, e.g. the security solution implemented in the products of Netscape Communication Corp. is based upon the open SSL industry standard security protocol and the evolving SET open payments protocol.

Of course, the approach developed by Forrester Research, Inc. and Netscape Communication Corp. is not the only one. It might be interesting to compare this approach with other proposals. In particular, on the client side Microsoft offers a solution based on the Microsoft Explorer, which is a browser that offers an excellent alternative to Netscape Navigator. On the server side, based on the Windows NT platform, Microsoft offers solid pieces of an intranet solution, which are, *inter alia*, the BackOffice suite of client/server products, including the Internet Information Server HTTP product, and Microsoft Exchange Server, which is a key component of an Intranet responsible for the integrated messaging, e-mail, groupware, collaborative database and document sharing. The budget conscious users may be interested in the fact that Microsoft is giving away its Explorer to everybody, and Internet Information Server to installed Windows NT users. Details can be found on the pages *http://www.microsoft.com/ corpinfo/press/1996/jun96/ovallpr.htm* and *http://www. microsoft.com/office/intranet/volcano/default.htm.*

Novell is offering an intranet solution, too (for more information one can visit the page *http://www.novell.com/ corp/solutions/inet/index.html*). Sun's comprehensive proposal regarding intranets (so called Solstice Intranet

Management) is presented on the page *http://www.sun.com/ 960901/cover2/solstice.html*. Also, companies dealing with database software—the lifeblood of a corporation—such as Oracle or Sybase Inc., have developed tools for intranets (see *www.oracle.com/products/websystem/html/webSystem Overview.html*, and *http:// www.sybase.com/Partners/ internet_solutions/ipnewswallop.html*, respectively). Incidentally, the dramatic war between the intranet vendors [COO96] is justified by the fact that, as predicted by Zona Research, an analysis firm in Redwood City, California, spending on Intranet projects will outpace Internet spending by more than four to one and reach up to US$ 7.8 billion by 1998.

6. Basic development hints

The development of an intranet is still more an art than a science. Constructing an effective intranet infrastructure requires attention to three distinct areas: management, technical and content. The main hint for those who really want to have an intranet is: start today. If one waits too long, catching up can be very difficult. The senior management support, and involvement of the users are a key success factor. Strategize on how to get it. Developing an information strategy (user needs and the way of meeting them), and business policies (a definition of access rights, publishing rules, security facilities, etc.) are absolutely a must. Before one does it, basic questions, such as the following, have to be answered:

- What is my business intent, i.e. where do I want to go?
- What are my business needs?
- What is the amount and structure of my legacy information systems/resources?
- Is my staff sufficiently experienced in terms of computer applications and information technology?
- Am I supposed to have remote users, i.e. is my intranet going to be used mostly for internal (headquarters) or external (outlets, customers) communications?
- Do I have enough funds?
- Do I want to connect the intranet to the whole Internet, and what should be done to provide security?
- What happens if the project gets into trouble (a contingency plan has to be defined)?; do I have anyone who can help me, if needed?

In addition, one has to constantly track developments that apply to key areas. The strategy based on small steps works best; simply do it, test it, redo it, move on. Once started, be prepared to manage evolution and change.

One of the most important tasks is setting up an intranet publishing policy aimed at standardizing the look of company documents, defining access rules, determining what links to other documents should be embedded in the material to be published, etc. Another vital issue is security, i.e. a mechanism for protecting the information on a network, as well as the network itself. Also, do not forget to communicate, evangelize, and train all the protagonists. And finally, when the intranet is up and running, start worrying about managing growth. Anticipating the flood is the best approach. Chances are that the intranet traffic will outstrip the Internet traffic within a few months. "As soon as you start putting in-house information out on the Web, ..., others in the company will get their own bright ideas. And the more data you get, the more hits you'll get. And the more hits you get, you'll soon find that users are just

waiting too long for a response", said C. Ryder, Intranet analyst at Zona Research. One has to expect that managing the intranet will be a demanding task. C. Ryder points out "The bigger your Intranet gets, the closer you'll get to a ticking time bomb, as far as managing all this stuff goes". It is important to have a good administrator of the intranet who could even remotely administer all the critical functions, and in particular to have someone who will be responsible for changing content. Design your intranet from the start with the ability to change content frequently.

Last but not least, although selecting and installing hardware and software for implementing the intranet are probably the easiest part of the intranet building process, one should design and implement the technical infrastructure according to the actual needs, rather than be driven by the latest technological novelties and fashions. Remember, however, that your intranet has to be scaleable. Make sure you can add or increase processor, memory, and disk components when your intranet project becomes popular and known around the corporation.

The Intranet Success Scale to assess how a company is prepared to introduce an intranet was proposed in the paper [COM96]. Now, we present a modification of this approach, which may help in a rapid, yet very preliminary, assessment of the company status *vis-à-vis* intranets. Our scheme is composed of questions, each of them is assigned a quantity of points. If the answer to a given question is in the affirmative, one adds the points related to the question to the score; otherwise nothing is added. The questions and corresponding points are as follows.

Can one assume the following is true and/ or available

	points
• Clearly defined objectives	0.5
• Expectations are realistic	1
• Comprehensive set of requirements	1
• Significant experience with computers/LANs	1
• Serious user involvement	2.5
• Constant support of executives	2.5
• Competent information technology staff (if not, outsourcing is an alternative)	1
• Realistic planning	0.5
Total points	10

The decision table is as follows.

Score	Action
9.5 or 10 points	do not hesitate; go ahead
9 points	success is within your reach; try
8 or 8.5 points	will work hard to succeed
less than 8 points	think again; " danger zone"

If the total score is 8 or more points, then a classic feasibility study on introducing the intranet can be started. Of course, the questionnaire and the decision table provide some general indications only; their value lies mainly in the fact that they trigger and guide a thinking process on setting up an intranet in a company in a disciplined way.

7. Conclusion

We believe that an intranet will soon be as basic a tool within the corporate world as networks are today. However, in the end the deciding factor will not be the intranet, but the way we use it. Meaningful changes are not generated by tools and applications themselves, but they come from changes in how we think and carry out our work.

The success of intranets, which is a triumph of the Internet technology, also behind the firewall, i.e. at the organization level, may encourage asking the question: Is a corporate desktop now dominated by Windows going to change its face and before long show a browser of the Netscape-type on the monitor rather than Windows? Although the corporate world is a rather conservative place, chances are the answer is in the affirmative. M. Andreessen, who devised the first browser, Mosaic, and co-founded Netscape Inc., once predicted that "The rise of the browser will turn Windows into a partially debugged device driver", by implication downgrading Windows to a hidden interface linking the browser with such devices as a printer, monitor or a modem [ECO96]. In the report [FSI96] Forrester Research, Inc. reasons in the same direction: "Corporations will migrate from proprietary NOS (Network Operating System) to Full Service Intranets to get the benefits of: (i) easy connections with the outside world, (ii) multiple competing suppliers, and (iii) lower costs". Hence, will the present corporate information technology abandon proprietary solutions leaving room for the open alternatives by the end of the century? Probably yes, at least as far as the majority of companies and organizations are concerned. This will likely happen because the open solutions are cheaper, easier, faster, and well support new tendencies in business, in particular co-evolution and business ecosystems. Whatever the future, now, to improve their operations, the organizations have another robust, and easy-to-use tool at their disposal—the intranet, the latest baby of the computing revolution.

8. References

[AND96] Andreessen M., and the Netscape Product Team, "The Netscape Intranet Vision and product Roadmap", *Netscape Communication Corporation*, 16 July, 1996.

[BWE96] Special Report "Making Money on the Net", *Business Week*, 23 September, 1996.

[BYR96] Byrne, J., "Strategic Planning", *Business Week*, 2 September, 1996.

[COM96] Comaford Ch., "Mission Critical. Soothsaying your intranet's future", *PC Week, http://www. pcweek.com/archive/1335/pcwk0021.htm,* 3 September 1996.

[COO96] Cooper Ramo, J., "Winner Take All", *Time*, 16 September 1996.

[ECC96] "New media and the future of the book", lecture given in the Polish PEN Club on the 23rd of February, Warsaw, Poland, 1996.

[ECK96] Eckel, G., Steen W., "Intranet Working", *New Riders Publishing*, Indianapolis, Indiana, 1996.

[ECO96] "The Software Industry Survey", *The Economist*, 25 May 1996.

[FSI96] Pinicince T., Goodtree D., Barth C., "Full Service Intranet", *Forrester Research,* report, vol.10, No. 4, 1 March 1996,(*http://www. forrester.com/*).

[HAM94] Hamel, G., Prahalad, C.H., "Competing for the Future", 1994.

[HIN96] Hinrichs, R.J., "Intranet 101. A guide for Intranet newbies . . . .", extracts from an upcoming book, *SunSoft Press/Prentice Hall*, 1997.

[HUM96] "The Intranet.Implementation of Internet And Web Technologies In Organizational Information Systems", *Hummingbird, http://www. hummingbird.com/whites/intranet.html,* 1996.

[GIL96] Gillmore, S., "otes Opens Up to the Web", *Byte*, vol. 21, No. 10, October 1996, p. 49.

[LEV96] Levitt L., "Intranets: Internet Technologies Deployed Behind the Firewall for Corporate Productivity", prepared for the Internet Society, *INET'96 Annual Meeting*, 1996.

[MCC96] McCarthy V., "Jump Start Your I-Nets", *Datamation Plug In*, 1 February 1996 (*http:/ /www.datamation.com/PlugIn/issues/1996/feb 1/02ant100frame.html*)

[ROB96] Roberts B., "Groupware Strategies", *Byte*, vol. 21, No. 7, July 1996, pp. 68-78.

[UDL96] Udell, J. "Your Business needs the Web", *Byte*, vol. 21, No. 8, August 1996, pp. 68-80.

[VAR96] Varney, S., "Link the Web to Your Legacy Data and Apps", *Datamation Plug In*, 1 April 1996 (*http://www.datamation.com/PlugIn/ issues/1996/april1/04asoft1.html*)

B. NEWS AND EVENTS

Internet: which future for organized knowledge?

The history of Internet development is discussed in terms of "what we might have known"; "what we know"; and "what we do not know". With respect to the latter, it is almost impossible to predict how the Internet is going to affect organized knowledge. In order to understand the problem, it is necessary to put the Internet into the context of the history of the human encyclopaedia. The printing press mechanically enlarged intellectual space, and the computer has made it electronically manageable. The conversion of the domain of organized knowledge into a new, digital macrocosm began in the 1950s and it has since then followed three fundamental directions—extension, visualization and integration. In the book age, primary data sets were collected and organized into structures that were necessarily unalterable and rigid. Information technology has changed this.

New problems have arisen as a result and there are ten major questions to be considered. These cover digital discrimination; disappearance of great compilers; emergence of the computerized scholar; stored knowledge and knowledge accessibility; knowledge accessibility and knowledge management; loss of information on paper; universal access; new language of the encyclopaedia; intellectual space or polluted environment; and decentralization versus fragmentation. The Internet requires an infostructure of centres that will, through their coordinated efforts, guarantee the stability, reliability and integrity of the digital encyclopaedia; provide constant access without discrimination; deliver a continually updated map of the digital universe of thought; expand the number and quality of on-line resources; and support and improve tools and methods for storage, retrieval and manipulation. Today the body of organized knowledge has a new electronic life and the digital heritage of the next millennium is being constructed. (Source: *Information Society*, 12(1) January/March 1996)

Surfing for corporate intelligence

With an increasing number of both large and small commercial enterprises on the Internet, there is an increase in their market audience and their visibility to their competition. There are three methodological tools available to people with Internet access—business indexes; smart search engines; and on-line publications and news. Corporate intelligence is defined as gathering information about the public activities of companies. Public company information on the Internet can be used to identify competition; observe competitors' changes in the structure; determine pricing; keep up-to-date with new product announcements; and be informed of mergers, acquisitions, executive appointments, etc. Gathering corporate intelligence can be an expensive venture, especially if commercial services are used.

Sources of information include indexes. While company information is freely available on a company's Web page, there is no centralized index of all businesses on the Internet. Currently there are a series of independent business indexes, each maintained by a site in accordance with site resources. The business information search engines available on the Internet are tabulated. The news networks are storehouses for current business information as they include editorial commentary in addition to their business sections. Once information is found on the Internet, it is necessary to use bookmarks to enable users to find their way back to the information when required. Some difficulties that may occur when using search engines are missing links; commercialization; exceeding capacity; browser limitations; irrelevant finds; redundancy; duplication and accuracy; errors; and false retrieval.

With the vast quantity of information on the Internet, it is becoming very important to develop concrete techniques and methods for finding relevant collections of information sources. However, it should be remembered that much of the business information available on the Web is subject to company bias. The Internet should only be used as one possible source of information and its limitations should be remembered. There are some useful nuggets of competitive information freely available if one knows how to find them. (Source: *Business Information Review*, 13(1) March 1996)

Information professionals in the corporate sector

Large corporations are finally beginning to realize the power of information in a highly competitive world. Information professionals in the corporate sector find themselves in the middle of it all. On the one hand, it is much easier, because clients understand the importance of information and are willing to pay for it. But on the other hand, it is more difficult: people mostly need strategic information at very short notice, often within 24 or 48 hours. They do not want articles or photocopies from books, they want value-added information which is of high quality and up-to-date.

The environment is constantly changing. One of the big challenges is keeping up-to-date with developments in delivery mechanisms. Along with day-to-day demands of the job come other pressures: making sure the information department's role is taken seriously and its contribution to the organization valued. The technological advances of recent years, especially the arrival of information tools on the desktops of end-users, and the sudden ubiquity of the Internet, mean that attention is focused on the role of information in business as never before. As well as management commitment, those practicalities involve communicating change to users.

Information is becoming more and more important, and that creates new opportunities for librarians and information managers. The Internet, for example, has had an enormous effect on how executives think of information and its use in their daily decision-making. (Source: *Information World Review*, May 1996)

A framework for information policy analysis based on changes in the global economic forces

Information policy is a set of policies for developing and implementing concrete information-intensive programmes or information resources in terms of global economic development. A model is proposed which supports information policy-making, by the continuous study of relations between diverse phenomena and examining the object of information policy in context. The intention is to design a model that is capable of analysing the wide range of phenomena influenced by changes in the global techno-economic-social environment caused by developments in the information technology field. The resulting model pro-

vides a framework for information policy analysis and is intended to operate within the micro and macro level interaction context and includes cultural, social, and organizational aspects. It serves as a multifaceted tool or matrix which allows merging different components and can be used to examine deployment of resources and implementing processes.

The intelligence culture is discussed in terms of its characteristics and skill requirements, and various theories of information policy and information management are examined. It is concluded that the proposed model offers a global approach to analysing the impact of global economic forces on society. Information policy is a tool for solving practical problems relating to innovation and the implementation of information technology or information-intensive programmes. The development of an intelligence culture forms a cornerstone of an information policy. It can be argued that in an information-intensive society and environment, the management-centred framework should be replaced by an information policy-oriented (political) frame of reference. It is felt that this perspective is more suitable for understanding the development of society and is a better tool for acting strategically. (Source: *International Forum of Information and Documentation*, 21(1) January 1996)

Legal and ethical issues of information

It is necessary to understand legal issues of information to cover the use of statutory or judicial/administrative measures to regulate questions concerning the use of information. Ethical issues cover an evaluation of different information-processing modes. It is important to understand that the ethical dimension concerning the qualitative aspects of information handling and meeting ethical standards is a qualitative control for librarians. A major professional demand and responsibility is to ensure free access to information and this can pose certain problematic questions. There can be situations where the policy of the State restricts access to certain forms of information. Connected with freedom of access is the question of information costs. Personal ethical demands may be placed on information professionals.

Considering the future, it is concluded that information law is an important field where there is a need for research aimed at enhancing the understanding of the general structures of the legal regulation of information to provide practical guidance for information professionals. Because of modern technology and internationalization, information law is an innovative field. It is important that information professionals be aware of proposed legal changes, new bills, new draft directives, etc. They should be active in legal policy debates and ensure that their suggestions and views are taken seriously. Ethical standards should be advocated and the general interests of information users, in particular ordinary citizens, should be promoted. In addition, it is important to maintain and sustain a constant discussion of ethical demands and standards. Standard formulation should be tried out and one aim should be the drafting of a code of conduct for librarians, including rules of good librarianship. Such a code could be the concrete result of an intensive ethical debate and form the starting point for ongoing ethical deliberations. (Source: *International Forum of Information and Documentation*, 21(1) January 1996)

Cheap Internet PCs

The appearance of "network computers" (NCs)—cutdown PCs priced at under $500 and intended to interact with the Internet—may have significant implications for the PC industry. Oracle and Sun are actively promoting the concept, and players such as Netscape are indifferent as to whether their Internet access software runs on a PC or NC. The potential cost-savings to large corporations are immense.

If only 5 per cent of IS managers opt for NCs, however, the impact on the revenues of PC manufacturers will be considerable. In addition, every major Japanese computer supplier is planning a major assault on the US and European markets. It remains to be seen whether the *Java-Netscape* axis will displace Intel and Microsoft from their market dominance, but some stock market investors are already retreating from high technology stocks. (Source: *Computer Business Review*, 4(3) March 1996)

How to help developing countries

The British Library for Development Studies (BLDS) has existed as the library of the Institute of Development Studies since 1966. In the recent past is has mounted a World Wide Web page with information about IDS and the BLDS, including the BLDS catalogue. It has also been integral to the development of the Electronic Development Information System (ELDIS) project aimed at providing an information gateway and referral service to information from or about developing countries.

The problems inherent in providing information to people in developing countries are complex. There is the issue of whether information speeds the development process, or prolongs economic imperialism, or whether people in developing countries have affordable or reliable access to the Internet. For BLDS scanning entire or parts of collections to offer access via the Internet is prohibitively expensive, leaving the only option document delivery which is also expensive to operate. If the BLDS charges a realistic rate then document delivery is priced out of reach of most users in developing countries. Such a service would have to operate as heavily subsidized.

An attempt has to be made to find solutions within the constraints that exist. A project aimed at helping one university or a small group of research institutes in one country would be appropriate. The whole idea would rest on aid being made available and might include the provision of IT equipment, training, guidance in appropriate resources and document delivery. The BLDS has not yet instigated any of these types of projects but now that it has its catalogue available on the Web is seeking to evaluate the most effective way of ensuring that the information made available through the service is useful. (Source: *Focus on International and Comparative Librarianship*, 26(3) 31 December 1995)

Charging, paying and copyright—information access on open networks

Publishers wishing to use the Internet as a delivery mechanism have two major concerns: the protection of copyright and the receipt of payments. Two EU-funded projects, COPINET and COPICAT, are currently looking at methods of meeting these concerns.

The COPINET project is concerned with developing appropriate mechanisms for secure financial transactions

over the Web. The specific objectives are to determine how electronic payments can be applied to commercial publishing without the need to register every user, and to implement a WWW server capable of supporting searches within a database of abstracts, with automatic linking to a full-text archive. The latter element in the prototype system comprises articles from the INSPEC database.

A decision has yet to be made as regards the payment mechanism to be employed, although it is likely that a choice of such methods will be offered. There are a number of payment order and token-based schemes which could be used. Under the first heading are NetCheque, NetChex, First Data, First Virtual, First Bank of Internet, NetBill, Open Market and CyberCash. Under the second are such systems as NetCash, DigiCash and Mondex. The COPICAT project has developed a system in which copyright material is "wrapped" or encrypted prior to delivery, and only "unwrapped" as a result of a specific authorization issued by the CITED subsystem. Material is only visible within the COPICAT environment, and any attempt to copy items for subsequent reuse elsewhere results in encrypted copies. A functional PC-based system has been demonstrated, and work on an Internet version is in progress. (Source: *Serials*, 9(1) March 1996)

Simply faster (chip design)

Squeezing more components onto a chip makes for faster processing. Physics, however, dictates limits to miniaturization in chip design: the ultraviolet light used to etch components onto raw silicon wafers cannot produce images below 0.1 micrometres. Creating smaller components will require the use of X-ray or electron beam techniques, but these are proving costly to develop. Researchers are now looking at alternative approaches to improving chip performance.

One such approach appeared in the 1980s, with the introduction of reduced instruction set (RISC) computing. These worked with a slimmed-down instruction set, transferring the task of building compound instructions to the compiler.

RISC technology has permitted the creation of bigger, more powerful processors by simply adding additional processing modules. This "superscalar"architecture enables chips to initiate two or more instructions simultaneously. The drawback is that such devices need additional components to manage operations at the chip level, and these consume space which could otherwise be used for memory or processing modules.

More recently, one research team has exploited changes introduced by RISC designs to eliminate the clock normally found within a chip. This results in chips which consume power only when work is being undertaken. Another research team has developed HOLISTIC (high order language instruction set computer), which seeks to remove the "semantic gap" between machine code and high-level programming languages, simplifying the task of the compiler.

A further approach is to employ VLIW (very long instruction word) technology, which offers potential performance increases over RISC. The technique was developed for minicomputers, however, and there is no guarantee that it would represent an effective solution for PCs. (Extracted from *New Scientist*, 9 March 1996)

Wafers cleaned without chemicals

A quantum-based method of cleaning surfaces using high-energy radiation is being funded by the US Environ-

mental Protection Agency as a demonstration project. The process is a method of cleaning contamination from surfaces without the use of chemicals, with no hazardous wastes and no wetability limitations.

According to Radiance Services Company (RSC, Bethseda, Md.) there are two working components to the process: a light source and a flowing inert gas (e.g. nitrogen). The light lifts the contaminant from the surface and the flowing gas sweeps it away. The light source for the process is preferably a pulsed laser, radiating in the DUV-C region (172-257 nm). These energies are sufficient to break a variety of bonds holding contaminants to a surface, including covalent, ionic, coulombic, dipole-dipole and hydrogen bonds. A gas, chemically inert to the surface, flows in a laminar regime across the surface, providing a neutral medium that surrounds the ejected contaminant and sweeps it away from the surface. Laminar flow produces a stable boundary layer that prevents contaminant reattachment.

Termed the Radiance Process by RSC, it can remove particles and flakes 0.1-80 microns in size, fingerprints and other organic films, hazes and metallic ions. These have been removed from wafers, photomasks and microstructures. All these contaminants are removed in a single step rather than requiring a chemistry-specific step for each contaminant, as is the case in conventional wet cleaning. (Extracted with permission from *Semiconductor International Magazine,* February 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

SuperJournals deliver the goods

SuperJournal is a collaborative research project involving publishers, universities, their libraries and researchers to make a critical mass of electronic journals available to readers in the sciences and social sciences. The SuperJournal Consortium is made up of 20 publishers who collaborate on a pre-competitive basis, and will contribute journals to the project. Manchester Computing at the University of Manchester will develop the host environment to make the electronic journals available to user sites.

In 1996 the first electronic journals will be ready for testing. Libraries at the user sites will identify readers, make the journals available, and provide training and support. Tracking the use of journals over two years in many universities and disciplines will identify success factors, and how they vary with discipline and local conditions.

Key considerations will be the types of multimedia content that add greatest value, what motivates authors to submit it, and the implications for publishers and libraries when we move beyond parallel publishing and the multimedia journal has no print counterpart. Key technical issues will also be standards, library organizational models, library technical models, and scalability. SuperJournal will develop and test production and distribution models that are scaleable to large volumes, expandable to include new features and viable in an international context. (Source: *Library Technology,* 1(2) April 1996)

Business process support: data warehouses that reinvent the business environment

Business process support (BPS) systems employ data warehouses to make relevant data available to decisionmakers when required. Decision support systems (DSS) are often limited to transaction data or forecasts, and are organized by functional areas such as marketing or finance, whereas BPS systems include data measuring quality, cycle

times, status and events occurring throughout business processes.

The need today is for an information system that identifies problems, suggests probable causes and indicates opportunities relating directly to an individual's job. Searching for such material using conventional methods is a lengthy and arduous task, but a BPS system can highlight these items automatically. To achieve this, they draw upon "star-schema" databases, i.e. databases supporting business analysis rather than transaction processing.

Instituting BPS systems involves four main stages: obtaining senior management commitment, establishing business requirements, technical implementation and business implementation. Establishing business requirements via the traditional means of user interview is time-consuming, and does not solve the problem of making the system adapt to a changing business environment. One solution to this is to employ an intellectual capital repository (ICR), comprising an application used by each individual employee to define and maintain his or her personal business requirements, and a star-schema database. Rather than it being necessary for programmers to modify applications when requirements change, the ICR is continually updated in the light of changing requirements. As a result, the applications automatically adjust to constant changes. (Source: *FID News Bulletin*, 46(5) May 1996)

Voice, data and video connections on the Internet

Last March, Intel and Microsoft (plus more than a hundred other companies) proposed to establish open industry standards for voice, data and video connections across the Internet. For the last few years, Intel has been involving itself in higher bandwidth systems such as ISDN and cable TV, while Microsoft has also been active in this area, signing a joint marketing arrangement with MCI in the US.

The new standard appears to be rather more open than some of Microsoft's previous ventures. It will include International Telecommunication Union (ITU) standards and Internet Engineering Task Force (IETF) specifications, including T.120 data conferencing, H.323 audio and video conferencing, and the RTP/RTCP and RSVP specifications. Although the initiative will help the companies to define new extensions to the PC standard, essentially they are addressing the network hardware rather than the transport systems. Successful implementations will be largely dependant on how quickly the telephone companies can increase the available bandwidth.

Internet-based telephone systems pose a potential threat to the telecommunications companies: if telephone hard- and software, and Internet access, is fitted to PCs as standard, revenues from conventional telephone services might decline. Most observers expect the telephone companies to start offsetting lost revenues by selling value-added services such as higher bandwidth lines and managed network systems.

The reaction of the telephone companies to the Intel-Microsoft programme has varied. Deutsche Telekom has associated itself with it. France Telecom has not backed it yet, but has started its own Internet service, while BT, which has only recently started offering consumer Internet services, is openly hostile to high-bandwidth consumer data services. (Source: *MicroScope*, 22 May 1996)

Ozone-friendly CFC substitute

Cleaning and degreasing, solvent applications, and secondary loop heat transfer are key applications for 3M Co.'s new HFE (hydrofluoroether) technology. Performance closely resembles that of the ozone-depleting substances they will replace, but unlike chlorofluorocarbons, the new materials have zero ozone-depletion potential, says 3M. Other attributes: short atmospheric lifetimes, low global-warming potential, low toxicity, nonflammability—all without contributing to smog formation. In addition, 3M says the materials are non-corrosive; compatible with key materials such as plastics, metals and elastomers; and exhibit low surface tension and viscosity. The company says commercial quantities will be available as of June 1996. (Source: *Industry Week*, 20 May 1996)

Indoor surfing

An Intranet—featuring a Web server to which access is restricted to employees or other designated individuals—provides a convenient means of browsing corporate databases. The popularity of this approach is increasing. In the UK, companies such as Reuters, Glaxo Wellcome and Rover are making use of the technology. According to the US group Forrester Research, the Intranet server business will be worth an estimated $1,000 million by the end of the decade, and is growing 25 per cent faster than use of the Internet itself.

Internal Web sites can be used to disseminate information throughout the organization. Services might include staff training, briefing, product and company news updates and similar material. The costs of establishing and maintaining the system are offset by savings on conventional paper and printing expenses.

There is some dispute as to whether this development is really new. Lotus Development maintains that groupware applications such as *Notes* have been around for some time, and offer the added advantages of security, access control, graphical forms design and full-text searching. From this viewpoint, the publicity afforded to Intranets simply brings the concept to the attention of a wider market.

A survey of a hundred corporate *Notes* users suggests that the proprietary product and Intranet technologies complement each other, rather than one substituting for the other. Material published on the Intranet is often that handled least successfully when using group working tools: discussion and information broadcasting do not produce business value, whereas *Notes* is most effective when applied to tracking and workflow. (Source: *Computing*, 16 May 1996)

New electronics consortium formed

A new consortium, the National Electronics Manufacturing Initiative Inc. (NEMI), has been formed to "ensure the sustained growth and competitiveness of electronics manufacturing in the United States".

NEMI is described as an industry-led, private-public partnership that brings together the largest electronics equipment manufacturers in the United States, their key suppliers and government agencies, including the Defense Advanced Research Projects Agency (DARPA), Semiconductor Industry Association (SIA) and SEMATECH.

NEMI projects will initially focus on five areas of electronics manufacturing: interconnection substrates, board assembly, final assembly, flip-chip packaging and energy storage systems. More than 10 NEMI projects are currently being formed to foster and implement better electronics manufacturing technology. Projects generally will range from $5 million to $50 million, last six to 24 months, and be funded primarily through in-kind industry support. Future focus areas are likely to include manufacturing for

the environment, computer-integrated manufacturing and supply chain management, radio frequency components (including miniaturized passives), board-mounted optical components and test equipment.

NEMI will operate as a virtual organization with minimal permanent staff. NEMI has no laboratories or manufacturing facilities of its own. (Extracted with permission from *Semiconductor International Magazine*, May 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

Monetary transactions on the Internet

Many companies that have invested in Web sites intended to act as shop windows have been disappointed when the predicted sales have failed to materialize.

Part of the problem is finding a means of handling payments in a secure manner. Another arises out of the nature of so-called "micro-transactions", or purchases involving very small amounts of money, often less than the charges imposed by the banks for handling the transaction.

However, a number of possible solutions are appearing. One such is a product supplied by Open Market, the *OM-Transact* package. Originally developed to enable Time Warner to bill readers accessing its publications on the Web, this handles purchases of less than one dollar (often only a few cents). A user's purchases are amalgamated within a single account, and the total of all the transactions can either be charged to a credit card when they reach a pre-determined threshold, or incorporated in the on-line charges. The software is run by the Internet service provider (ISP), which has the responsibility for collecting the transactions and charging the subscriber.

The package is expensive—about $250,000—but can be used by multiple suppliers. Other commercial servers, such as that supplied by Netscape, are stand-alone, single-user products.

Unipalm PIPEX, a UK-based ISP, is installing *OM-Transact* and will charge its customers about $23,000 a year for the provision of "back office" services. Open Market has also announced an agreement with Novell to establish secure transactions between company networks. (Source: *Communications International*, May 1996)

Internet e-cash gets confidence boost

Deutsche Bank is the latest to join DigiCash, the developer of electronic cash software and hardware, in a pilot scheme using electronic money over the Internet. Its effort shows a rise in confidence among banks with regard to electronic cash. (Source: *Electronics Weekly*, 15 May 1996)

Computer system translates Japanese into English

An agreement has recently been signed between the USA and Japan establishing the Machine Translation Center for Japanese Science and Technology Literature. The Centre offers a new, computerized system for the translation of technological and scientific documents from Japanese to English easily accessible to business, industry, and university researchers.

This service is designed to demonstrate the usability of machine translation and help ease the language barrier US researchers face in accessing Japanese information. Researchers can use the raw output from the system to get the general information contained in a Japanese technical document. If the article is determined to be relevant, a professional translator can be used for further editing and refinement. The service is available to business, industry, and university researchers by mailing, faxing, or e-mailing the text they want translated.

The Centre has been established through cooperation between the Japan Information Center of Science and Technology (JICST), under Japan's Science and Technology Agency, and the US Office of Technology Policy and Commerce.

The machine translation system was developed by JICST and originally ran on a mainframe computer. It was recently ported to run on a personal computer. The Office of Technology Policy is offering matching translated documents to the public for non-commercial purposes only. For information on translations, contact Patti O'Neill-Brown at (202) 482-6805; e-mail at poneillb@doc.gov; or mail to OTP, Asia-Pacific Technology Program. Dept. of Commerce, Rm. 4226, Washington, DC 20230. (Source: *Sea Technology*, June 1996)

Price shock to hit DAB users

The world looks set to be served by two Digital Audio Broadcasting (DAB) receiver designs which differ massively in price.

The DAB satellite service receiver, supplied by the US WorldSpace organization, at under $100 promises to be less than a tenth the price of the mainly terrestrial-based European counterpart for the reception of the Eureka 147 DAB standard. WorldSpace receivers will be available for use in developing countries by 1998, implemented with chipsets supplied by SGS-Thomson.

Eureka 147 and WorldSpace have been discussing for a while a single DAB service world-wide, but without success.

Although WorldSpace and Eureka 147 will transmit compressed audio and data for text, graphics and video, the main price difference lies in the modulation technologies used. The Eureka 147 uses a much more expensive COFDM (coded orthogonal frequency division multiplexing) modulation scheme while WorldSpace uses QPSK. COFDM signalling offers greater robustness to noise and multipath reception.

Eureka 147 is planning to launch its own satellite system although a more costly one than WorldSpace's, and a pilot scheme is already in place in Australia.

The European Space Agency has teamed up with Daimler-Benz to launch elliptical orbit satellites, which provide better coverage of Europe than geostationary satellites.

When combined, satellite and terrestrial DAB will provide a superior service, as individually neither provides total area coverage. For example, terrestrial DAB is ideal for mobile reception but is unsuited for open areas. However, their unification is likely only to further increase the price of the receivers. (Source: *Electronics Weekly*, 12 June 1996)

Researching Internet communities: proposed ethical guidelines for the reporting of results

Communication researchers and social scientists are quickly discovering the value of data that exists in the postings of members of Internet e-mail, Usenet, and real-time groups. The ability to communicate with one's peers, no matter how esoteric the interests, is causing an explosion in the number of new virtual communities. The interpersonal dynamics of these groups are increasingly

coming under the scrutiny of academic research. The publicly available archived records of Internet virtual communities are being analysed for a wide variety of research interests. The ability to do naturalistic observations of group dynamics, as they are exhibited in these exchanges of text, has captured the attention of many researchers. The institutional review boards of major universities are granting researchers exempt or expedited (exempt from full review) status for this work, due to the public nature of the notes being analysed. These studies often involve the lack of informed consent, where the group members under study are unaware they are being monitored. There is a potential for psychological harm to the members of these groups, depending on the way the results are reported. The ethical considerations must be taken into account to protect cyberspace participants. The guidelines proposed are based on the American Psychological Association ethical guidelines for use of human subjects in research. An explanation is offered as to how such guidelines can best be applied to the study of Internet communities. The constructs of Group Accessibility (the public/private nature of the actual cyberspace occupied by a group) and Perceived Privacy (the level of privacy that group members assume they have) are defined and proposed as two dimensions by which individual Internet communities may be evaluated in order to assure the ethical reporting of research findings. (Source: *The Information Society*, 12(2) April/June 1996)

Down the line: how cable TV systems could be used to get the Internet into every home

The best and most available option for fast access to the Internet seems at the moment to be access via cable, which has the potential to provide cheap access at full or higher than Ethernet speed. A cable company can send 30 or more channels and its prime concern is to distribute television, with the topography of the distribution system defining how it can offer additional services such as telephony and Internet access via a pure coaxial cable structure. Fibre optic technology will provide a hybrid fibre and coax (HFC) network with a much higher bandwidth can carry signals further without degradation. However, it is too expensive to provide to every subscriber and is used only for long runs known as Fibre to the Neighbourhood (FTTN). Cable modems are available at a top price of approximately US$ 400 and there is considerable interest in deals from cell-phone companies where the initial hardware cost is discounted in return for higher service fees.

Everything depends on cable companies' willingness to provide infrastructure support. In the US companies such as Motorola, Zenith, Hewlett-Packard, Intel and Nortel have announced products and a standard (IEEE 802.14) is being developed by a consortium. In the UK, a recent survey revealed that few of the existing companies had any policy or strategy, or a knowledge of or interest in cable modems. Those who are interested are waiting to see how US trials are developing before committing themselves, thus giving BT more time to press its wish to run fibre to everyone, develop ADSL systems, etc. (Source: *PC Magazine*, June 1996)

New manufacturing process builds better superconducting wires

Superconductivity's promise of more efficient motors and power transmission is a little closer to being a practical reality thanks to a new method of making YBCO (ytrium-barium-copper oxide) wire. Developed by scientists at Oak

Ridge National Laboratory, the RA BiTS (Rolling-assisted biaxially textured substrates) process enabled Oak Ridge engineers to build a wire with a critical current density of 2 million A/cm^2 at 77° K. (For comparison, standard household wire carries less than 1,000 A/cm^2.)

The new technique aligns the grain structure in the substrate which, in turn, gives the wire a high degree of alignment, a necessity for efficient current flow through superconductors. (Extracted from *Machine Design*, 13 June 1996)

"Nomadic" Internet access from mobile telephones

Ericsson, the Swedish mobile telephone operator, has demonstrated a wireless Internet access working at 64 kbit/s. Basic rate ISDN lines can give 128 kbit/s access rates, but the rental is high and with ISDN you cannot surf the Web while travelling on the train. The answer to slow Internet access is not a GSM mobile phone and a PCMCIA card modem plugged into your laptop.

Wireless data rates of 28.8 kbit/s, never mind 64 kbit/s, over the GSM cellular phone network are still little more than targets on a standards committee timetable. Today's GSM mobile phone and a PCMCIA modem will give you a disappointing 9600 bit/s data rate.

It could be another three or four years before GSM mobile phone networks support the 64 kbit/s data services—which will make truly nomadic Internet access, anywhere any time, a reality. But precisely when high speed data services are introduced is not solely dependent on the mobile phone operators; there are also hardware technology, spectrum planning and standardization issues to be addressed.

The Ericsson 64 kbit/s demonstration was real enough—it used standard GSM handsets and the commercial mobile phone network. The problem was that it used a non-standard radio interface protocol. But, more importantly, the 64 kbit/s data channel was created by multiplexing eight time slots in a single GSM channel. In other words, during the course of the Internet connection, the link was using the equivalent of eight separate GSM voice connections.

That is not only unrealistically expensive to the user in call charges, but it ties up too much network capacity and is unworkable using today's GSM infrastructure.

Data rates over the GSM network of 19.2 kbit/s and 28.8 kbit/s are theoretically workable with minimal changes to network infrastructure and handset design. European operators and manufacturers are already discussing a standard protocol for the introduction of 19.2 and 28.8 data rates. That standard is expected in October, and it will then take another year or so to get commercial networks up and running.

Nokia Mobile Phones has proposed a 28.8 kbit/s data interface specification based on the GSM half rate speech coder design, which offsets some of the loss of radio channel efficiency.

A 28.8 kbit/s data connection will represent the equivalent of four voice calls over the GSM network. This is practical only for downloading files, with the result that the multiplexed connection is only required for a very short period of time—far less than a typical voice call for example.

The GSM standards work is also looking at rates beyond 28.8 kbit/s, in three steps at 34.4, 56 and 64 kbit/s. These rates may be possible on GSM with only minor handset redesigns in 1998/1999.

However, real-time Internet access and World Wide Web browsing is impractical using the standard GSM radio interface. For real-time web browsing the mobile phone industry is looking to a new network architecture to solve the problem called packet-switched data network.

This is not a new concept; dedicated mobile data networks are based on packet-switched techniques. The problem is grafting these on to a GSM mobile phone technology which was designed first and foremost for voice traffic.

GSM uses a circuit-switched network methodology, which means that for a call connection to be made a "continuous" data path must exist between sender and receiver. Spectrum efficiency is maintained by multiplexing in time more than one call on the one digital radio channel. This is called a time division multiple access (TDMA) radio protocol.

In a packet-switched network a continuous connection between sender and receiver is not maintained. The network relies on multiple data paths which are shared between a relatively large number of users—not just two, as with TDMA. Data for transmission is divided up into packets of a certain size which may be routed through the network in different ways. A digital address in each packet ensures they arrive at the right destination.

The code division multiple access (CDMA) radio protocol, which is being used in US mobile phone networks, shares some of the spectrum efficiency benefits of a packet-switched network.

Despite the availability of CDMA, European operators have opted to create their own GSM packet-switched network standard. That will require a new radio channel coding scheme, which means new silicon in handsets and base-stations, and a network infrastructure with more sophisticated call routing systems.

It seems that Web surfers will stay dangling on the end of a phone line for a while yet. (Source: *Electronics Weekly*, 5 June 1996)

OECD releases study of cable communication regulation

A new OECD study of policies for the cable television industry concludes that competition in the provision of communication infrastructure is essential for countries to reap the benefits of convergence in telecommunication and cable television networks.

Current status of Communication Infrastructure Regulation—Cable Television reports that most Governments still prohibit competition in communication infrastructure: cable operators cannot offer telecommunication services, and public telecommunication operators cannot provide cable services.

Though existing regulations restrict the freedom of both operators, public telecommunication operators (PTOs) are nevertheless twice as free to restructure and offer new services as cable operators (COs). In countries that prohibit cable operators from entering the telecommunication market, PTOs have been able to rapidly expand their share in the cable market. This has been the trend over the last five years throughout the OECD area, but most pronounced in European countries with telecommunication monopolies. In 1990, cable television markets were shared equally in those countries, but by 1995 PTOs controlled 59 per cent, and COs 41 per cent. The report highlights the major implications of this trend for competition policy.

In countries that have reformed their regulation, on the other hand, cable operators have moved rapidly to upgrade

and expand their networks in order to be able to offer a full range of telecommunication services. Today in the United Kingdom, for instance, the cable communication industry provides telecommunication services to well over one million customers. Since the reforms were introduced in 1991, there were more new telecommunication subscribers added to cable networks every two days than the total number of subscribers registered by COs between 1986-1991 when the services they could offer were restricted.

Countries best able to introduce competition into their local communication markets stand to benefit most, economically and socially, from the gains of competition. But, the report warns, Governments must ensure that competitors and their customers can efficiently access the telecommunication infrastructures already in existence, virtually all of which are controlled by PTOs. PTOs are three times more likely to own cable infrastructure in monopoly telecommunication markets than in competitive markets. This can be a formidable barrier to achieving competition in communication access and should be given urgent consideration by policy makers in these countries, the report advises.

The large share of cable television infrastructure generally owned by monopoly PTOs in European Union countries—except in Finland, Sweden and the United Kingdom where infrastructure competition is permitted—put these countries at a tremendous disadvantage compared to Canada, Japan and the United States where infrastructure is much more independently owned. Countries with monopoly markets will have to emphasise providing an efficient interconnection of networks, and early introduction of "seamless" infrastructure competition.

The report, issued by the OECD Committee for Information, Computer and Communications Policy, identifies several steps that countries can take to encourage competition in their local communication markets:

- Accelerate liberalization by allowing cable communication operators and other alternate infrastructure providers to offer public switched telephony services;
- For countries that are considering privatizing PTOs, to sell their cable subsidiaries as separate entities;
- Prevent further acquisitions or mergers by PTOs in home markets, where such acquisitions will increase their dominance;
- Introduce safeguards where needed to ensure that monopoly telecommunication service operators are not cross-subsidizing the expansion of cable television networks prior to the arrival of competition;
- For transition to a fully competitive market, ensure a stable regulatory framework that will encourage investment in alternative infrastructures and preclude established PTOs from using unfairly their dominant positions.

"*Current Status of Communication Infrastructure Regulation—Cable Television*" is available on the OECD World Wide Web site at: http://www.oecd.org/dsti/sti_ict. html.) (Source: *News Release*, 17 June 1996)

Internet domain names

The domain part of an e-mail address is important because, for name recognition purposes, most companies want to use their corporate name or trademark as their domain name. There are two types of top level domain name; descriptive and locative. Descriptive names end in, for example, "com" for a business, "org" for some other organization, and "edu" for an educational establishment.

Locative names end in two letter codes representing the countries of the world, for example a domain name ending in a "fr" is in France, "uk" in the UK. Only descriptive names have effect world-wide. Locative names have effect only in the country concerned.

No-one has a right to a domain name. They are registered on a first come, first served basis. In the USA, com names are managed by NSI, Network Solutions, Inc., a non-profit making organization. NSI has been subjected to threats of legal action from rightful owners for awarding domain names to people who do not have a bona fide claim

to the name. As a result, under a recent revision to its rules, an applicant must state that the use or registration of the domain name by the applicant does not interfere with or infringe the right of any third party in jurisdiction with respect to trademark, service mark, trade name, company name or any other intellectual property right. In the UK, co.uk domain names are allocated by a Naming Authority made up of the various service providers but they do not publish any rules. However, an organization may only register one domain name. (Source: *Information Management Report*, June 1996)

C. NEW DEVELOPMENTS

Nanostructure self-formation of high-density Si-doped GaAs thin film observed

JRCAT (Joint Research Center for Atom Technology), a research institute managed under the equal partnership of the National Institute for Advanced Interdisciplinary Research (NAIR) and the Angstrom Technology Partnership (ATP) has established a cross-section scanning tunnel microscope (XSTM) technology and succeeded in observing for the first time the mechanism of silicon (Si) nanostructure self-formation in high-density silicon impurity-doped gallium arsenide (GaAs) thin films. This nanostructure is formed as a result of the segregation of excess silicon.

Addition of more than 6×10^{19} silicon atoms per cm^3 of GaAs will not increase the activities of these impurities, due to the generation of both negative and positive charge carriers by the silicon impurities substituting for both gallium and arsenide atoms, so-called the self-compensation phenomenon. The new discovery has elucidated the actual mechanism of inactivity.

The cross-sectional STM technology was applied to observing the mechanism of silicon nanostructure self-formation in a GaAs wafer doped with a high density of silicon atoms by the molecular beam epitaxy (MBE) technique. The nanostructures were formed linearly at roughly 100-nm intervals along the direction of growth of nano-structures of circular silicon impurity crystals with an axis of around 8 μm. The length of the nanostructures may exceed 0.5 μm.

The orderly nanostructures were not observed near the epitaxial film/substrate boundary region but appeared in the film of later growth stages, indicating the importance of growth surface smoothness for the occurrence of orderly nanostructures. When the silicon impurity density surpassed a fixed level, silicon atoms became oversaturated, and if the growth continued, silicon was segregated on the surface as if by the action of stress, the nanostructure being created by self-formation due to the segregation effect.

Therefore, by optimizing the growth conditions and performing appropriate controls to prevent segregation that is linked to the nanostructure formation, high-density silicon impurity doping may become possible. High-density doping may also be applied to the production of compound semiconductors other than GaAs semiconductors.

Further details from Angstrom Technology Partnership, Research Planning Division, 1-1-4, Higashi, Tsukuba City, Ibaraki Pref. 305 (Tel: +81-298-54-2573. Fax: +81-298-54-2575) (Source: *JETRO*, April 1996)

Fujitsu develops wavelength extraction device

Fujitsu Laboratories Ltd. has developed a virtually imaged phased array (VIPA) optical device capable of resolving the individual wavelengths out of a beam of multiple wavelength components.

The operating principle is totally different from that used in conventional prisms or diffraction lattices. VIPA consists of a focusing lens and a sheet of thin (0.1 mm) glass, the rear surface of which is 95 per cent reflective, passing only 5 per cent. Half of the front surface of the glass reflects 100 per cent of the light, and the remainder is transparent.

The lens focuses the input light to the interface between these two glass sheet sections at a preset incident angle, and the light bounces between the front reflective region and the rear surfaces. Because the rear surface passes 5 per cent of the light, each time the light hits the rear surface, some passes through. When this output light is at a predetermined angle it is intensified through interference effects. Because the interference conditions differ with wavelength, the angle is different for each output wavelength, resolving the input light into component wavelengths.

The firm is considering application of the new high resolution technique to wavelength multiplexed optical communication, claiming that device structures would be simplified and equipment could therefore be made more compact. (Reprinted with permission from *Semiconductor International Magazine*, February 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

Suspended particle display offers advantages

Suspended particle displays (SPDs) have a potential advantage over twisted nematic liquid crystal systems because no external polarizers are needed. This could lead to brighter, more efficient displays with a wider viewing angle that does not require the same control of cell thickness or the same flatness of substrate as liquid crystal devices. SPDs suffer from the same response time problems that LCDs do, so they need to be in an active matrix for high information content. Operating voltages exceed those of LCDs, but are being reduced.

M.J. Lee of the department of electrical and electronic engineering at the Imperial College of Science, Technology and Medicine (London) has described "the first high information content SPD." It uses a 320 column X 288 row active matrix system based on cadmium selenide thin film transistors (TFTs). The display operates with 12.5-50 ms frame times without loss of contrast and requires a maximum drive of <25 V.

Present development work is concentrating on improving the resistivity of the suspension medium to ensure grey scale operation and further improve the optical aperture ratio. (Extracted with permission from *Semiconductor International Magazine*, February 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

Unknown crystal phase with magnetic properties discovered

N. Kikukawa and his research team drawn from the National Institute for Resources and Environment, and the Agency of Industrial Science and Technology, have discovered that a substance of unknown crystal phase displaying magnetic properties is formed as a main component in the process of synthesizing yttrium-iron-garnet ultrafine particles by plasma evaporation technique.

This substance is a spherical ultrafine particle with a diameter of about 0.02 μm. The composition is supposed to be yttrium, iron and oxygen at a ratio of 1:3:6. A substance with this composition and X-ray diffraction pattern does not exist in the database. The structure consists of a face-centred cube lattice centred on a metal atom, but the positions of the oxygen atoms are as yet unknown.

This new substance has magnetic properties, so the research team repeated experiments by using aqueous solutions with various yttrium and iron compositions. Although the magnetic substance was obtained only when the raw material contained powders, the aqueous solution was used to change the composition with ease. The plasma reaction system has a quartz pipe at the lower part, with the diameter changed to control the temperature of the argon-oxygen plasma. The experiments showed that a new crystal phase is obtained whenever the yttrium to iron ratio was 3.2-3.4:1. Optimum synthesis was possible when the plasma tail flame is approached close to the quartz pipes.

Supplying the raw material in the form of an aqueous solution did not produce a substance displaying magnetic properties. Even if the heat treatment temperature was raised to 900° C to promote crystallization, the magnetic property was grossly inferior compared to using raw material powders. Therefore, the future plan is to continue experiments using powdered raw materials and to elucidate the crystal structure and magnetic properties.

Further details from: The National Institute for Resources and Environment, AIST, Materials Processing Dept. 16-3, Onogawa, Tsukuba City, Ibaraki Pref. 305; (Tel: +81-298-58-8111; Fax: +81-298-58-8118) (Source: *JETRO*, April 1996)

MPEG-2 encoder includes HDTV

LG Electronics has succeeded in developing the first ever MPEG-2 (Moving Picture Expert Group) encoder. LG invested US$ 1.29 million in the development project over the past two years.

The MPEG-2 encoder is a digital signal processor, capable of reproducing signals for HDTV (high definition television) as well as signals for video CD, DVD (digital video disc) and DBS (direct broadcasting service). Unlike existing signal processors exclusively for DVD and DBS developed by Philips and Sony, this newly developed signal processor is capable of processing a wide range of signals, including those for HDTV, which requires the highest level signal. (Source: *Korean Business Review*, May 1996)

Instant pictures

Samsung Electron Devices Co. has announced that it has successfully developed the first "quick start" cathode ray tube (CRT). After three years of development and an investment of US$ 2.5 million in the next-generation CRT, the quick-start CRT features instant appearance of images on the screen unlike the conventional CRT which takes 8 to 10 seconds before a clear picture appears.

The new CRT will also upgrade thermal efficiency by using less electric power (2.5 to 4 watts) than conventional CRTs. (Source: *Korean Business Review*, May 1996)

Single-frequency laser oscillation using glass microspheres

Professor K. Hirao of the Faculty of Engineering, Kyoto University, and K. Miura and his research team of the Research Development Corporation of Japan, have jointly succeeded in generating laser oscillations using both the 4F3/2-4I11/2 and 4F3/2-4I13/2 transitions of Nd ions in fluorozirconate glasses formed into microspheres.

The laser wavelengths were assigned to the whispering gallery modes from the mean values of the spacings between resonance peaks. The thresholds at 1,051 and 1,334 nm for these modes were found to be 5 mW and 60 mW of the incident pump power, respectively. Further,

the laser oscillation at a single frequency was also observed by changing the incident condition of the pump beam.

With this laser system, the excitation light generated by a semiconductor laser is revolved repeatedly inside a microsphere to resonate and cause oscillation outside the microsphere. A fluorozirconate glass containing the rare earth element neodymium was used to form microspheres with a diameter of 100 μm. In addition, the surfaces of these spheres were etched to minimize the loss of oscillation light, so that when an excitation light of a generic semiconductor laser system (wavelength 0.8 μm) was irradiated from outside the sphere, it was possible to oscillate a laser beam of 1.3 μm usable in optical communications.

Normally, a laser beam is oscillated by repeating excitation light reflection with a pair of mirrors. Depending on the wavelength, a distance of several metres was necessary between the mirrors. In these respects, the new oscillation method eliminates the use of any mirror. Also, conventional methods require an excitation light intensity of at least several watts, but the new system requires only a weak excitation beam of several milliwatts. Therefore, the oscillation system can be compact and operated with a lower energy.

Neodymium was added this time, but using some other rare earth element or changing the glass composition will provide a laser beam of different wavelength. The oscillated beam will be weakened when the sphere is irradiated with a light beam other than the excitation light beam. Therefore, by utilizing these phenomena, it will become possible to detect light beams. Experiments have confirmed that it is possible to detect light with an illumination intensity that is a thousandth part of that detected by conventional types of systems, making the system applicable to high-sensitivity cameras.

However, for optical communications, the system cannot be used with the laser beam in a scattered state, so the research team plans to study a method for light concentration. There is also a possibility of acquiring a laser beam of longer wavelength than that by the oscillation method using mirrors, so the plan is to establish a technique to oscillate laser beams with wavelengths in other domains.

Further details from: Research Development Corporation of Japan (JRDC), Hirao Active Glass Project, 1-7, Hikaridai, Seika-cho, Kyoto 619-02, (Tel: +81-7749-5205. Fax: +81-7749-5206) (Source: *JETRO*, January 1996)

Step-flow etching and diamond growing for diodes

A research team at the Electrotechnical Laboratory of AIST has developed a process of step-flow etching and growing a diamond on the (001) surface. A diamond film was tentatively deposited and made into a diode, which proved to have excellent features. The achievement is attributed to optimization of the process so that diamond substrate and deposition are levelled on the atomic order.

Diamond is a semiconductor with superior properties, and may be developed into electronic devices that can manage high power and high frequency, and include numerous integrated components. Possible applications range quite widely, and include a power transmission system, in which devices must harness a large power in a brief time, so silicon devices are unqualified.

Electronic devices made of diamond films have developed to the extent that there are already prototypical transistors as well as diodes. The diamond diode produced by the new process, however, has much better features than

predecessors and silicon diodes. The development is a great step toward practical diamond devices.

The process involves micro-wave chemical vapour deposition (CFD), which is almost the same technique as employed by the National Institute for Research in Inorganic Materials for the world's first deposition of a diamond film. The difference lies in the direction of the incident microwave.

Further details from Electrotechnical Laboratory, AIST, 1-1-4, Baien, Tsukuba City, Ibaraki Pref. 305, (Tel: +81-298-54-5059. Fax: +81-298-58-5349) (Extracted from *JETRO*, January 1996)

Detailed observations of molten silicon with turbulent flow

S. Kimura and a research team at the Research Development Corp. of Japan (JRDC), have made detailed observations of the molten silicon from which a silicon crystal was growing in the Czochralski process. The observations established that there was turbulence in the melt under the crystal, and that dopants vary in eliminating this turbulence. The Czochralski process may be modified to inhibit turbulence, and can then provide large single crystals of high quality.

In the Czochralski process, molten high-purity silicon with or without a desired doping impurity is prepared. A small seed crystal of silicon is then dipped into the melt, rotated, and slowly withdrawn. If the melt is disturbed, the product crystal has additional defects in the atomic lattice, and is unsuitable for use. There has been no method to prevent such flaws except reconditioning of the reactor or the operation of an experienced worker.

To investigate the problem, the melt density and other physical properties were examined. Three samples of the melt were prepared: pure molten silicon with no impurities, silicon doped with gallium, and silicon doped with boron. The physical properties were measured at temperatures above the melting temperature (1414° C) of silicon, and their dependency on temperature studied.

In the melt containing gallium dopant, the physical properties shifted moderately with temperature. However, with no impurities or boron dopant, the physical properties changed much more in a 15° C range upward from the melting temperature than in the higher range.

This observation implied that there was turbulence in the melt under the crystal. Computer simulation backed the presence of turbulence. To confirm this prediction, the temperature of each sample melt under a crystal was measured with a precision thermometer. In the narrow temperature range, the pure silicon and boron-doped samples exhibited definite chronological variation, while the gallium-doped sample did not. The research team analysed the variation of temperature, and confirmed that this was caused by turbulence in the melt.

The research team believes that turbulence of melt can be prevented by adequate selection of crucible dimensions and controlling the melt temperature so that single crystals of even higher grade can be produced.

Further details from Research Development Corporation of Japan (JRDC), Kimura Metamelt Project, 4-1-8, Honcho, Kawaguchi City, Saitama Pref. 332 (Tel: +81-48-226-5601. Fax: +81-48-226-5653). (Source: *JETRO*, January 1996)

High-Tc superconductor joint research

The Superconductivity Research Laboratory, Kyocera Corp., Sumitomo Electric Industries Co., and Matsushita Electric Industrial Co. Ltd. have been engaged in joint research related to high-Tc superconductors for use in the ground bases of wireless transmission systems.

The SRL has developed high-Tc and high-magnetic superconductors with support from Japan's New Energy and Industrial Technology Development Organization (NEDO). The three companies started a research project related to high-grade information transmission systems using high-Tc superconductors, which was partially supported by MITI with a subsidy for practical development of technology related to energy use rationalization.

In this joint research, the SRL was responsible for basic research on high-quality superconductors for high frequency and high power applications. In addition, the SRL supported the development of an information transmission device that provided two 25W channels in the 1.5~2.5 GHz band.

This joint research investigated the response of superconductive thin film to high frequency, high intensity currents, large-area and high-quality, high-Tc superconductive thin films, electromagnetic wave response of superconductive thin film circuits, and package material for superconductive filters. Through this basic research, a superconducting microwave device was developed.

Microwave devices using superconductors can decrease the loss of electric power to less than one-fifth of a conventional device using dielectric devices. Consequently, the power demand of an amplifier in the ground base is cut. In addition, integration and miniaturization of the device enable fabrication of a cryo system. The use of small and low power consumption cooling devices allows the filter to be installed in a base one-tenth of the usual size.

Further details from Superconductivity Research Laboratory, International Superconductivity Technology Center, 1-10-13, Shinonome, Koto-ku, Tokyo 135 (Tel: +81-3-3536-5703. Fax: +81-3-3536-5717) (Source:*JETRO*, January 1996)

Chromium cyanide thin films form electrically tunable magnets

A team of Japanese researchers has prepared mixed-valence chromium cyanide thin films whose magnetic state can be tuned electrochemically. The films are prepared electrochemically in an aqueous solution of $K_3Cr(CN)_6$ and $CrCl_3$. The highest critical temperature (T_c) was observed in a film of $Cr_{2.12}$ $(CN)_6$. It became magnetic when cooled to 270 K (-3° C), one of the highest T_c values obtained for molecular-based magnets to date. After the films are prepared, they can be electrochemically switched between ferrimagnetic and paramagnetic states. In the ferrimagnetic state, electron spins on neighbouring atoms are oriented in opposite directions, but their magnetic moments do not cancel out because the moments oriented in one direction are larger than those oriented in the other. In the paramagnetic state, the spins are oriented randomly and thus the material is only very weakly magnetic. The researchers—Akira Fujishima of the University of Tokyo, and Kazuhito Hashimoto, Osamu Sato, and Tomokazu Iyoda of Kanagawa Academy of Science & Technology—say their study "opens up a new route for developing magnets in

which magnetic properties are coupled with electrical functions." (Source: *Chemical and Engineering News*, 8 January 1996)

MBE process of organic optical film with large nonlinear susceptibility

A research team at Kansai Advanced Research Centre; Communications Research Laboratory of Ministry of Posts and Telecommunications, has developed a molecular beam epitaxy (MBE) process for depositing an organic optical film. With the process, the research team formed a prototype film with so large an optical susceptibility that the film can handle optical signals well. Specifically, the new film exhibits a third-order nonlinear susceptibility several times as great as earlier organic films.

When an optical material receives an intense light such as coming from a laser, the response is not proportional to the intensity of the incident light. Nonlinear optics is concerned with such deviations from linearity. Some optical materials have so large nonlinear deviations that the refractive index distinctly changes with the light intensity. Other extensively nonlinear materials let an incident light pass or not depending on the light intensity. They thus have applications in optical computer devices and converters of laser light wavelength.

Nonlinear optical materials may be organic or inorganic. Organic films are quicker to respond to an incident light than inorganic films, and thus can better accelerate optical computers and reduce their power consumption. Unfortunately, no conventional organic material presents an adequately strong response. In applications of nonlinear optics, as a consequence, a device using the organic material would require much more incident light than the inorganic material type. Therefore, most nonlinear optical devices so far have used an inorganic material such as a semiconductor.

The research team employed the MBE process to deposit a 17-nm-thick film of vanadyl phthalocyanine (VOPc), an organic material, on a 1 X 1-cm underlayer of potassium bromide (KBr). The research team measured the third-order optical susceptibility of the VOPc film with the third harmonic generation (THG) technique at a wavelength of 1,200 nm. The value was 2.87 X 10^{-10} esu, about 7.7 times as much as that of a polycrystalline VOPc film. This means that the epitaxial film works with much less incident light. The improvement is attributed to the MBE process, which seems to prevent contaminants from sneaking into the deposited film.

Further details from Kansai Advanced Research Center, Communications Research Laboratory, 588-2, Iwaoka, Iwaoka-cho, Nishi-ku, Kobe City, Hyogo Pref. 651-24, (Tel: +81-78-969-2100. Fax: +81-78-969-2259. E-mail: tada@crl.go.jp) (Source: *JETRO*, January 1996)

Tougher chips

US researchers claim to have found a way to strengthen silicon chips. Chips are usually heated with hydrogen to toughen them. However, using deuterium seems to extend their life by as much as 50 times.

Isik Kizilyalli of AT&T Bell Laboratories in Orlando says that this offers the opportunity for someone to operate smaller electronic devices with higher supply voltages, which means faster circuits.

As nanotechnology gathers pace, devices will be smaller, driven harder and expected to last longer, explains Kizilyalli. During the heating process, hot electrons charge through the chip, breaking hydrogen-silicon bonds. This

decreases the chip's performance and strength. With deuterium, the bonds along the surface of the chip remain intact.

The process appears to be compatible with current chip processing and would not cost much more, says Kizilyalli. The added durability should mean that computers perform better, go faster and last longer. Also, devices containing these chips should be able to withstand harsh environments, like temperature extremes or radiation exposure in space. (Source: *Chemistry & Industry*, 4 March 1996)

SGS-Thomson eases MOSFET process

SGS-Thomson Microelectronics has borrowed a technique from DRAMs to ease the manufacture of power MOSFETs which promises to decrease the price/performance of these devices.

Power FETs are multi-cellular structures. The basic unit in the new FET is a long strip-like structure rather than a square or hexagonal cell. Both new and old structures are made in n-type semiconductor grown on a substrate. For the new structure, the gate oxide and polysilicon gate are deposited using the same mask.

The polysilicon acts as a mask for the implantation of the p-type dopant that forms the channel material.

Diffusion carries the dopant out under the gate oxide edges. A further, thick, layer of oxide is deposited over the whole wafer. This is isotropically etched to remove all of it, except chamfered sections along the inside edges of the strip.

The spacers act as the mask for implanting the n+dopant that forms the source. This step requires an alignment procedure in the conventional cell structure. Source metallization is then laid down over the whole surface.

To allow gate metallization to short the p and n type regions together, essential for MOSFET operation, the n doping is interrupted periodically along the strip.

The process is still in development and SGS-Thomson is not disclosing an introduction date. (Source: *Electronics Weekly*, 29 May 1996)

Heat makes a ceramic shrink

Most materials expand when they are heated, but a new exception has been found by researchers at Oregon State University in Corvallis and at Brookhaven National Laboratory in Upton, New York. It is a ceramic—a blend of tungsten, oxygen, and zirconium atoms called zirconium tungstate—that shrinks until it reaches its decomposition temperature of about 1,050 K. Application possibilities include controlling thermal expansion in such things as circuit boards and composites. (Source: *Industry Week*, 20 May 1996)

Chaos theory enables less switch-mode interference

Researchers at the University of Surrey's Department of Electronic and Electrical Engineering have used chaos theory to reduce the conducted electromagnetic interference created by a switch mode power supply.

Chaotic behaviour has already been observed in switch mode supplies, but the group at Surrey has deliberately designed a supply to work in the chaotic region. The aim is to use the chaotic behaviour to modulate the switching clock and hence spread the spectrum of the interference. An important point is that the system uses no more circuitry than is already required in a switch mode supply.

A boost converter was chosen as the basis for the tests because of its simplicity. Running at 2.5 kHz, the power spectrum of the supply showed a fundamental peak of -43dB and a first harmonic of -52dB. With the chaotic feedback loop inserted, the fundamental, first and second harmonics dropped by 7,11 and 7dB respectively. (Source: *Electronic Weekly*, 26 June 1996)

Chips that encrypt data transmission

Two chips can encrypt data transmissions so that they are in effect uncrackable. Had the chips been developed in the United States, the Government would have classified them as "munitions" and banned their export. But they were developed in Japan by NTT, the telephone giant, and the Japanese subsidiary of RSA, an American encryption company. They can therefore be used around the world, and even be imported into the United States, failing America's restrictive encryption policy. NTT has already sold the chips in 15 countries, and they should soon be incorporated in products. Stewart Baker, the former general counsel of America's National Security Agency, concedes that the chips have probably killed encryption controls in America, but argues that the battle will continue to run in Europe, where countries such as France limit their use. For the rest of the world, these bits of silicon may indeed make it harder for police to protect citizens. But they will also make it easier for citizens to protect themselves. (Extracted from *The Economist*, 8 June 1996)

Researcher reduces silicon need 100-fold

A UK researcher is using evolutionary techniques and an FPGA to generate hardware designs that may reduce silicon requirements 100-fold.

Adrian Thompson, at the University of Sussex, has developed a circuit that differentiates between two tones, one at 1 kHz and one at 10 kHz. These are fed directly into an input of a Xilinx 6216 FPGA. The output is taken from another pin.

Thompson began training the FPGA by sequentially loading 50 random patterns of characterizationdata into the chip and seeing which ones differentiatedbetween the tones best.

By "breeding" the best of the 50 to produce another 50, and evaluating these, Thompson honed the performance. He emphasizes that the evolutionary technique generates solutions requiring the actual silicon used for development.

The current work is based on a project in which Thompson controlled an autonomous robot by a similar technique using only 32-bits of RAM and two flip-flops. (Extracted from *Electronics Weekly*, 26 June 1996)

Chip has logic and DRAM

Silicon Magic, a recently formed memory design house in California, has developed a method of combining logic and DRAM on the one device.

The company is using this embedded DRAM technique to design a graphics chip called MAX (multimedia accelerator) that integrates all the necessary DRAM and control logic on a single device.

A conventional graphics card would be reduced from five chips to just one, along with the EPROM, crystal and passive components. The extra speed obtained by integrating memory makes the chip ideally suited for use with Intel's accelerated graphics port (AGP).

Other applications suited to this technology include MPEG-2 audio and video decoding, where large amounts of memory are required. (Source: *Electronics Weekly*, 19 June 1996)

Thin film carbon transistor technology developed

Cambridge University (Cambridge, UK) has collaborated with a group in Brunei towards the development of a thin film carbon transistor process that could enable semiconductor materials to be deposited directly onto plastic substrates. The use of plastic substrates for LCD panels is very attractive, but the processing temperatures of at least 250° C required for silicon would ruin plastic. All but one of the processing steps to produce the new transistor can now be carried out at less than 100° C.

The semiconductor material employed is tetrahedrally-bonded amorphous carbon (T:a-c) in which many of the bonds are diamond-like. It is doped with boron to form a p-type semiconductorwhose conductivity is readily affected by applied electric fields. The deposition of the silicon nitride gate insulator currently does not require a higher temperature than the other steps of the process. Bill Milne at Cambridge said the transistor is the first of its kind, but added that much development remains to be done, including a nitrogen n-type doping technique. (Reprinted with permission from *Semiconductor International Magazine*, June 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

High power transistors made from SiC

Westinghouse Electric Corporation has unveiled a new generation of digital transmitter technology for High Definition Television (HDTV) broadcast based on silicon carbide (SiC) transistors. At the National Association of Broadcasters' convention in Las Vegas, Westinghouse described a 500 W transistor which is built into 1.5 kW power-amplifier modules. The company said that the use of these high power transistors will allow television stations to operate in a smaller space.

Westinghouse said the solid-state silicon carbide based transmitters hold great promise for stations as they convert from analog to digital broadcasting. Transmitter manufacturers will be able to abandon tube-based technology and build smaller, lower-cost transmitters. Westinghouse is projecting a product rollout by mid-1997, which is dependent on the transition from analog to digital television, regardless of whether the format is standard definition or high definition. (Reprinted with permission from *Semiconductor International Magazine*, June 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

ASICs get smaller and faster

Two ASIC industry firsts have been announced, with IBM laying claim to the world's first subquarter-micron ASIC offering, and Mitsubishi with the industry's fastest 0.35 μm ASIC.

IBM said its new SA-12 ASIC product features a nominal 0.18 μm effective channel length. IBM says this makes it the fastest and highest performing ASIC product commercially available, outpacing LSI Logic's G-10, reported to have an effective channel length of 0.25 μm.

Mitsubishi Electronics America announced the industry's fastest 0.35 μm ASICs, offering 101 picosecond gate speeds and high performance clock distribution architectures enabling faster overall chip performance. (Reprinted with permission from *Semiconductor International Magazine*, June 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

NEC demonstrates advanced Al-Ge-Cu process

NEC researchers are continuing to investigate the use of germanium as an addition to aluminium-copper interconnects in an effort to come up with a production-worthy low-temperature reflow sputtering process. Most recently, the company reported the development of an Al-Ge-Cu multilevel damascene process using low-temperature reflow sputtering and metal planarization by CMP. The work was reported in the May 1996 issue of *IEEE Transactions on Electron Devices*.

Electrical tests showed the interconnects had an electromigration lifetime of approximately ten years. (Reprinted with permission from *Semiconductor International Magazine*, June 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

World's smallest coaxial connector

MKT Taisei Co. Ltd. has developed the world's smallest coaxial connector TXC Connector with an aperture thread part of 3-mm diameter and an area of 5mm x 5mm.

The coaxial connector area is less than one-fifth that of the MIL (American military specifications)-C-39012 (SMA type) that had been the smallest in the world up to now. This downsizing enables the necessary ancillary devices to be miniaturized substantially. The company plans to promote the connector as a world standard product to replace the SMA type.

This TXC Connector was developed in response to the downsizing trend of portable handy systems as well as electrical equipment such as mobile communications base stations, antennas and instruments, with the result that the devices incorporated in this equipment such as splitters, directional couplers, mixers, doublers and impedance converters are being miniaturized.

Further details from MKT Taisei Co. Ltd., Sales Dept., 5-16-2, Nishi-Ikebukuro, Toshima-ku, Tokoyo 171. (Tel: +81-3-3982-0029. Fax: +81-3-3986-1537) (Source: *JETRO*, June 1996)

First working device made with extreme ultraviolet lithography

Researchers at Sandia National Laboratories in Livermore, CA have fabricated what they believe to be the world's first working microelectronic device to be made with extreme ultraviolet light. The device is a field effect transistor with an electrical channel, or gate width, less than 0.13 μm.

Sandia claims the experimental lithography tool it assembled a year ago is the first extreme ultraviolet patterning system capable of overlaying features, a function which is necessary to create a working device. (Extracted with permission from *Semiconductor International Magazine*, June 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

New technique for non-destructive 2-D dopant profiling

It is now possible to measure dopant concentrations in semiconductor devices without complicated sectioning and imaging processes, thanks to a new technique called scanning capacitance microscopy (SCM). Developed by Digital Instruments (Santa Barbara, CA) in conjunction with SEMATECH, SRC and NIST, the technique is similar to that used for atomic force microscopy (AFM), but uses a conductive probe tip (usually coated with tungsten) to detect small changes in capacitance that are used to detect near-surface variations in carrier density. Features as small as 10 nm on sharp dopant gradient structures can be resolved. Digital Instruments reports that it is the only method that is capable of directly measuring LDD (lightly doped drain) underlap and channel length. It also enables two-dimensional calibration for TCAD simulations, which is critical to the development of the "virtual fab".

Other applications of SCM include grain boundaries in polysilicon, III-V material characterization, dopant segregation in SiC, 2-D implant profiles of cross-section DRAM trench capacitors, oxide uniformity and failure analysis (i.e., implant-related failures).

Presently, techniques used to profile dopant concentrations include secondary ion mass spectroscopy (SIMS), scanning resistance probes (SRP) and CV (capacitance-voltage), as well as transmission electron microscopy (TEM) and differential etch profiling. By comparison, Digital Instruments said the new technique is more straightforward and offers the potential for non-destructive profiling. It also measures the broadest range of carrier concentrations, is semiquantitative, requires relatively easy sample preparation and permits the sample to be imaged repeatedly. (Reprinted with permission from *Semiconductor International Magazine*, June 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

Fresnel lens shrinks sensor size

Optical sensors often rely on focused beams that detect nearby objects and defocus the background, but associated lenses tend to be large and heavy. Omron Electronics Inc., Schaumburg, IL, has developed a compact optical sensor that detects nearby objects while ignoring the background.

A miniature Fresnel lens aims and focuses light from an LED emitter. Light emitted at a 45° angle reflects from objects 4.5 mm from the sensor body; a second Fresnel lens collects the light and focuses it onto a phototransistor. Any flat, smooth surface from 4 to 5 mm away will reflect most of the beam to the receiver, but objects closer than 1.5 mm or farther than 9 mm return less than 20 per cent of the emitted light and are electronically filtered out. Because the beam hits the object at a low angle, reflectivity, rather than opacity, allows it to be detected. That is, a translucent sheet will reflect incident light to the detector, rather than let light pass. (Source: *Machine Design*, 13 June 1996)

Microprocessor carries first big dram on chip

Mitsubishi Electronics America Inc. has developed the first microprocessor with large on-chip dynamic random access memory (DRAM), eliminating a separate memory chip. The M32R/D chip—a combination 32-bit Risc CPU and 2-Mbyte DRAM with DSP capabilities and 2 kbytes of static random access memory (SRAM) cache—removes data-transfer bottlenecks and reduces overall system power consumption, Mitsubishi says.

With DRAM and a 32-bit Risc processor, the new chip can run a personal digital assistant (PDA), set-top box, multimedia processing system, or any system requiring a high-performance processor and plenty of memory, according to the Sunnyvale, CA, company. (Source: *Machine Design*, 23 May 1996)

Thick resist layers for surface micromachining

New micromachining technology using traditional UV exposure and resist application technology has been developed by German researchers Professor A. Heuberger and

Dr. B. Lochel, from the Fraunhofer-Institut für Siliziumtechnologie (Berlin, Germany), to address the demands for higher integration, smaller sizes and lower costs of microsystem technologies.

The new technology, called 3-D UV-Microforming, fabricates micro components such as coils, ducts, cantilevers and parts of micro valves directly on the surface of substrates.

The researchers developed procedures for thick photoresist layers using a high viscosity resist (Hoechst's AZ 4000 series). To produce different thicknesses for all the elements of the 3-D coil, resist was spun on both sequentially and in a single step. Standard spin coaters were used for layers up to 20 μm thick followed by a curing phase. Thicker layers were then obtained by repeating the resist/curing procedure. (Reprinted with permission from *Semiconductor International Magazine*, February 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

Glass wafer TFT-LCD developed with low-temperature polysilicon technology

Sony Corp. has established a technology to fabricate colour LCDs that assemble the drive circuits on an inexpensive glass wafer, using Low-Temperature Polysilicon TFT Forming Technology, which forms polysilicon layers at a temperature below 400° C.

Conventional fabrication technology requires a temperature of over 1,000° C, which prevents the use of inexpensive glass wafers, so the manufacture of large LCDs and cost reduction had been difficult. The new technology incorporates the Polysilicon Superthin Film Crystallization Technology using excimer laser and Low Temperature Gate Insulating Film Forming Technology based on the plasma chemical vapour deposition (CVD) technology. Fabrication is performed at a temperature as low as 400° C. Applying the new technology enables cost reduction and the manufacture of high-resolution colour LCDs.

The polysilicon thin-film transistor (TFT), compared with the amorphous TFT, is smaller and allows high resolution of LCDs with the ability to realize built-in driving circuits. However, fabrication demanded a high-temperature process of over 1,000° C, so up to now expensive quartz wafers of excellent thermal resistance had to be used to form polysilicon films. The company observes that the new low-temperature polysilicon TFT forming technology is applicable to the fabrication of high-performance 20-in class LCDs by using inexpensive glass wafers and existing facilities which are being employed to manufacture amorphous silicon TFT LCDs.

The technology was first applied to the fabrication of a 5.6-in full-colour LCD as a prototype. The company plans to commercialize a smaller 5-in class LCD by autumn 1996.

Further details from Sony Corporation, Corporate Communications, 6-7-35, Kita-Shinagawa, Shinagawa-ku, Tokyo 141. (Tel:+81-3-5448-3311. Fax: +81-3-5448-3061) (Source: *JETRO*, April 1996)

Argon fluoride excimer laser resist compatible with 1Gb-DRAMs

Fujitsu Laboratories, Ltd. has developed an argon fluoride (ArF) excimer laser resist, which is applicable to microelectronics devices, such as 1-Gb DRAMs and beyond.

This is single-layer positive resist using chemical amplification, prepared by polymerizing with an alicyclic monomer with dry-etch resistance and a newly developed highly reactive monomer with excellent adhesion to silicon wafers, by which considerable improvement in resolution have been achieved along with high transparency at the exposure light wavelength and excellent dry-etch resistance. The new resist enables the use of the standard alkaline developer that had been unusable up to now. High sensitivity of 6 mJ/cm^2 and a high resolution of 0.17 μm has been attained with the single-layer positive resist for the first time, which are applicable to 1-G DRAMs.

Fujitsu Laboratories and Fujitsu Ltd. succeeded for the first time in achieving both transparency at exposure wavelength and excellent dry-etch resistance using a methacrylate polymer with alicyclic adamantine and cyclic ketone (oxocyclohexyl) groups in the side chains, and have been studying the feasibility of commercializing these technologies. The major technical problem with the newly developed resist was the poor adhesion to the wafer, so the formulated resist patterns were often peeled off after standard alkaline development.

Fujitsu Laboratories perceived that the poor adhesion was due to the strong hydrophobicity of the resin, and searched for a reactive group exhibiting a reactivity comparable to that of the oxocyclohexyl group and a greater polarity (large polarizability). The cyclic ester group, mevalonic lactone, in methacrylate has high reactivity comparable or better than that of the oxocyclohexyl group and strong polarizability, which contribute to the excellent adhesion to wafers. This compound is extremely stable at room temperature and can also be readily mass produced.

Based on these results, the base resin for the ArF excimer laser resist was synthesized by copolymerization of the methacrylic acid mevalonic lactone ester and methyladamantyl ester, that shows excellent dry-etch resistance comparable to that of Novalak resist as well as other lithographic performance. The resin has high transmittance of over 70 per cent at 193 nm at 0.7 μm thick film, thermal resistance of over 170° C, good solubility in resist solvents, and a dry-etch resistance comparable to that of Novolak resist widely used in device manufacturing.

Further details from Fujitsu Limited, Public Relations Dept., 1-6-1, Marunouchi, Chiyoda-ku, Tokyo 100. (Tel: +81-3-3213-4160. Fax: +81-3-3216-9365) (Source:*JETRO*, April 1996)

CVD Control System for forming superthin, extrahard amorpous carbon films

Youtec Co. Ltd. has started marketing a plasma CVD Fully Automatic Control System for forming superthin, extra hard diamond-like carbon films with a thickness of less than 10 nm, which are difficult to form by conventional chemical vapour deposition (CVD) systems. The Vickers hardness of the surfaces of these films is over 4,500, nearly twice as hard as those of films produced by conventional systems up till now with a thickness of about 2,000 nm.

The CVD system is used to form extrahard surface films. To minimize the coefficients of friction, the films are as thin as possible. Up to now, the thinnest films formed by CVD systems were about 10 nm thick, but below this thickness, the films did not become flat. The new CVD control system has achieved a breakthrough by forming films thinner than 10 nm, as thin as 2.5 nm and featuring long service life.

The new system is to be marketed for coating films on the tip friction parts of precision heads of magnetic disk

readout systems and for coating the bearing parts of micromachines and M.R. heads.

Further details from Youtec Co. Ltd., 6-2-3, Minami-Nagareyama, Nagareyama City, Chiba Pref. 270-01. (Tel: +81-471-50-5731. Fax: +81-471-50-5741) (Source: *JETRO*, March 1996)

University ARM reaches Amulet-2e

The Manchester University asynchronous ARM microprocessor project is about to reach another milestone with the tape out of the second generation Amulet-2e.

The Amulet-2e will be implemented using a 3V, 0.5μm CMOS process.

The Amulet-2e and its predecessor, the Amulet-1, are ARM 32-bit processors that use asynchronous logic instead of a global clocking scheme. Using an asynchronous approach, a circuit works at its own optimal speed. The scheme also offers power savings since consumption only occurs when data processing takes place.

According to Professor Furber, head of the project at Manchester, while the Amulet-1 successfully showed the feasibility of asynchronous processing it did not demonstrate any significant performance advantage.

The Amulet-2e, in contrast, is expected to show a large improvement in processing performance, approaching the published figures of the ARM 810. In particular it has been designed to demonstrate the benefits of asynchronous design for embedded applications, and uses a modified signalling scheme to ease its interfacing to standard peripherals, such as memory and I/O devices. (Source: *Electronic Weekly*, 8 May 1996)

Low-power Mesfet closer to market

The University of Virginia research group that recently demonstrated an ultra-low power two dimensional mesfet has moved a step closer towards a production version.

The remarkable characteristic of the original device is that it operates properly with only 200 electrons in its channel. Conventional FET structures are swamped by second order effects at such low currents.

The advance is in the construction of the device. The developmental FET was made using a AlGaAs/InGaAs/GaAs heterostructure, built up layer by layer on the substrate and patterned using an electron beam.

The newest version is constructed using ion implanted bulk n-doped GaAs—a conventional technique and material.

The channel of the 2-D Mesfet is a 0.4μm wide strip connecting the drain and source. The strip is only a few nanometres thick, hence the 2-D label. Gates on either side of the channel control the width of the conduction region within. (Source: *Electronics Weekly*, 8 May 1996)

Superconductor and GaAs on same substrate

A team at the University of Kanagawa, Japan, is reported to have successfully formed an yttrium superconductor and a gallium arsenide semiconductor on the same substrate. The team now intends to develop devices that make use of the very fast characteristics resulting from the combination of the two materials. The group has previously mounted yttrium superconductor on a titanium-strontium substrate. (Source: *Electronics Weekly*, 17 April 1996.

Glass substrate enables larger-sized displays

Saint-Gobain of France and the US company Corning have developed a glass substrate which is expected to enable the production of larger-sized, high definition colour plasma display panels. The glass would be used for wall-mounted TVs ranging in size between 40 and 55 inch in diagonal. (Source: *Electronics Weekly*, 17 April 1996)

2.5 inch Toshiba drive claims to be slimmest yet

Toshiba has announced what it claims is the slimmest 2.5 inch hard disc drive yet. It is 8.45 mm (1/3 inch) high, which is 33 per cent thinner than Toshiba's previous offering. With a capacity of 271 Mbyte and a weight of 110 g, the drive is aimed at portable applications. Average seek time is said to be 13 ms, data transfer is 16.6 Mbyte/s and power consumption is 2.3 W active, 0.7 W idle and 0.15 W when asleep. (Source: *Electronics Weekly*, 17 April 1996)

Deuterium extends chip life

A new chemical treatment will give computer chips renewed zip, making them faster, smaller, and longer lasting. According to researchers at the University of Illinois, coating microchips with deuterium can increase performance, allow them to better withstand harsh environments, and reduce maintenance.

Hydrogen is currently used for coating chips to smooth surface defects. As the hydrogen wears off, generally in about five years, the chips wear out. Deuterium is more durable, heavier, and provides a tougher coating which allows the chips to handle larger jolts of electricity and last 10 to 50 times longer. The tougher coating also provides better insulation so the chips can be smaller, thereby increasing their speed. (Source: *Machine Design*, 4 April 1996)

Giant wheel-shaped molecules

The largest wheel-shaped molecule, containing 154 molybdenum atoms, has been constructed by German chemist Achim Müller and his colleagues at the University of Bielefeld. The wheel is built from smaller molecules containing a molybdenum atom surrounded by six atoms of oxygen. In all, the finished molecule contains more than 700 atoms and has a relative molecular mass of about 24,000, making it bigger than any other wheel. The well-known "ferric wheel" contains only 10 atoms of iron. The new wheel is water soluble, which Müller says is unusual for a wheel of this size. He attributes this to the molecule's shape, which was detected using X-ray crystallography. Müller says it may be possible to customize a wheel for specific jobs by changing its diameter using different templates. (Source: *Machine Design*, 4 April 1996)

Cilia next micromechanical breakthrough

To assemble future generations of ever-smaller electronic devices, roboticist Peter M. Will looks to bacteria and protozoa for inspiration. He has shown through computer simulation that small, mechanically simple robotic devices covered with appendages resembling cilia, the wispy whiplike organs one-celled organisms use to move, can perform useful work assembling microelectronics.

Currently, humans work with microscopes to delicately insert tiny components into multichip modules and miniature circuit boards. According to Will, this type of assembly is nearing a dead end. He believes his micromechanical cilialike devices can solve the problem.

Peter Will coined the term intelligent motion surfaces (IMS) to describe surfaces made up of different patches of cilia, each patch moving in an independently programmable direction. Properly arrayed, for example, they can form a

pipeline. Parts entering one end of the pipe are sorted and spaced so they flow through at a constant rate, are centred, aligned, and inserted into another part.

Working at the University of Southern California, Dr. Will has built two prototype cilia chips using standard solid-state construction methods. The first type, a "fixed-purpose" surface, borrows a technology used in aircraft engineering to create tiny projections that rise or fall to change wing aerodynamics. These projections are strong, but only move in a single direction that is fixed when they are manufactured. The second type is an IMS, with cilia that are multidirectional and programmable, but is too weak for useful work. Will estimates an IMS would need to handle at least 4 mg to be useful. The best silicon-based IMS he has made handles less than one-tenth of that. Will believes time is on his side as he builds stronger devices and the parts they are built to handle get smaller. (Source: *Machine Design*, 4 April 1996)

Chaos keeps communications secure

Chaos theory promises the ultimate in secure communications, enabling systems to emit signals indistinguishable from background noise.

Researchers at the University of Birmingham's school of electronic and electrical engineering under the leadership of Dr. Jim Edwards have developed a communications system that chaotically encodes a digital data stream. At the same time, it hides the signal within a noise-like structure. This is desirable especially for military applications where the "enemy" would not even know communications are taking place.

The chaos system offers enhanced security since the initial conditions must be known exactly. Any slight difference and the system quickly diverges. This is comparable with the chaos theory example that says weather cannot be predicted without knowing all the starting conditions, which may include a butterfly's wings beating in Australia.

The claimed bit error rate (BER) of the current system is 1 in 10,000 at a signal-to-noise ratio of 10 dB. The University is working on a system where an acceptable BER is obtained for negative signal-to-noise; in other words, the noise has more power than the signal. This would give truly undetectable communications.

Synchronizing the transmitter and receiver, critical with chaotic systems, is not a problem according to Edwards: "Because the system is digital, it tends to self-synchronize". (Source: *Electronics World*, April 1996)

Magnetism motivates microactuator research

Researchers into microelectromechanical systems (Mems) at the Berkeley Sensor and Actuator Center (BSAC) have developed a powerful microactuator that uses magnetism as the actuating force and can be batch-manufactured in relatively simple processes.

Mems specialists Jack Judy, Richard Muller and Hans Zappe at BSAC report that their microactuator has so far demonstrated forces and displacements far larger than those generated by most electrostatic microactuators. In addition the microactuator can be fabricated using conventional electroplating, lithography, materials and equipment.

Novel features of the technology are that actuation can be controlled by a remote magnet—a hand-held permanent magnet was used in some of the experiments—and that structures can be actuated in three dimensions: i.e. movement is not restricted to the plane of the wafer.

The microactuator itself is essentially a polysilicon cantilever beam, or flexure, onto which a magnet is formed at the free end. That magnet interacts with an external magnetic field, bending the flexure.

Fabrication is straight-forward in that the magnetic layer of NiFe layer is simply electroplated onto the silicon at the end of a process which is already in use to produce chips of polysilicon resonant structures.

Using an external magnet to provide the actuating force means surface-to-surface interactions such as those found in linear and rotary variable-capacitance, and variable reluctance structures, are not required—so fabrication is easier.

The external magnet can also be used to activate many devices simultaneously—though that also means that control of independent microactuators will require miniaturized sources of magnetic fields, perhaps even on-chip sources.

So far the tip of an 800 μm-long cantilever has been deflected over a distance of 1.2 mm and rotated through an angle greater than 180° under an imposed torque of 0.185 nNm.

The team is hopeful that similarly fabricated magnetically-actuated microstructures might be applied to micromanipulators, microgrippers, magnetometers or microphotonic systems.

Jack W. Judy can be contacted at 497 Cory Hall 2041 San Francisco, Apt. No. 5, Berkeley, CA 94720-1770, USA or j.judy@ieee.org (Source: *Electronics World*, April 1996)

Making photons interact is first step to quantum computer

Physicists at Caltech, Pasadena, have taken a step closer to quantum computing with testing of an optical gate whose output depends on the polarization state of two photon inputs.

Photons normally do not interact. But the team led by Professor H. Jeff Kimble at Caltech, has found that they can be made to strongly influence each other when brought together with an atom inside an optical cavity.

To be useful in computing, any legitimate logic gate must display an essential feature called conditional dynamics, where the output must depend upon both inputs. In an optical quantum logic gate, the output state of each photon must depend on the input state of both photons.

Kimble's group has shown strong conditional dynamics for an atom in an optical cavity formed by two highly reflective mirrors, one of which allows partial transmission of light. The scientist sent pairs of photons through the cavity, and investigated the states of the photons when they re-emerged, showing that the output state of each photon depended on the polarization of both input photons.

In effect, the cavity functioned as a rudimentary logic gate at the single photon level. Changing the photons' polarization is analogous to flipping the bits in conventional computers.

This is the first demonstration of conditional dynamics at the single-quantum level, and while many complex problems remain to be solved before even primitive networks of quantum logic gates could be built, the result is being seen as a significant first step in quantum computing. (Source: *Electronics World*, April 1996)

Crossing the Terabit Threshold ...

Three separate groups of researchers have succeeded for the first time in transmitting information at a rate of one trillion bits a second—one terabit—through an optical

cable. Fujitsu, Nippon Telegraph and Telephone, and a team from AT&T Research and Lucent Technologies reached the terabit threshold four years earlier than expected and reported their results at the Optical Fiber Communications Conference '96 in San Jose, California. The three approaches have one thing in common: instead of sending one stream of light through the fibre, as is done today, they send multiple streams of light, each a slightly different wavelength, thereby multiplying the amount of information transmitted. The results are 400 times faster than the fastest commercial systems currently in use. (Source: *Communications of the ACM*, Vol. 39, No. 5, May 1996)

Nd:YAG Ceramic Laser

Krosaki Corp., in collaboration with Prof. K. Yoshida at Osaka Institute of Technology and others, has developed the first neodymium-doped yttrium-aluminium-garnet (Nd:YAG) ceramic laser oscillator.

The ceramic oscillator can be produced in a few hours, much less than the one month production period of the conventional monocrystalline oscillator. In continuous wave (CW) oscillation, the ceramic Nd:YAG laser provides twice the output intensity of a monocrystalline type. The ceramic oscillator may allow the manufacture of high-performance YAG lasers at low cost.

The YAG laser is a common type of solid-state laser. Although the output power is lower than the CO_2 laser, the YAG laser has a much shorter wavelength so that the beam is suitable for microfabrication. The YAG output can also be transmitted through glass fibres. As a consequence, the YAG laser is being rapidly introduced in the fields of machining and medicine.

The pulsed laser generally increases output when more Nd is doped. Prof. K. Yoshida is evaluating the ceramic laser performance in pulsed oscillation, and determining the greatest concentration of Nd that the YAG ceramic can contain.

Further details from: Krosaki Corporation, Technical Research Center, 1-1, Higashi-hama-cho. Yahata-Nishi-ku, Kita-Kyushu City, Fukuoka Pref. 806. (Tel: +81-93-622-7231; Fax: +81-93-622-7215). (Source: *JETRO*, May 1996)

Amplifier for YAG laser light sources

Advanced Telecommunications Research Institute and Mitsubishi Electric Wire Industrial Co. Ltd. have jointly developed the first optic fibre amplifier for YAG laser light sources that operates with a high gain when working in the 1.06 μm wavelength band.

The YAG laser system features the advantage of generating monocolour light beams more than a hundred times more intense than the semiconductor laser system, but has not been widely used since there is no high-performance amplifier. The development of the new optic fibre amplifier for YAG laser light sources now enables satellite communications distances to be extended by more than ten fold.

The YAG laser system is an yttrium-aluminium-garnet laser system featuring excellent luminescence spectral width, less luminescence brightness disparity and wavelength disparity compared to the optic fibre communications semiconductor laser system. Therefore, the YAG laser is being applied to optic fibre sensors, laser radar systems, medical laser scalpels and welding, and use is anticipated in optical satellite communications systems. With optical space communications, a high output is demanded to increase the reach of optical signals, which

demands amplification of feeble optical signals with minimum noise.

To cope with this technical issue, ATR directed attention to the YAG laser system as an excellent light source and tried to develop an optic fibre amplifier working in the 1.06 μm wavelength band. The new technology is based on the development of the amplifier using neodymium. The optical amplifier is set midway in the system, and when the signals pass through the neodymium-doped optic fibre, an excitation light (wavelength 0.8 μm, and excitation input of 50 mW for a 10-mW system) from the semiconductor laser source is added with the wave mixer to intensify the weak input signals for output.

The optical amplifier with an output of 10 mW class is to be commercialized by Mitsubishi Electric Wire Industrial.

Further details from Advanced Telecommunications Research Institute, 2-2, Hikaridai, Seika-cho, Soraku-gun, Kyoto 619-02 (Tel: +81-774-95-1114. Fax: +81-774-95-1109) (Source: *JETRO*, May 1996)

System for automatic correction of TFT liquid crystal black matrices

NTN Corp. has developed a system for the automatic correction of black defects (pattern shape defects) and white defects (pinhole) which are generated on the black matrices of thin-film transistor (TFT) type colour filter wafers.

The black matrix is a thin black film coated on the glass substrates of LCD colour filters to partition in lattice form the pixels which emit light in the background, by which the contrast is increased. When the lattices are damaged, or holes that should remain clear become blocked, image quality is deteriorated.

The new liquid crystal colour filter correction system collates a colour filter substrate prior to colouring with the correct lattice pattern input beforehand, accurately specifies the defective parts of the black matrix and corrects them automatically. For black defects, the shape of one pixel can be corrected with one irradiation of a YAG laser beam, and a large area of up to a maximum of 3502 μm^2 corrected to a position accuracy of 1 μm.

Defect specification and correction are accomplished in about 15 seconds. The white defects are detected accurately by image processing and corrected by applying a very small volume of the filling material at the necessary parts. A special type of needle is used for material application, then hardened by irradiating an ultraviolet ray on the coating material. This task is accomplished in about 30 seconds.

Up till now, most defective products were rejected due to the lack of an appropriate automatic correction system, while some products were corrected tediously by skilled workers using a laser beam. Hole filling was also performed manually.

Further details from: NTN Corporation, 1-3-17, Kyomachibori, Nishi-ku, Osaka City, Osaka 550. (Tel: +81-6-449-3526. Fax: +81-6-443-3226) (Source: *JETRO*, March 1996)

Double-pulse dual-beam laser method for large crystals of polysilicon on amorphous substrate

Professor M. Matsumura and his research team at the Department of Physical Electronics, Tokyo Institute of Technology, have developed a method for fabricating a polysilicon film with crystals large enough for use in the

next generation of thin-film-transistor (TFT) liquid-crystal displays (LCDs).

The double-pulse dual-beam laser method recrystallizes an amorphous-silicon (a-Si) workpiece twice with two successive pulsed laser beams. The scheme causes the amorphous silicon to melt and then "gradually" solidify. The crystals have an average diameter of 11 μm, some 100 times as big as crystals of conventional polysilicon. The research team envisages producing a film with crystal grains 100 μm across.

The conventional laser method of recrystallizing amorphous silicon into polysilicon causes the molten silicon to solidify in as short as 0.1 μs or so. The new method lengthens the crystallization process by 30 times. Since the grain size is proportional to the square of the solidification time, the crystals grow much larger.

Further details from: Tokyo Institute of Technology, Dept. of Physical Electronics, 2-12-1, O-okayama, Meguro-ku, Tokyo 152 (Tel: +81-3726-1111. Fax: +81-3-5734-2559. E-mail: matumura@pe.titech.ac.jp)(Source: *JETRO*, March 1996)

Porous silicon semiconductor emits green photo- and electro-luminescence

H. Mimura of ATR Optical and Radio Communications Research Laboratories and Y. Kanemitsu of Tsukuba University have jointly succeeded in emitting green photoluminescence from a porous silicon semiconductor.

The silicon semiconductor had been regarded as unsuitable for use as a light emitting device, but the possibility of generating an intense visible luminescence by making silicon porous has triggered research on silicon crystals with sizes on the nanometre level. More recently, it has been discovered that the size of the porous silicon crystal is correlated with the wavelength of the emitted light, but up till now it had been impossible to measure the change of the wavelength of the emitted light since the electronic state of electrons is changed by oxygen on silicon surfaces.

The green electroluminescence emitted this time still has a low brightness, but this may be improved by introducing a pn junction diode. Therefore, commercializing a practical porous silicon semiconductor emitting green electroluminescence will require some ideal p-type material.

Further details from: ATR Optical and Radio Communications Research Laboratories, 2-2, Hikaridai, Seika-cho, Soraku-gun, Kyoto 619-02. (Tel: +81-7749-5-1511. Fax: +81-7749-5-1508) (Source: *JETRO*, February 1996)

Nanofabrication of metal granules on semiconductor substrate

Associate Professor K. Tsutsui and his colleagues at the Tokyo Institute of Technology have developed a nano-technology method of growing metal granules on a semiconductor substrate. The technique promises to develop into a tool for placing an electron-confining quantum box exactly at a target position, and might be a key technology for the next generation of electronic devices.

The process involves either scanning an electron beam linearly over a surface-treated silicon substrate or focusing an electron beam to a spot on such a substrate. The substrate changes chemical properties of the surface on the thin trace strip or at the spots. As a consequence, when the substrate is subjected to molecular beam epitaxy (MBE)

using a metal, the substrate has the metal growing on the strip or at the spot. While the research team tentatively had metal granules in a straight line, they can be arranged as required.

While Ga is not a semiconductor, the granule structure may be used in a single-electron transistor. The method will offer a granule of gallium arsenide (GaAs), a semiconductor, when the MBE process is supplemented by As source.

The new method may serve for fabricating quantum boxes, for which a few processes exist. A conventional quantum box process makes use of lithography. Another takes advantage of a property of a crystal surface to let a quantum box grow in due course. However, the conventional processes cannot yield boxes equal in size. The new method will fix the problem.

Further details from Tokyo Institute of Technology, Interdisciplinary Graduate School of Science and Engineering 4259, Nagatsuta, Midori-ku, Yokohama City, Kanagawa Pref. 226. (Tel: +81-45-924-5462. Fax: +81-45-921-1204) (Source: *JETRO*, February 1996)

64-Mb DRAM-compatible excimer stepper

Nikon Corp. has developed a package type excimer stepper that is compatible with the mass production of 64-Mb DRAMs. A krypton fluoride (KrF) excimer laser beam with a wavelength of 248 nm is used as the light source, and a high resolution finer than 0.28 μm has been achieved over a wide exposure area of 22 mm^2.

The new excimer stepper NSR-2205EX12B was developed for use in the manufacture of the second and third generation 64-Mb DRAMs to be commenced in 1997. In addition to featuring a high resolution finer than 0.28 μm, it can be used for modified illumination on the mass production level through improvements in illumination systems.

The introduction of robot arms has shortened wafer transport time, improved exposure power, and the throughput has been increased by about 40 per cent compared to conventional types of excimer steppers through speed-up of the wafer stage processes. Processing of 63 8-inch wafers/hr, comparable to that of i-line steppers in wide use today, has become possible.

Further details from Nikon Corporation, Public Relations Dept., 3-2-3, Marunouchi, Chiyoda-ku, Tokyo 100. (Tel: +81-3-3216-1032. Fax: +81-3-3216-1454) (Source: *JETRO*, February 1996)

Current lead made of oxide superconductor

Showa Electric Wire & Cable Co. Ltd. has started marketing a current lead that is expected to enable much more compact, refrigerator-cooled superconducting magnets to be fabricated.

The new current lead is available in three models with current capacities of 500 A, 1,000 A and 1,500 A, with those of up to 500 A fabricated in column form and those of over 500 A in cylindrical form. The lengths are 160 mm. The model with a current capacity of over 1,500 A has a diameter of 19 mm and thickness of 2 mm, but the current capacity can be increased by modifying the specifications.

The oxide superconductor contains 5 wt per cent of silver, by which the critical current density is raised to a maximum of 2,500 A/cm^2 (at -196° C), an improvement of 1.5 times compared with the non silver added type. Silver acts as a sintering assistant in the heat treatment process, which promotes the growth of superconducting particles

and, at the same time, strengthens the electrical contact between the superconducting particles. In addition, by covering the current lead with fibre-reinforced glass, the strength that was a problem up till now with oxide superconductors is improved for safety warranty.

Further details from Showa Electric Wire & Cable Co. Ltd., Public Relations Dept. 1-1-18, Toranomon, Minato-ku, Tokyo 105 (Tel: +81-3-3597-7011. Fax: +81-3-3503-4506) (Source: *JETRO*, March 1996)

First water-soluble inorganic polymer

Associate Professor K. Oka and his research team of the Research Institute for Advanced Science and Technology, Osaka University, have succeeded for the first time in making polysilane, an inorganic polymer, soluble in water. This was achieved by introducing oxyethylene (alkoxy oligoethylene oxide) into the side chains of polysilane, by which the production yield has been improved by 3.4 per cent and the properties also improved substantially.

The structure of this water-soluble polysilane consists of main chains of silicon, with a new design for the side chains. Oxyethylene resembling ethylene oxide was introduced into the side chains, so the side chains possess four oxygen atoms, the groups are non-ionizing, and the molecule is hydrophillic, so the surface tension assumes a similar large value to that of water.

When this polysilane was irradiated with an ultraviolet beam, light was absorbed in the 317 μm wavelength domain, which is assumed to be the effect of the silicon chains, which consist of more than 50 silicon atoms. The water solubility is manifested even when the molecular weight exceeds 30,000.

The water-soluble polysilane displays a fluorescence effect that is extremely close to 1. The excellent optical characteristics are applicable to electroluminescent devices as well as generating a light beam by activating an electric field without having to direct a light beam. The substance has great potential for uses as a high-performance organic photosensitive material for electronic photography including laser printers. In addition, by introducing ion electric conductivity into the side chains, there is the possibility of using the substance as a battery material.

Further details from Osaka Prefecture University, the Research Institute for Advanced Science and Technology, 1-2 Gakuencho, Sakai City, Osaka 593 (Tel: +81-722-52-1161. Fax: +81-722-52-1163) (Source: *JETRO*, April 1996)

College teams notch-up filter coup

Researchers from Kings College London and Surrey University have demonstrated a simple electrically tuned, monolithic microwave notch filter.

Incorporating a tunable filter on a microwave device has traditionally proved difficult. Such circuit elements are typically used to remove unwanted tones, for example local oscillator leakage, adjacent channel interference and jamming signals.

The proof-of-concept, single-stage device, offers better than 50 dB rejection, with an independently adjustable Q and a tuning range of between 2 GHz and 3.5 GHz. Modifications to the topology could extend the tuning range to 10 to 1.

It is based on a 3 dB quadrature directional coupler and two identical LCR series networks. Each of the network components is electrically variable. The whole filter

has been fabricated, using a 0.5 μm process, on a MIMIC 4 mm by 3 mm.

The action of the coupler is such that half of the energy into any port emerges, in phase, from the one to its left. The other half comes out, with a 90 degree shift, from the port opposite the point of entry. The LC elements become effective short circuits at their resonant frequencies. If the resistors are set to 0Ω, all the energy leaving a port is reflected back with no phase shift.

The result of the phase shifts and reflections is that, at resonance, all energy entering port one leaves through port three.

Alternatively, if the resistors are set to the characteristic impedance of the network, no energy leaves port three. Variations in the values of R, L and C therefore control the attenuation, resonant frequency and Q of the filter. The electrically variable components are all fabricated from MESFETs.

Having built this filter, the team sees ways it could be improved. (Source: *Electronics Weekly*, 12 June 1996)

Batteries recharge storage

Chemists at the University of St Andrews, Scotland, UK, have produced a rechargeable lithium ion cell using a manganese compound which is far cheaper than the cobalt compound used at present. Developments with the material could double existing storage capacity.

Peter Bruce, Professor of Chemistry at St Andrews said: "Manganese, as a raw material, is 100 times cheaper than cobalt and much less toxic". A useful manganese compound, with the correct structure, has been difficult to make. The positive electrode in most lithium ion cells is $LiCoO_2$, a cobalt-based material.

Bruce's team has produced $LiMnO_2$, in a form suitable for battery use. "The structure we have is a lithium-oxygen-manganese-oxygen sandwich which stores ions effectively".

The capacity of the St Andrews cell is currently 260 Wh/l, good commercial cobalt cells currently achieve 280 Wh/l.

However, cycle life, the number of times the cell can be recharged is still currently low for the new technology. (Source: *Electronics Weekly*, 12 June 1996)

Flip-chip assembly gets patent

With a patent for the use of innovative flip-chip assembly, a small-sized, passive-matrix display capable of video data rates took a step towards commercialization. The Spire Corp. (Bedford, MA) bump-bonding technique is used to integrate the electronic circuit drivers to each of the flat panel display's (FPD's) 1-in edges, according to the project's manager, Ward Halverson. The patent is the result of research and development contracts with several US government agencies. Spire is now working to demonstrate its FPD in a year as part of a NASA programme.

Bump-bonding assembly is necessary for the development of the small, passive-matrix display that can achieve video display rates. Wirebonding is used for larger passive matrix displays, down to 4 X 6 in, but cannot bond wires at the fine pitch required for the 1-in^2 display. Spire is developing a small-sized FPD for this application because the long driving lines from a larger display's external borders cause electrical performance problems.

(Extracted with permission from *Semiconductor International Magazine*, May 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

Micromachine with high rotational speed

Workers at the University of Sheffield have borrowed the idea of levitation and used it in a micromachine that circumvents one of the big problems in such devices.

Some types of micromachines, like accelerometersand pressure sensors, are already in mass production. All those that have made it to quantity manufacture have one thing in common, they have no rotating parts, only bending cantilevers and flexing diaphragms.

There are several problems with rotating parts, but the life of bearings is the major one that keeps micromotors a scientific curiosity.

In the early days of micro-machining, there was talk that extremely small bearings would have infinite life. But this seems to have been wrong, and the life of some micromotors is measured in minutes.

Some groups, like the one at Sandia Labs, are pushing on towards a bearinged micro-motor, as they want to transmit force to an external load.

The workers at Sheffield have a different idea. They have sidestepped the whole issue by making a microgyro, using a magnetically levitated rotor.

The project started over a year ago at the University's micro-electromechanical systems (MEMS) facility. Professor Colin Whitehouse is head of Electronic Engineering at Sheffield.

The moving part of the gyro is an aluminium rotor half a millimetre across. Levitational, rotational and restraining forces on the rotor are created by currents in a pattern of conductors laid down on a substrate under the rotor. These cause magnetic fields which, in turn, induce current in the rotor. The magnetic fields from the rotor currents interact with the fields from the track currents, lifting and spinning the disc as well as stopping it escaping sideways.

Three S-shaped coils are currently employed, fed by three-phase 0.7A signals at between 1 MHz and 10 MHz.

At this drive frequency the rotor could be expected to spin at a phenomenal rate.

The speed is limited by viscous drag from the air. Modelling predicts 2,500 rpm in air, suggesting that all the forces involved are not yet fully understood.

Future plans include operating the device in a vacuum, to allow it to reach its potential of one million rpm (calculations predict the rotor can withstand 25 million rpm).

Once full speed operation is achieved, the gyro is expected to be more sensitive than existing, vibrating microgyros that rely on the Coriolis effect. In a paper, the team claims that the sensitivity should exceed greatly the Prometheus specification for yaw-rate sensing in active suspension cars of 0.1°/s at 20 Hz. This kind of low cost, high performance, application is one of the areas that the gyro could be aimed at in the future. (Source: *Electronics Weekly*, 12 June 1996)

Philips produces 66 million pixel CCD array

Scientists at Philips Imaging Technology, a research and production arm of Philips Research in the Netherlands, have manufactured a CCD (charge coupled device) image sensor containing over 66 million pixels. Covering almost the whole of a six inch wafer, the IC is claimed to be the largest ever fabricated.

One of the main problems in producing a large area die is the complexity of the masks used in the lithography process. Philips' new CCD uses a modular production technique to reduce the time and cost of development.

Philips has manufactured its largest device on a six inch wafer, allowing the stitching together of nine by seven blocks of pixels. This absorbs almost the entire wafer, measuring 86 x 100 mm and containing just over 66 million pixels. With the accuracy of modern production processes, the stitching of the blocks introduces no apparent physical distortion. (Extracted from: *Electronics Weekly*, 29 May 1996)

D. MARKET TRENDS AND COMPANY NEWS

Market trends

Increased demand for chips from pre-designed blocks

Trends in integrated circuit design have seen an approximate tenfold increase in-transistor count every six years. Small scale integration of the seventies has expanded to today's very large scale integration (VLSI) devices with many millions of transistors.

Although this has generally been acceptable from the designers point of view, pressure is increasing for a shorter time to market. As a result, this limits the ability of integrated circuit designers to lay out large and complex chips in the time available.

A more widespread usage of intellectual property (IP), or pre-designed blocks, such as bus interfaces, processor cores and communication modules is being forced. It will become necessary for increasing proportions of chips to be formed from pre-designed blocks in order to meet deadlines.

Providers of the IP itself face several problems, including the protection of the IP in a copyright or ownership sense, guaranteeing the performance of synthezised code and ensuring the manufactured block can be tested.

The performance problem exists at different levels of abstraction within the design.

For IP provided as a physical layout, performance can depend on a manufacturing process or a particular speed grade of device. For example, in the case of a high performance computer peripheral targeted to an FPGA, the fastest and hence most expensive version may be required to ensure timing parameters are met correctly.

This also applies to schematic layout and hardware description language (HDL) design entry formats such as Verilog and VHDL. At these levels, which are the most appropriate for the distribution of IP, different synthesis tools will create different physical representations of the same circuit. Some tools may not be able to optimize for timing efficiently, particularly when the target device is an FPGA or PLD.

If a system uses different types of programmable logic and some ASICS, then more than one synthesis tool may be needed—something few companies could afford.

Performance of the core or block can be made more certain in several ways.

IP could be provided in just a physical format. However, this is target dependent, whether it be programmable logic or an ASIC. This is used by ASIC vendors for library functions although normally for smaller blocks.

A second approach sees the target device vendors supplying RTL code for the functions, optimized for their own process. This is currently used in the programmable logic market, for example Altera's Megafunctions and Xilinx's LogiCore range.

A better solution is to force the synthesis tool to create silicon layout with correct timing parameters by applying constraints to particular timing paths earlier on in the design cycle. (Extracted from: *Electronics Weekly*, 19 June 1996).

NC software market continues healthy growth

Numerical control software vendors enjoyed a good year in 1995 and 1996 should be even better, according to CIMdata. The world-wide market for off-line NC software and related services grew 10.8 per cent to nearly $500 million last year and is forecast to increase another 14 per cent to exceed $550 million this year, the Ann Arbor, MI, consulting and market research firm reports.

Among vendors, Surfware showed the most growth (45 per cent) in 1995, followed by Cimatron (32 per cent) and Dassault Systems (31 per cent). Matra Datavision is the largest supplier with 1995 revenues of $46.9 million, but CIMdata forecasts that Dassault will overtake Matra this year. (Source: *Machine Design*, 23 May 1996).

Internet directions in 1996

The Internet in 1996 will see changes in many areas. One likely to experience significant changes is the software front. The continuing development of Internet-related software will have a significant effect on the use of the Net. TCP/IP stacks, mail readers, news readers, automated diallers, and Telnet applications will continue to be developed and improved as the market grows. This is necessary as faults such as systems crashes, incompatibilities, and lack of standard features are the norm for many Internet programs and program suites.

The year 1996 may see significant development towards including or integrating e-mail receiving software into World Wide Web browsers. Many browsers can send a single message, but using a Web browser to read incoming mail remains in the experimental stages. Bookmark organization and maintenance needs more improvement, although both Mosaic and Netscape have made some significant strides. Updating to the latest version of a browser should become more seamless, and browsers will also incorporate more formats that can be displayed directly by the browser, such as Adobe Acrobat PDF formats.

Searching the Net for specific information needs will become just one tool of the searcher's arsenal. Parallel to Internet searching becoming more commonplace, searching techniques and strategies will be refined. Using the collaborative capabilities of the Internet, more finding aids, guides, and indexes will be created, shared, and updated, many with specialized subject focus. These tools will help simplify the process of answering questions with the Net. Yet despite many people's efforts, the process will remain a difficult one. (Source: *Online*, 20(1), January/February 1996).

Making money on the Internet

Figures indicate that the user of the Internet at this time is predominantly male, will spend several hours a week on-line, and will be more educated and more affluent then the general population. North America is the leading market, followed by Europe. At least half of the users are aged 16 to 34; most of the balance of the user base consists of users who are older but generally not retired from their professional life. A growing population of female users of all ages is increasingly surfing the Internet.

Currently the business models in play on the Internet include the product listing models, such as Yellow Pages; a company store or mall model; and a third-party catalogue model, which are derived directly from their marketing and sales equivalents in the paper and retail world. Regardless of earlier models, the Internet may be the only mass market channel available to the public, especially for the distribution of information or ideas, where there is little cost of manufacturing or shipping.

The Internet's interactivity also provides comparative shopping agents, an element unknown in retail, catalogues and other channels. These agents service their customers by assisting them in pursuing their interests and leading them electronically to various options and their comparative values. Customer response can now speed its way to the marketer, who can just as quickly respond. A business model has yet to be defined which encompasses the breadth of electronic commercial networks, however, old models will serve us as the new ones emerge. (Source: *CD-ROM Professional*, 9(5) May 1996).

LCD price reductions hit FED investment

The prices of liquid crystal displays (LCDs) have fallen sharply over the past 12 months as companies in the Far East enter the market. Improved production techniques have raised yields so that those who planned to invest in competing technologies are discouraged from doing so. Field emitter displays (FEDs) offer a number of advantages over LCDs, such as wider viewing angle, wider temperature range and brighter displays, but large investments are required to set up the high-volume plants necessary for FED production. (Extracted with permission from *Semiconductor International Magazine*, May 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA).

Programmable logic on the march

Programmable logic is making great strides in increasing its share of the ASIC and overall logic markets. According to Dataquest, the programmable logic element of the ASIC market grew by 50 per cent last year while the overall ASIC market (both factory-programmed and customer-programmed) grew by 29 per cent.

The programmable segment now represents 12.7 per cent of the $14 billion overall ASIC market with gate array taking 46.5 per cent and standard cell the remaining 40.8 per cent.

Programmable logic is 9 per cent of the entire $20 billion logic market.

By the decade's end, the programmable element is expected to account for 17 per cent of the total logic market, and for a quarter of the total ASIC market.

That is fast moving for a technology (CMOS programmable logic) that was in its infancy 12 years ago.

To command a $1.8 billion market after a dozen years makes programmable logic the fastest growing new product sector in the chip industry's history.

An indication of how far and how fast the specialist programmable logic companies have moved is that the largest of them, made it into the ranks of the top ten ASIC manufacturers in 1996.

Dataquest reckons that the programmable suppliers "are rapidly capturing the low-density ASIC market (below 20,000 gates)".

The biggest growth for the programmable logic suppliers is at the high density end with complex PLDs growing 89.2 per cent and FPGAs at 58.7 per cent.

A market segment showing 30 per cent growth is the embedded megacell market (e.g. where an SRAM cell is made on the base wafer)—already the embedded market accounts for $700 million sales, says Dataquest.

By contrast low density, simple PLDs grew at only 6.3 per cent, while the older, bipolar, type of programmable logic is in decline.

It is notable that the big companies have failed to make an impression on the programmable logic market, which is still dominated by its pioneers—Xilinx, Altera, Lattice and Actel—though AMD still has a big position in the low density and bipolar end of the market achieved through its takeover of Monolithic Memories. (Source: *Electronics Weekly*, 15 May 1996).

Robust growth reported for the fabless semiconductor segment

The results of the Fabless Semiconductor Association's (FSA) 1996 Wafer Demand Survey, which was designed to "communicate accurate and timely data to foundry partners", based on data collected by Ernst & Young from 56 fabless participants, indicate the following trends:

- Fabless wafer needs are expected to grow 40 per cent annually through 1998.
- Fabless respondents indicated that their 1996 wafer needs exceed their 1995 actual requirements by 39 per cent; 1997 wafer needs will exceed 1996 by 44 per cent; and 1998 wafer needs will exceed 1997 by 41 per cent.
- CMOS is by far the predominate technology for fabless companies, with bipolar and BiCMOS constituting only 2 per cent of the overall technology requirements for the fabless group.
- Fabless companies are moving rapidly to 0.35 μm technology.
- Demand for 0.6 μm or less will match demand for 0.6 μm and above in 1996.
- Requirements for 0.5 μm and less are expected to grow at a compound rate of almost 200 per cent.
- By 1998, the respondents expect that in excess of 80 per cent of their requirements will be for processes with three or more layers of metal at 0.6 μm and below.

Although the survey does not measure revenue growth for fabless companies, the FSA tracks revenue and estimates of 32 publicly held fabless companies. According to a recently revised revenue projection for 1996, fabless revenues will be $6.86 billion, representing a 45 per cent growth over 1995 revenues.

The new survey also indicates that the fabless growth will outpace the overall semiconductor industry by a wide margin. (Extracted with permission from *Semiconductor International Magazine*, June 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA).

Contract manufacturing market to triple

The world-wide semiconductor contract manufacturing (SCM) market is projected to triple from $6.2 billion in 1995 to $18.5 billion by the year 2000, according to a new Dataquest report.

The trend towards SCM is a megatrend similar to those that have evolved within the electronic equipment markets. The semiconductor contract manufacturing market consists largely of a traditional semiconductor foundry and a small amount of a newly defined segment called OEM/ASIC.

Demand for SCM services will continue to grow in all four regions of the world. The North America region will continue to account for more than one half of the SCM market through the year 2000. (Reprinted with permission from *Semiconductor International Magazine*, June 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA).

Second-hand equipment market

The second-hand semiconductor manufacturing equipment market is getting interesting. Process technology is entering a new generation, and equipment is being upgraded. Second-hand equipment retailers are aiming to resell unneeded equipment cheaply, reducing the investment needed by the semiconductor manufacturers. Not all manufacturers are making state-of-the-art devices, and there is a strong demand for second-hand equipment.

In the USA, the second-hand market is already well-established under the guidance of equipment manufacturers, but in Japan, the word "second-hand" has a bad image, and the market is very weak. Recently vendors have appeared offering value-added services such as refurbishing, maintenance and warranty, while in the past the second-hand equipment market in Japan consisted only of brokers. Adding this type of service is helping second-hand equipment attain a better image, but there are a number of problems with resale problems and discord between the original manufacturers and resellers concerning refurbishing and maintenance. To eliminate these problems and establish a strong second-hand equipment market in Japan, the entire semiconductor industry must cooperate to draw up market rules. (Extracted with permission from *Semiconductor International Magazine*, June 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA).

Computer manufacturers look abroad for future growth

Computer manufacturers continue to look abroad to jump-start stalled US sales of personal computers (PCs). Dataquest estimated that world-wide PC shipments grew by 25 per cent in 1995, accounting for a record 59.7 million units. However, most of this growth came from abroad. Domestic sales of PCs began to slow markedly in the fourth quarter of 1995 with a cooling of consumer spending. The first quarter of 1996 has been particularly tough for PC manufacturers with bulging inventories and lackluster sales. Recently, however, shipments of PCs and related equipment have rebounded smartly. The outlook for PC shipments remains very good, with foreign sales accounting for a larger share.

The most pronounced growth in PC shipments came from two overseas markets in 1995. According to Dataquest, the largest gains were reported in Japan, with shipments reaching an incredible 71 per cent, and in Europe, which experienced close to a 30 per cent increase. This bodes well for US computer manufacturers still reeling from the write-downs and losses at year-end. (Reprinted with permission from *Semiconductor International Magazine*, June 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA).

Microprocessor sales booming in Japan

The sale of microprocessors to Japan has reached stratospheric levels over the last year. Japanese PC manufacturers have been buying record numbers of microprocessors as they ramp-up production for an entrance into the US market. Japan, after earlier failed attempts, will re-enter the US PC market by year-end. Ironically, they are entering a mature, slower growth market place. However, Japanese PC manufacturers have much more brand recognition with the success of notebook computers. Increased sales of microprocessors bode well for US semiconductor manufacturers. Typically, microprocessors are higher value components that US chip manufacturers excel at producing.

Sales of microprocessors to Japan have been growing in leaps and bounds. Sales increased by an astounding annual average of 90.2 per cent in February 1996. The rate of sales has increased dramatically from a low of 37 per cent at the beginning of 1995. Sales to Japan have outpaced all other world-wide markets. Sales to other Asian counties slowed to 21.8 per cent in February, down from the high of 33.8 per cent in the middle of 1995. In terms of dollar volume, both markets are virtually even, with yearly sales just over $2 billion. European and North American markets, while two and three times the size in terms of dollar volume, have not achieved the rapid growth rates of the Japanese market. Both markets have experienced declines in sales since the end of 1995. (Extracted with permission from *Semiconductor International Magazine*, June 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA).

Cable modems take on ISDN

The cable modem market is forecast to almost double this year as frustrated Internet users turn to the speedier devices. The US market research firm Dataquest forecasts 92 per cent growth in cable modem unit shipments this year to reach 25,000 units. In 1997 this is set to grow to 80,000 units.

Cable modems, however, will soon begin competing with ISDN and XDSL communications technologies, which have the advantage of running on existing telephone lines.

Although ISDN and XDSL will be available to greater numbers of people, Dataquest points to the advantages of cable modems: they can easily transmit data types like video and two-way audio, they offer lower cost per tranmitted bit, and also support constant connectivity down the line. (Source: *Electronics Weekly*, 5 June 1996).

...as DRAM price heralds recession

DRAM prices will drag the world-wide chip industry into recession this year. So argues a report from the US market research firm, Pathfinder Research. The report predicts that the chip industry revenues will be 9 per cent lower this year than in 1995.

This would be the first such decline in revenues in 10 years. But the decline will not be evenly distributed. The huge memory market will be the hardest hit but microprocessors for instance will thrive with double digit growth. (Source: *Electronics Weekly*, 26 June 1996).

Company news

Roche claims "quantum leap" in liquid crystal

Roche has launched a new liquid crystal R&D company called Rolic and claims its technologies are a "quantum leap in making high-resolution, large area displays possible".

Rolic, based in Basel, Switzerland, has been spun off from Roche Liquid Crystals. The firm has four major new technologies. Linearly photopolymerisable polymers (LPP) improve the yield of liquid crystal display manufacturing by using a photographic process to align the crystals.

Deformed helix ferroelectric (DHF) LCDs overcome limited fields of view and slow responses at low temperatures, which restrict video LCD applications.

Rolic also has cholesteric LCD projector technology which the company claims will "revolutionize the projection industry with small, light-weight devices capable of projecting bright colour video images onto large screens".

The company's non-linear optics (NLO) devices integrate optical elements with solid-state lasers and driving electronics. They will be used to develop the "information superhighway". (Source: *European Chemical News*, 10-16 June 1996).

Philips drives at trench for next generation MOSFETs

Philips Semiconductor has adopted trench technology, called TrenchMOS, for its latest power MOSFET range. The FETs are aimed initially at the automotive market and are being made in the UK.

The company has moved from the more traditional planar structure to trench because, it claims, it is more cost effective for a given R_{DSon}.

Philips argues that the trench power FET structure has an inherently lower R_{DSon} for a given chip size and, despite the more complex processing required, results in a cheaper chip. It believes that planar technology is nearing the end of its usefulness because it cannot be shrunk to finer lithographies without parasitic components restricting further R_{DSon} gains.

Trench is the technology that Temec-subsidiary Siliconix has been using in its production automotive power FETs for the last two years. (Extracted from *Electronics Weekly*, 26 June 1996).

ITT sounds out AC-3 for digital video chips

German semiconductor maker ITT Intermetall, is planning to start mass producing AC-3 multichannel audio decoder DSPs next year. The AC-3 audio standard is expected to emerge as the world standard for Digital Video Discs (DVDs).

The move by ITT is part of a general feeling among chip makers that the market will be flooded with DVD information content, instigated primarily by the movie industry in the US.

Although the standard bodies have agreed that for DVD machines, a PAL video signal (used in Europe) will be supported by an MPEG-2 audio signal while NTSC video (used in the US) will be combined with AC-3 audio, the ultimate world standard will be driven by users themselves, who will require the running of any software on any machine.

For chip makers this is straightforward to address as hardware, based on DSP chips, can be adapted to address any standard as long as the software is available.

At ITT Intermetall the processing will be done with its MACS DSP device, which can be adapted to decode any of the audio standards currently available: MPEG-2 layer 3, AC-3 and ADR (the Astra satellite broadcast audio standard).

ITT Intermetall has already one customer for the MPEG-2 layer 3 decoder. It will produce the decoder for a contract it won from WorldSpace in June 1966, to design, develop and manufacture the Starman chipset for satellite DAB receivers. (Source: *Electronics Weekly*, 19 June 1996).

Single-chip coder for MPEG-2

The MPEG-2 Encoder market, still confined to professional broadcast and authoring applications, is set to take off with the advent of single chip encoders, according to digital video specialists C-Cube Microsystems.

To this tend C-Cube expects to announce a single chip MPEG-2 encoder next year. Such a device will bring MPEG-2 encoding to the PC, feeding authoring applications for DVD (Digital Video Disc) and enable full duplex coding/decoding for high quality video conferencing.

C-Cube has announced it has signed an agreement to acquire Divi-Com, the digital video network specialists. DiviCom provides professional video encoders for DBS (Direct Broadcast Satellite) and has licensed its set-top architecture to a number of US cable companies. (Extracted from *Electronics Weekly*, 5 June 1996).

British company to develop new display technology

Cambridge Display Technology Ltd. (CDT, Cambridge, UK) plans to develop its light-emitting polymer (LEP) technology that it claims can revolutionize the global display industry. It holds the fundamental LEP patents, but needs to raise $6 million as the first stage of its venture capital funding. It hopes to bring out its first products in 1997.

The discovery that conjugated polymers could be used to produce light emissions was made by a team led by Professor Richard Friend, Cavendish Professor of Physics at Cambridge University, in collaboration with chemistry colleagues. Friend said: "The attractiveness of LEP displays is that they combine high performance with low cost and can be fabricated on flexible sheets of plastic using well established and inexpensive manufacturing processes. Very large area, wafer thin displays of all kinds and shapes can be envisaged". (Reprinted with permission from *Semiconductor International Magazine*, February 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA).

Siemens facility comes on-line

The Siemens Microelectronics Centre in Dresden (Germany) began production of 16 Mb chips on 10 November 1995, 15 months after construction began on the plant. A 5,400 m² cleanroom is in use and a similar cleanroom will come into use early this year. Mass production is expected to start in mid-1996. The investment up to the present time is $850 million, but this will rise to nearly $2 billion by 2004, about three-quarters of which will be for high-tech production systems. The present workforce of 950 will rise to about 1,450. The plant will process over 7,500 200-mm silicon wafers per week of linewidths down to 0.25 µm. It will require 240 m³/hour of deionized water, over 70 per cent of which will be recycled. (Reprinted with permission from *Semiconductor International Magazine*, February 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA).

TI shrinks process to 0.18 µm at Dallas fab

Texas Instruments (TI) has announced its next generation semiconductor manufacturing process, with a shrink down to 0.18 µm.

The company claims this will allow the development of ICs containing over 100 million transistors with internal speeds of 500 MHz and operating voltages down to one

volt. Suggested applications include Internet servers, wireless communications and high end computing systems.

The first fab to run the process will be TI's new $2 billion facility located in Dallas, Texas. Initial designs at the 0.18 µm level are said to be under way, with beta testing planned for the third quarter this year and production by 1997. (Extracted from: *Electronics Weekly*, 29 May 1996).

MasterCard and Visa back US banks' smartcard plan

American banks, supported by the international financial organizations Visa and MasterCard, are to launch one of the largest electronic cash smart card projects yet.

Citicorp and Manhattan Chase, New York's two largest banks, announced that they are going to equip a significant part of the city with automatic cash dispensers that will allow the "loading" of electronic money onto smart cards. The scheme is similar to the Mondex electronic purse being promoted in the UK.

Local retailers will be supplied with card readers and customers with smart cards in an effort to break society's deep-seated habit of paying for items with cash.

The scheme is scheduled to start at the end of the year and if successful the applications will be broadened to support loyalty programmes and provide secure payments over the Internet. (Source: *Electronics Weekly*, 17 April 1996).

AMD and Fujitsu break ground on second flash memory fab

The AMD and Fujitsu joint venture, Fujitsu-AMD Semiconductor Ltd. (FASL), headquartered in Sunnyvale, CA, began construction in March on a new, state-of-the-art semiconductor fabrication plant for the production of flash memories. The plant will be located in Aizu-Wakamatsu, Japan.

At full capacity, the $1.2 billion plant is expected to produce more than 6,000 eight-inch wafers a week. Initial production will use 0.35 µm process technology, migrating to 0.25 µm. Shipments are planned to commence around year-end 1997.

In 1995, AMD and Fujitsu had an estimated combined flash memory market share of 40 per cent, according to market research firm Dataquest (San Jose, CA). The flash memory market was estimated to be $1.8 billion in 1995. In-Stat (Scottsdale, AZ) forecasts it to grow rapidly for the next several years. The fastest growing portion of the market are single-power supply flash memories, such as those currently being produced by the first FASL facility. (Reprinted with permission from *Semiconductor International Magazine*, May 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA).

Toshiba/Samsung in super-small flash project

With help from Toshiba, Samsung Electronics says it has developed a super-small flash memory card, one third the size of a credit card and holding between 1 to 8 Mbytes NAND flash memory. The format, known as a Solid State Floppy Disk Card (SSFDC) has some 40 companies supporting it. Samsung and other companies foresee large markets for such cards in electronics devices such as digital cameras, voice recorders, and portable game systems. Within four years, the market for SSFDC cards is expected to be at least 10 m cards. Samsung will begin volume manufacture of a 2 Mbyte SSFDC by the end of the year. (Source: *Electronics Weekly*, 12 June 1996).

Toshiba takes a slice of NC pie

Toshiba is developing a 64-bit single-chip silicon solution for the Network Computers (NCs) which will run several different operating systems.

The company expects that the NC will be based on a number of microprocessors and operating systems rather than a PC environment single Intel-type micro running the Microsoft-type operating system.

The requirement for a single-chip solution is because Toshiba sees the High Street price-tag of these appliances at a maximum of $500, so Toshiba has only $70 to $80 for the silicon cost.

As yet it is unclear which operating systems will run on the Toshiba chip but the company's MIPS core is expected to be able to run a number of operating systems.

It is thought that all the major Japanese consumer companies are looking to produce NCs later in 1996. They see the NC as a product opportunity and a way of escaping the PC industry's domination by the x86/Microsoft combination. (Extracted from: *Electronics Weekly*, 12 June 1996).

Acorn supplies Oracle with Internet platform

Acorn Network Computing, a division of the Acorn Computer Group, has demonstrated "netSurfer its range of network computers (NCs).

The Network Computing division was set up in January 1996 after Acorn won the contract to supply Oracle with the NC reference design. The design aims to provide a platform for open Internet standards such as HTML and Java, while costing less than $500.

Acorn plans to ship NetSurfers during the fourth quarter of this year. Initial outlets for the NC will be Online Media, the company's division responsible for the interactive TV market, and Xemplar Education, an Apple/Acorn joint venture promoting the use of IT in schools.

NetSurfers use an ARM7500FE microprocessor from Advanced RISC Machines, a company in which Acorn has a 43 per cent share. Manufactured by Cirrus Logic, the processor includes the video control, stereo sound outputs and keyboard interface. The units demonstrated used 4 and 8 Mbytes of DRAM. Depending on the configuration, NCs can drive either a standard TV or a monitor.

Communication links are via either standard telephone lines, suitable for a consumer version, or networks including Ethernet LANs and broadband ATM for corporate use.

Startup code for the computers is contained in 4 Mbytes of ROM with word-processing and similar applications being down-loaded at run-time from the service provider or server.

At the unveiling by Oracle of the NC in San Francisco, SGS-Thomson announced plans to develop a hardware accelerator IC for Java. The accelerator core could also be integrated into the main processor chip in the future.

UK software developer Eidos Technology has been selected by Oracle to provide video compression software for its network computer (NC). A licensing agreement with Oracle will make the London-based company's video compression software available to all developers of the Oracle specified NC, allowing them to incorporate a videophone capability. (Source: *Electronics Weekly*, 29 May 1996).

E. APPLICATIONS

World's first cordless videophone

Matsushita Electrical has developed the world's first cordless videophone system, which achieves real-time person-to-person communication with both audio and colour moving images. The new videophone is compatible with Japan's Personal Handyphone System (PHS).

The cordless telephone and other mobile multimedia applications are targeted as expansion priorities of the PHS. Transmission of colour moving images through PHS wireless channels is an essential technology for this development. Since the bandwidth of individual PHS channels is only 32 kbps, the H.261 codec, which is a standardized high-compression rate coding system, has to be employed. Higher error rates and severe error-rate fluctuation are inevitable when a radio transmission line, such as those of the PHS, is used, compared with a wired line. This can cause severe deterioration of picture quality and transmission delays.

These problems are solved through the development of an error-free transmission line incorporating an automatic repeat request (ARQ) feature in the wireless transmission stage, and a system preventing the deterioration of picture quality and maintaining low delay time to combat throughput variance caused by transmission errors through the optimization of the H.261 coding parameters at the point of transmission.

The new cordless videophone realizes transmission of high-quality colour moving pictures equivalent to that available by wired-line transmission through the use of the PHS. It features a battery-operated portable handset with a 2.5-inch colour LCD screen. Combining the functions of a notebook PC, Personal Digital Assistant and other devices, the videophone represents further progress in the development of mobile multimedia.

Matsushita plans to work on the systemization of this technology within a private branch exchange (PBX). Additional targets include reduction of power consumption and miniaturization to make private multimedia systems practical. This technology may be applied to the public PHS network in Japan and other countries.

Further details from Matsushita Electric Industrial Co. Ltd., 1-1-2, Shiba-Koen, Minato-ku, Tokyo 105, Tel.: +81-3-3578-1237. Fax: +81-3-3437-2776. (*JETRO*, January 1996).

Plasma displays for wall mount TVs

The first plasma displays suitable for use in TVs will be mass-produced by Fujitsu from October at an initial $5,000 price tag.

The displays are the world's only 42 inch plasma panels available commercially. Although the company has had 21 inch displays available for two years, they are considerably more expensive than CRTs and are not used by TV makers.

At 42 inch, however, the screens are bigger than CRTs and, naturally much thinner. Fujitsu's panel is only 75 mm thick, allowing a TV to be hung on the wall. The company is currently supplying panel samples to TV manufacturers, including Thomson, Nokia, Philips and Bang and Oluffsen in Europe.

Unlike thin-film transistor alternatives, plasma displays have a wide viewing angle and are therefore useful for public information displays as well as TVs. (Source: *Electronics World*, April 1996).

High-brightness, sharp-contrast colour plasma display

Pioneer Electronics Corp. has developed a high-brightness, sharp-contrast 40 inch colour plasma display (PDP), in which the pixels themselves generate light to illuminate the screen. A cell structure has been introduced featuring an excellent light-emitting efficiency of 1.2 lumen/W that provides a brightness of 350 cd/m^2.

This 40 inch PDP has a dimensional ratio of 4:3. The cell light emittance and drive system are based on an AC system that determines the display brightness and contrast ratio. Up to now, the maximum brightness of 300 cd/m^2 was displayed by a product developed by Fujitsu, but the new PDP has a brightness of 350 cd/m^2. In addition to the brightness and sharp contrast, an 8-subfield drive has been introduced that enables full-colour display in 256 graduations and 16,700,000 colours.

Further, the light leakage at the dark part has been decreased to lower the reset discharge voltage, so that a high contrast of maximum 150:1 was attained for an AC system that led to the realization of quality full-colour display.

New types of colour PDP are being developed by electronics manufacturers as a promising next-generation type display for use in wall type TV sets and for public displays. The company plans to commercialize the new colour PDP for use in commercial and home TV sets.

Further details from Pioneer Electronic Corporation, Public Relations Div., 1-4-1, Meguro, Meguro-ku, Tokyo 153. Tel.:+81-3-3495-9885. Fax: +81-3-3495-4301. (Source: *JETRO*, January 1996).

System for inputting data into computer by hand signals

Professor K. Sekine and his research team at the Science University of Tokyo have developed a system for inputting data into computers by hand signals. The hand is positioned in front of a camera in various shapes, by which the object displayed on the screen is moved or expanded.

By applying this system, a prototype system has been built that provides instructions to the computer based on hand signals. The three-dimensional object displayed on the screen is moved up and down as well as from left to right. The size of the object can also be changed with a hand signal. However, the hand shape and length of fingers will differ from person to person, so the major problem with existing systems is that the degree of recognition will vary.

The research team developed the new method for recognizing handshapes by applying computer vision and an object manipulation method. With this new method, attention is focused on the fingers.

Recognition results from using characters and marks to determine hand directions, forward-backward hand position, finger combinations and number of fingers, even if the hand size or direction are changed in the input image. The manipulation method moves the object forward and backward, left to right, expands or shrinks, by hand signal recognition.

Further details from Science University of Tokyo, Faculty of Science and Technology, 2641, Yamazaki, Noda City, Chiba Pref. 278. Tel.: +81-471-24-1501. Fax: +81-471-23-9362. E-mail: sikine@sekineOOce. noda, sut.ac.jp. (Source: *JETRO*, January 1996).

Low-priced voice facsimile information system

Matsushita Electric Industrial Co. Ltd. has marketed a low-priced voice facsimile (FAX) information system CF-UMF10. In this voice FAX information system, voice and facsimile data stored in a personal computer are linked to a public telephone circuit and can be retrieved by telephone or with a FAX system.

The new product is compatible with the PC based UNIX system, and statistical information in voice and FAX service is displayed by circuits and by time intervals.

The system consists of a personal computer, a voice/FAX circuit board and the software used as the server.

Further details from Matsushita Electric Industrial Co. Ltd., 1-1-2, Shiba-Koen, Minato-ku, Tokyo 105. Tel.: +81-3-3578-1237. Fax: +81-3-3437-2776. (Source: *JETRO*, January 1996).

High-end network computer

Sun Microsystems has demonstrated a high-end network computer (NC) at the Americas Telecom show held in Rio de Janeiro, Brazil.

The NC is aimed for use by large financial institutions and will be introduced later in 1996. Called the Zero Administration Cost Station, it features a 32-bit Sparc II microprocessor, 24-bit colour card, 16-bit sound card, a PCMCIA card and a 1Gbyte hard drive.

Sun is targeting financial institutions and retail companies and says that it will sell NC versions tailored to specific customers. Sun says the price will be about $1,000 depending on the configuration.

Sun's is one of many NC types being developed by a number of vendors. Network computers will range from cheap, discless systems to high end systems. All will rely on downloading applications from the Internet or Intranet networks. (Source: *Electronics Weekly*, 19 June 1996).

Virtual reality systems on PCs

Increasingly, virtual reality (VR) systems are moving out of the world of supercomputers, and onto the PC. VR software is improving rapidly: the better products are now capable of producing smooth motions of realistically shadowed shapes, in real time.

Possibly because of strengths in computer games and film post-production, the UK has a strong presence in this market, represented by firms such as Virtuality, Superscape and Division. The first of these intends to open up the games market, and has developed proprietary hardware employing parallel processing, in an attempt to make immersive headsets cheaper. Superscape specializes in non-immersive systems for PCs. Division operates at the high end of the market, in the emerging field of virtual engineering.

It has been estimated that UK companies created about £13.2 million ($20 million) worth of VR products and services in 1995, a figure anticipated to rise more than fivefold by 2001, by which time the market will be worth $1,000 million. As yet, no company has produced more than a token profit, but analysts expect some of them to start generating real profits this year.

To date, the games market has been inhibited by fears from head-set suppliers that they might be vulnerable to lawsuits claiming that VR has health risks, e.g. triggers epileptic seizures.

Two areas currently dominate the market: design automation in CAD/CAM, and training, where it can be used to simulate hazardous environments. Already, Boeing claims to have reduced the development phase of the 777 by using VR techniques. As regards training, the cost of creating a burning oil platform to train firefighters can run into millions: a VR simulation can reproduce the conditions, without there being any physical risk to trainees. (Source: *Computing*, 23 May 1996).

More milestones in drive performance

IBM Corporation's new Travelstar hard drives for notebook computers pack more than a billion bits of data (a gigabit) per square inch of disk surface. The implications are more data with fewer parts, which can lead to lighter, more rugged, and more reliable products with lower power requirements. The Travelstar 3LP is available in two capacities—1.44 and 1.08 gigabytes, both with two 2.5 inch disks with a thickness of 0.5 inch. The 2XP version has a data capacity of 2.16 gigabytes on three disks and is less than 0.75 inch thick. The company also announced the Deskstar 3, a 3.5 inch desktop disk drive at 3.24 and 2.16 gigabyte capacities. IBM says its magneto-resistive head technology can reduce the number of disks required. (Source: *Industry Week*, 20 May 1996).

Simplifying the programming of bar-code scanners

What if the programming of portable bar-code scanners could be done directly from an Excel spreadsheet with data captured under selected column headings and titles? Setup would be simplified dramatically with substantial savings in time and money, says Hand Held Products Inc., Charlotte, NC, a maker of bar-code scanners. Hand Held's software could be particularly useful for firms that use spreadsheets routinely to track inventory and shipments, pick orders, and document other variables. (Source: *Industry Week*, 20 May 1996).

One tough computer mouse

Need an industrial-strength PC mouse? The DuraPoint is a sealed stainless-steel design that can probably withstand more abuse than any PC. For example, one recently survived a five-storey drop during testing, says Interlink Electronics, Camarillo, CA. Others were operational after being run over by semi trucks—even submerged in water for hours, says the company. Beneath the mouse-button pad is the company's Force Sensing Resistor, a four-zone unit that translates pressure from the mouse-control button into signals that, when processed through a micro-controller, drive cursor direction and speed. A light touch moves the cursor at a precise crawl; heavier pressure speeds it across the screen. (Source: *Industry Week*, 20 May 1996).

Realistic head for medical research

Researchers at the University of Hamburg, Germany are developing a highly accurate "virtual" model of the human body for use as an educational tool and as an aid for the planning of operations.

Initially a model of the skull and brain has been created with the starting data being obtained from the scan of a subject using magnetic resonance and computed tomography techniques. The scan data is volume rendered, represented using volume elements (voxels or the 3D equivalent of pixels), and segmented into constituent objects. To

each object are attached associated attributes. These include visual parameters such as colour and texture, and those relating to the object's meaning—pointers to text, and information detailing mechanical properties and information likely to assist during simulated surgery. (Extracted from: *Electronics Weekly*, 17 April 1996).

Laser inductively coupled plasma emission analysis system

NKK Corp. has developed a laser ablation spectrometric analysis system and is the first company in the world to apply it to on-line on-site analysis of steel. The new spectrometer quickly and accurately analyses the chemical composition of steel during steel making processes and reduces the time required for such analysis to one-fifth of the time needed conventionally. The new technology is expected to contribute to production rationalization and steel quality improvement.

The new analysis technique was established by combining inductively coupled plasma (ICP) spectrometry conventionally used in high-accuracy liquid sample solution testing with laser ablation, creating the first system able to analyse solid steel onsite.

In the system, laser light is beamed onto the steel surface and the fine particles generated are subjected to ICP spectrometric analysis. The plasma emission is separated into its original spectrum elements in a spectroscope and measured to determine the types and quantities of elements in the steel. This analysis technique works on the basis of small analysis cells for laser sampling to directly generate the fine particles from the steel, the use of a compact laser-diode pumped YAG (yttrium-aluminium-garnet) laser, and the creation of analysis conditions for hot slab test samples. NKK has performed successful on-site analysis in just 60 seconds.

With conventional techniques (based on a spark discharge emission spectrometry method), samples were sent to a centralized testing facility where they were batch-processed in an automated spectrometer and required a minimum of 4-5 minutes before the test data could be sent back to the production site.

NKK installed its first laser ablation spectrometer at its Fukuyama Works in June 1994 for quick analysis of steel sheets for automobiles. The compact systems are also being implemented at its Keihin Works to rationalize steel products analysis and rapid production control analysis at converters. The company also plans to apply the system to on-site analysis of continuously cast slab both at Keihin and Fukuyama.

NKK has applied for more than 20 sole patents and 2 joint hardware patents with a domestic equipment manufacturer.

Further details from NKK Corporation, 1-1-2, Marunouchi, Chiyoda-ku, Tokyo 100. Tel.: +81-3217-2142. Fax: +81-3214-8436. (Source: *JETRO*, February 1996).

High-current lead wire made of high-temperature superconductor

Sumitomo Electric Industries Ltd. has succeeded for the first time in commercializing a high-temperature superconductor lead wire enabling passage of a large current of 1,800 A.

Superconducting materials can be classified broadly into the metal-based low-temperature superconductor and the oxide-based high-temperature superconductor, with the latter featuring significant economy since there is no need for expensive liquified helium and is easy to handle.

System commercialization has proceeded steadily in the application of low-temperature superconductors, such as the magnetic resonance imaging system, but commercialization is delayed for high-temperature superconductors due to the delay in establishing technologies to form the conductor.

The high-temperature superconductor passing a large current with stabilized passage of power was confirmed over two years by using a bismuth oxide-based high-temperature conductor as a lead wire to a superconductor deflection magnet of a compact superconducting synchrotron radiation (SR) system installed in the Harima Laboratory. The compact superconducting SR system uses low-temperature superconductor magnets to bend the directions of the accelerated electrons to capture a radiant beam that can be directed in a straight line. Up to now, current lead wires of superconducting magnets were made of thick copper wires, which is disadvantageous because the current passing through the copper lead wires generate heat, which volatizes the liquified helium used as the coolant.

The company used a lead wire made of high-temperature superconductor cooled to -169° C with liquid nitrogen as coolant, which was fabricated by fixing the laminated high-temperature superconductor on a fibre-reinforced plastic (FRP) support with epoxy resin. This type of lead wire was confirmed to decrease volatilization of liquified helium to a third compared to lead wires made of copper.

Further details from Sumitomo Electric Industries Ltd., Administrative Dept., 1-3-12, Motoakasaka, Minato-ku, Tokyo 107. Tel.: +81-3-3423-5221. Fax: +81-3-3423-5009. (Source: *JETRO*, May 1996).

Design synthesis grows in importance

Design synthesis, a relatively new form of software prototyping, involves simulating product functions and making engineering trade-offs to demonstrate how design changes affect engineering goals. The first step in the process is to simulate mechanical functions through motion analysis or structural capacities through stress, thermal, and vibration studies. The next step consists of sensitivity analysis to highlight the most critical design parameters. Finally, optimization helps fine-tune each component or the configuration of the system to best meet engineering goals.

Mechanical analysis looks at each part's kinematic and dynamic properties, modelling devices with their physical constraints and movement limits. Moving mechanisms are modeled using a range of joints such as pins, universals, and sliders. Loads and drives can be constant, time dependent, or variable. Analysis results include joint and point positions as well as their velocities and accelerations.

Stress, thermal, and vibration studies require more exact 2D and 3D models than the simple stick figures that make do in mechanism analysis. Typically, the part must be meshed, but this can often take place automatically through software.

Sensitivity studies determine which design variables have the greatest effect. The idea is to identify the two or three dimensions out of a hundred that have a critical impact on performance. Once identified, these critical parameters are altered during the rest of the analysis to learn how changes affect performance.

Optimization focuses on critical design parameters that provide an optimal design. It typically involves several disciplines. For example, a product might be optimized for strength and weight, but only while simultaneously considering thermal performance.

Optimization studies require designers to define which design parameters may vary and by how much. Designers also select required accuracy and time tradeoffs, because more accurate simulations take longer. (Source: *Machine Design*, 4 April 1996).

Timely data input with tablets

Digitizing tablets made today are designed for three main tasks: graphic arts, digitizing mechanical or architectural drawings for CAD systems, and entering geographical data from maps. Of these, mapping applications tend to be the most demanding. Tablets with high resolutions on the order of 10,000 lines/inch and ± 0.002 inch accuracies mainly serve this market. Prices are in the $2,000 to $10,000 range, depending on factors and options such as tablet size or back-lighting and illuminated cursors.

Tablets for graphic arts start at about $150 for 4 x 5 inch models for use with PCs and the Macintosh. However, there are also large-format digitizers with active areas in the 44 x 60 inch range that target this area. These might be used by industrial designers developing models for concept cars or similar projects.

Tablet targeting graphic arts typically work with pressure-sensitive pens which the artist can use much like a crayon, controlling the width of drawn lines with pressure exerted on the pen. Accuracy and resolution are less important than ease-of-use and flexibility for such applications.

CAD applications for digitizers are less demanding than uses in mapping, but generally do not need pressure-sensitive digitizing. Resolutions of up to 2,540 lines/inch and ± 0.005 inch accuracies are considered more than adequate for tablets digitizing drawings. Tablets are sufficiently large to handle drawing sizes ranging from A to E. Prices range from a few hundred dollars to about $3,000 depending on active surface area. (Source: *Machine Design*, 4 April 1996).

Recording and playback LSI chip sets

Oki Electric Industry Co. Ltd. has developed and started sequentially marketing two models of recording and playback LSIs and two models of serial resistors, which operate on voltages of 3 V and 3.3 V and usable in personal handy systems (PHSs) and portable telephones.

Both these products incorporate an internal address generating circuit. continuous serial read/write operations are possible by inputting a single clock frequency from the outside. Also, by inputting external serial addresses, it will be possible to designate addresses in 1,024 word units in the word direction. Further, incorporating a refreshing timer and a refreshing counter will make the external refreshing circuit unnecessary, so circuits can be simplified and the power consumption reduced at the same time (data holding current of M63V89C: 50 microamp max, that of M66V84A: $100\mu A$ max.).

MSM6588L adopts the adaptive differential pulse code modulation (ADPCM) system as its voice synthesis system and is a recording and playback LSI capable of working on 3 V. By linking it with an external microphone, a loud-speaker, an amplifier for driving the speaker and a special-purpose serial resistor for accommodating ADPCM data, it can be used for audio recording and playback in virtually the same method as a tape recorder.

As for MSM6789L, it is a long-term recording and playback LSI working on 3.3 V and which adopts the sub-band coding (SBC) system as its voice synthesis system. It

is usable as an external memory serial resistor or for the direct drive of versatility type DRAMs, also for the direct driving of serial audio ROMs, so it is usable for structuring recording and playback systems with fixed message function with ease.

Both these products incorporate a 12-b AD/DA converter, microamp and low-pass filter, so they enable the fabrication of high-quality recording and playback systems with a small number of components.

Further details from Oki Electric Industry Co. Ltd., Public Relations Dept., 1-7-12, Toranomon, Minato-ku, Tokyo 105. Tel.:+81-3-3501-3111. Fax: +81-3-3581-5522. (Source: *JETRO*, January 1996).

Colour supertwisted nematic liquid crystal display

Kyocera Corp. has developed the first 14.2 inch (36 cm diagonal) supertwisted nematic (STN) liquid crystal display (LCD) KCS8060 ESTT-X1. Up till now, the largest has been the 12.1 inch since a larger display had problems such as poor display quality and yield. The company overcame this barrier by establishing size enlargement technology through the commercialization of this product and plans to start the new LCD mass production from March 1997.

The SVGA type display of 800 X 600 pixels must be mass produced. With the STN type LCD, the display quality deteriorated when the display was enlarged. Kyocera solved this problem by reducing the resistance of the ITO electrode to suppress crosstalk and at the same time improved the liquid crystal characteristics and chip design, by which a high contrast ratio of 25:1 was realized. The cell gap was also narrowed to successfully improve the response speed to 330 millisec. A fluorescent (FL) hot cathode tube was introduced to generate a uniform background light of high brilliancy, by which a brightness of 200 Cd was attained.

Further details from Kyocera Corporation, Corporate Communications, 5-22, Kitainoue-cho, Higashino, Yamashina-ku, Kyoto 607. Tel.: +81-75-592-3851. Fax: +81-75-501-2766. (Source: *JETRO*, January 1996).

Lasers as scalpels

For nearly 30 years surgeons have been using lasers as hi-tech scalpels. Now, however, the development of cheap, portable semi-conductor lasers is opening up new medical applications, ranging from novel ways of treating cancers, to welding together severed nerves.

The main medical use of lasers at the moment is in making incisions and excisions. CO_2 lasers are mainly used; these penetrate up to a few microns and heat only a small volume of tissue.

The new applications would exploit lasers operating in the red and near infra-red end of the spectrum, which can penetrate up to a few millimetres. Because the light can be carried by fibre-optic cable, it can be delivered to internal sites for a range of uses.

One technique, in trial in the US and Britain to treat cancers but not yet in Ireland, is photo-dynamic therapy (PDT). Here the patient is given a light-sensitive drug specially designed to be taken up only by the cancerous cells. When laser light of a certain wavelength is shone on the tumour, the photo-sensitive compound reacts, producing free-radicals that kill the adjacent cells, thus attacking the tumour in a localized way.

PDT uses low-powered lasers, typically at 100 milliwatts/cm², but thermal effects are possible at higher

---

powers: for example cancer cells are especially sensitive to temperatures of 45° C and heating a tumour to this temperature is another way of attacking it.

At 68° C (produced by lasers at even higher powers) tissue coagulates (akin to the way meat turns white on a hot pan) and dies, suggesting yet another way of dealing with a tumour. Finally, surgeons are also looking at the possibility of using lasers to remove brain tumours, since they are neater to use in a critical area than ordinary scalpels.

But for all these applications, surgeons need to know how an individual tissue or tumour will react to a particular type of laser light. This will depend on the light absorption and scattering properties of the tissue, and the extent to which it conducts heat. The other factors are the power of the laser and the duration of exposure.

The greatest potential, however, lies in the fact that semi-conductor development mean that cheap, portable lasers will soon be common in hospitals. This will mean novel treatments will be cheap to perform, and available on an out-patient basis. "Everyone benefits. The potential is just tremendous". (Extracted from: *Technology Ireland*, April 1996).

Peripheral component interconnect

The PCI (peripheral component interconnect) bus now serves as the basis for connections on more and more workstations and PCs. The primary reason is that this standard allows throughput among peripherals and main processors that far exceeds that of older designs such as ISA and EISA. A 64-bit PCI bus, for example, supports a 264 Mbps throughput rate where 32-bit EISA devices work at 33 Mbps at best.

Additional advantages of PCI include its support for other buses that may attach to it, and the fact that it can run at a constant speed (33 MHz) that is independent of the main processor speed. It connects to the main processor bus through a bridge consisting of interface logic that allows the two buses to operate independently. This logic introduces only a small delay in data routed between the CPU and peripheral circuits.

Numerous vendors of both workstations and PCs now employ PCI architecture. One reason is that peripherals following this standard can be less expensive than those using older more complicated designs. Their simple interface circuitry allows some PCI cards to carry prices competitive with ISA cards. PCI also serves as an interconnection standard for some peripherals found on PC motherboards, such as hard disks and video adapters.

Physically, PCI peripheral cards come in either 7-inch lengths (a bit larger than a half-size ISA card) or in 12-inch format. Experts predict even notebook computers will adopt PCI connections because the standard allows use of 3.3-V ICs, in addition to more widely used 5-V versions. (Source: *Machine Design*, 4 April 1996).

Small vessels access Internet

Instant access to the much-vaunted global information infrastructure is now possible even from the smallest vessels afloat following a major service breakthrough from satellite communication provider Inmarsat.

The breakthrough came during the first quarter of this year when two of the organization's signatory service providers, BT and Telstra, launched Inmarsat-M data services from their land-Earth stations in England and Australia.

The Inmarsat-M service now provides a fully global, mobile, data communication service that will allow operators of vessels fitted with suitable terminals access to dial-up data networks, such as the Internet, even while they are at sea.

With its small, lightweight terminals and antennas, the Inmarsat-M service is primarily aimed at smaller vessels.

Inmarsat believes the new data service will be of particular interest to operators of yachts and fishing vessels.

Three Inmarsat terminal manufacturers—Neta, STN Atlas and Thrane and Thrane—all now offer Inmarsat-M terminals with data capability and software upgrades for existing terminals. (Source: *Ocean Voice*, April 1996).

Producing your own CD-ROM

Converting an idea into a finished CD-ROM can be a lengthy and expensive process, and many organizations turn to a third-party producer firm which can undertake the project.

Right at the outset, it is important to define the target market for the product and what it is intended to achieve. It is also essential that the client and the producer are able to work together in an effective manner. The initial discussions between the two are critical, since they will determine the shape of the project, its cost and success. The discussions need to embrace such topics as intellectual property rights and ongoing use of the material.

The next step is to storyboard the project on paper, or even produce a quick onscreen prototype, without the interactivity, to visualize the effect. Clients very often underestimate the effort involved in inserting the interactive connections. Once the general framework is in place, consideration must be given to commissioning any additional animations or video material. The soundtrack must also be created, and it is recommended that a professional voice-over artist be employed. An important element in the project is testing: it is best to get someone not previously involved in development to work through every screen and every option, to check that everything works as intended.

Estimating the total time and cost depends on many variables. Clients, however, should not expect a project to require less than three months, and it may need five or six. A formulaic approach, with the client providing all the material, would result in a cost of about $7,500, although a more impressive corporate production might cost up to $120-135,000. (Source: *Data Production International*, (5) 1996).

Voice processing

Voice processing used to be a simple concept of what was really a shared, high-capacity answering machine facility, provided either as a commercial offering or within companies for taking messages when employees were away from their desks. With the advent of computer-telephony integration (CTI), it became fashionable to regard voice processing as a subset of that technology. This perspective appears to have been fulfilled, and there are clear signs that the voice processing market is segmenting.

Over the past year, voice processing has become a more accepted form of business communication. Acceptance across many industries has resulted in many horizontal applications for customer requirements such as call centres, office communications, and bureau information.

These are early days and the new PC-based telephony switching market will first be dominated by departmental call centre solutions for the corporate market and by systems tailored for the needs of specialist operations, such as call back, calling card, and call through systems for International Simple Resale operators. Many telephony vendors

have already faced up to the inevitable and launched more open products.

One example is Mitel's development of its Media Path Platform. Based on a PC server running Windows NT, the Media Path Platform has brought together the hardware and software required to integrate call control, unified messaging and Interactive Voice Response (IVR) into a LAN environment. This allows users to transfer, hold, retrieve, conference, divert and forward calls from their Windows 95 PCs. (Source: *Communicate*, April 1996).

Laptops break through storage barrier

Previously, the limit for storage devices used in portable PCs was 1,000 million bits per square inch. Now a technology developed five years ago by Philips and Matsushita is finding a new application, and higher disc capacities have become possible, IBM's new drive enables 1,300 million bits to be stored on each square inch, which means that a laptop computer can store over 16 gigabits of data.

The technology is the use of thin-film magneto-resistance read heads. The electrical resistance of the head varies with the strength of the magnetic field through which it passes, producing variations in an electrical signal. The heads are sensitive, enabling them to read very small domains at high speed.

Two new audio recorders, the Technics RS-AZ6 and RS-AZ7 also use the system, which provides sound reproduction with greatly reduced background noise. (Source: *New Scientist*, 27 April 1996).

System to transfer CAD images to TV conference terminals

Toyo Engineering Corp. (TEC) and NTT Corp. have jointly developed the FREDERIC (File Retrieval Engineering on Distributed Environment and Interactive Communication) System for transferring computer-aided design (CAD) images to TV conference terminals, with the aim of building up a remotely-shared image engineering environment which allows remote offices to have a similar environment to that of home offices using ISDN (Integrated Services Digital Network).

This environment is now being experimentally operated towards practical used as a first step for realizing Virtual Enterprise (VE) or as an information-base technology to share information with the home office, domestic and overseas clients, vendors and project sites.

The remotely-shared image environment enables the plant walkthrough system to be a sort of virtual reality (VR) system in which a plant model represented in three-dimensional mode gives the illusion of walking through and surveying the plant.

The environment permits both home office and plant site office to work interactively, watching the same images, reducing trips between offices and the cost of installing a high-grade systems environment.

Presently the use of a shared environment is limited by the differences between countries in the availability of ISDN and in communication speed. In future, it will become an important basis for information technology towards the realization of virtual enterprise on the basis of Commerce At Light Speed (CALS), supported by global data sharing in distributed environments through standardization, such as STEP (STandard for the Exchange of Product model data).

Further details from Toyo Engineering Corporation, 3-2-5, Kasumigaeseki, Chiyoda-ku, Tokyo 100. Tel.: +81-3-3592-7411. Fax:+81-3-3593-0749. (Source: *JETRO*, February 1996).

Neuromorphic vision chips

The dream of building machines that mimic the behaviour of animals and people dates to the dawn of technology. With the advent of cheap and powerful digital computers, that dream is becoming reality. Computers, though, struggle hard to process the type of visual input people can instantly absorb, as when we identify a familiar face, read a scrawl, or hit a hurtling tennis ball. One reason for the contrast is that visual images contain so much information: a 1-second-long, uncompressed NTSC video segment amounts to about 22 MB of data. The need to process, store, and ship such vast data streams is what hampers machine vision. Yet miracles of real-time visual behaviour are performed by the common house fly, whose brain is the size of a grain of rice. Clearly there is much to learn from the computational strategies of the nervous system.

For a decade now, research at many university laboratories has sought to understand the biological circuits and principles that underlie vision and vision-based behaviour in flies, frogs, cats, monkeys, and human beings. At the same time, the complexity of the circuitry a single silicon chip can support has reached new heights. Capitalizing on these grains, a few researchers have built electronic chips that mimic neurobiological circuits related to visual processing: so-called neuromorphic integrated circuits, a term coined by Carver Mead at the California Institute of Technology (Caltech), in Pasadena. A neuromorphic imaging sensor consists of arrays of photoreceptors combined with analog circuitry at each picture element (pixel) in such a way as to emulate the vertebrate retina. More specifically, the sensor, like the retina, can adapt locally to vast changes in brightness, can detect edges, can signal temporal changes, and can detect motion.

Until recently, vision chips of this kind were laboratory curiosities. Now, they are powerful enough for use in a variety of products. In the long term, the principles of neuromorphic design will enable machines to interact with the environment and with persons, not through keyboards or magnetic strip cards, but with the help of robust, cheap, small, and real-time sensory systems of the type that have been ubiquitous for the past 400 million years. Appliances will become life-like: smart doors will let us pass once they have seen our faces; cars will navigate by themselves; and roach-like cleaners will scurry along floors to remove dust and dirt. Last but not least, because of their similarity to biological nervous systems, neuromorphic systems can provide a "natural" substitute for damaged parts of the human nervous system, such as the retina or parts of the cerebral cortex.

Silicon retinas are not limited to the region of visible light. One trend in infrared processing is to integrate heat-sensing elements with resistive grids to enhance local contrast. Combined with emergent technologies for room-temperature infrared sensing, this development promises a generation of infrared silicon sensors. A continuous version of discrete resistive grids, akin to a resistive sheet and made out of polymers, might lead to a more compact "plastic retina".

Evidently, highly integrated electronic sensors can utilize lessons gleaned from the way the nervous system works, and in so doing gain significant advantages over CCD cameras and digital computers. With their small size and low power consumption, and with their ability to out-

put spike-like pulses, they are attractive as prosthetic devices for retinal and cortical implants.

Biological vision systems, honed by several hundred million years of surviving a hostile, real-time environment, employ strategies that are conceptually quite distinct from those used in engineered digital systems. The conceptual rethinking required for designing neuromorphic vision systems seems well worth the effort and should lead to artificial vision systems that are cheap and small and may eventually rival the performance of animals. (Extracted from *IEEE Spectrum*, May 1996).

Where electronic vision enhancement stands today

Over three million people in the United States are affected by low vision—defined as any chronic visual condition, uncorrectable by lenses, that impairs the ability to perform every day functions. So the reports of the mid-1980s on virtual-reality helmets and on the image-processing technology being developed by NASA researchers proved an inspiration to The John Hopkins University's Wilmer Eye Institute in Baltimore, Maryland. The ophthalmologists and researchers there proposed a head-mounted video system for low-vision patients and in late 1985 applied formally to NASA for a technology transfer project.

Early studies indicated that components from commercially available camcorders might do for a first-generation system for acquiring and displaying images, so that NASA's contribution to the project would be in the area of image processing. For the wide-field viewing system required, 19-mm monochrome cathode-ray tube (CRT) screens were the only displays on the market with enough resolution and contrast. So until better options emerge, the low-vision enhancement system must be monochromatic.

A contract to develop the system's projection optics went to Polaroid Corp., Cambridge, MA. Prototypes were manufactured early in 1991, but it was not until the middle of 1994 that the first production model was completed by Visionics Corp., a Golden Valley, Minnesota-based company founded specifically to manufacturer and market the enhancement system.

The enhancement system has two main components: the headset and a control unit, which doubles as a battery pack and is worn around the waist. On the headset are three cameras based on charge-coupled devices (CCDs): two for orientation and a third for refined viewing. The orientation cameras located in front of the wearer's eyes have a fixed-focus objective lens, a 60-degree field of view, and near-unity magnification. The two provide separate images with near-natural binocular disparity.

The third camera, with 1.5-9X variable magnification and variable focus, is placed above the center axis of the unit and provides both eyes with the same cyclopean view. Its focal range at low magnification is about 1 cm (macro) to infinity; as magnification is increased, this range is progressively limited. Permanently attached to the zoom objective lens is a low-power (2-4 diopter) lens. Its job is to reduce the near-point distance at maximal zoom; with a 2-diopter lens, the focus range at 9X is 25 cm to infinity. When the wearer is working close up, the camera housing can be tilted downward.

Signals from the cameras are sent to the control unit, where a digital signal-processing chip maximizes edge sharpness in a previously selected region of interest. Switches let the user select the camera, motorized zoom, autofocus lock (in which case the zoom lever can double as

a manual focus control), and contrast. With contrast selection, the user may choose normal or inverted polarity, regular or enhanced contrast, and, if enhanced contrast is selected, the mid-point of the brightness scale. (The belt pack also has a nickel-cadmium battery providing 1.5-2 hours of operation; the unit can also be powered with 12 V dc using an ac or car-battery adapter.)

After all the selecting and conditioning, the video signals are returned to the headset for display on two forward-facing CRTs. The CRTs are mounted in the rear half of the headset's arms, which run along the wearer's temple. Aspheric optical projection systems image the CRT screens on the wearer's eyes at infinity, subtending 50 degrees horizontally by 38 degrees vertically. Given the CRT's resolution of 300 vertical line pairs, the image resolution is 5 arc-minutes—possibly a limiting factor for wearers with visual acuity of more than 20/100.

To customize the system, the 8-mm exit pupils of the projection systems are centered on the person's pupils, and his (or her) spherical and cylindrical eyeglass prescription is built into the system. A system of four straps supports the 1.0-kg weight of the overall system and keeps the projection system aligned with the eyes.

Under a grant from the Department of Veterans Affairs' Division of Rehabilitation R&D, evaluation research is now under way at Wilmer Eye Institute and at four Veterans Administration medical centers. The system is also being prescribed by over 30 centres in the United States and at centres in Waterloo, Ontario, Canada; Heidelberg, Germany; and Oxford, England. (Source: *IEEE Spectrum*, May 1996).

Double polysilicon flash

SGS-Thomson Microelectronics has announced details of its latest flash memory, dubbed SuperFlash. SuperFlash uses a double polysilicon structure, currently based on a 0.6 μm CMOS process. The devices feature a single power supply with on-board charge pumps for creating the split supply programming voltages.

A critical development by SGS-Thomson is the ability to erase and reprogram any size of memory block, even down to individual bytes. Because this allows the flash to emulate EEPROM, the company's next generation EEPROM devices will be constructed using this technology.

The eventual aim is to enable the placement of flash, EEPROM and perhaps SRAM on the same device. This has ramifications for the cellular phone industry. SGS-Thomsom sees the memory requirements for cellular phones moving towards fewer devices, ending with a single 40-pin device.

Initial products based on the technology are Advanced Micro Devices compatible. A single 5V supply 4 Mbit flash, the M29F040, is available now with a 3V alternative scheduled for production in October 1996. (Source: *Electronics Weekly*, 15 May 1996).

Small, affordable atomic clock

"Our ultraminiature atomic clock...could become a new time standard for the electronics industry." Dr. Ted M. Foster of Westinghouse (Pittsburgh, PA) said about the semiconductor laser diode pumped device. According to Dr. Irving Liberman, Westinghouse time standards program manager, the clock will be one-tenth of the size and 100 times lighter than any atomic time standard now available, and will draw one-tenth the power—about one-third of a watt.

Atomic clocks, in which an atom takes on the role of a pendulum, came into use a few decades ago as the ultimate in time-keeping accuracy, replacing astronomical observations of the mean solar day as the definition of the second. The name comes from the clock's use of the frequency of oscillation of certain atoms (cesium is most commonly used) to maintain an electronic circuit at a highly precise microwave frequency. They are not radioactive and, despite their name, have never been atomic in size. NIST-7, for example, a seventh-generation atomic clock placed in operation two years ago at the National Institute of Standards and Technology, is a cylinder 10 feet long and a foot and a half in diameter.

NIST-7 will neither gain nor lose as much as a millionth of a second in a year, a level of accuracy that makes it a tool in setting and maintaining international standards of time and frequency. The Westinghouse clock, the most advanced version of which will be about the size and weight of a walnut, has about a millionth of a second accuracy in a day.

The new clock promises benefits in applications that use the Global Positioning System, a technology that determines position by measuring how long it takes for radio signals broadcast from each of a constellation of space satellites to travel to a receiver at the point being measured. Based on atomic clocks already on the satellites, performance could be greatly enhanced if each receiver also had an atomic clock instead of a crystal oscillator. This improvement would increase accuracy, especially in altitude determination, and would increase system availability in urban areas where buildings tend to block the path of satellite signals. (Extracted with permission from *Semiconductor International Magazine*, February 1996. Copyright 1983 by Cahners Publishing Co., Des Plaines, IL, USA).

Printers now tell name, rank, and serial port number

Plug-and-play compatibility with Windows 95 is coming to more and more printers. On start up, the printer automatically tells Windows 95 about its identity and configuration. The operating system in turn looks for a matching driver in its database and installs it. In the event the driver is missing, Windows 95 prompts the operator to either install one or pick a close-fit from its database.

In addition, increased use of bidirectional parallel port connections now let printers exchange more information with the computer. This allows, for example, operators to configure printers from Windows, rather than by operating push-buttons on the printer itself. This is one reason why some printer makers now have eliminated manual control panels on their newer models.

High-end printers are starting to incorporate so-called high-density parallel ports, designed for better bidirectional communication. These use connectors resembling those found on SCSI peripherals.

Users who need fast throughput should be aware of the limitations of GDI (graphics device interface) printers. These units contain simple controllers. They rely on the PC or workstation to image a page and send it to the printer. This can slow other operations in the PC or workstation during printing, however. The trend is to put more intelligence in the printer itself and not burden the workstation during what are often computing-intensive graphic operations. (Source: *Machine Design*, 4 April 1996).

From computer monitor to TV screen

The conversion of computer-generated images to a format compatible with VCRs and TV screens entails the use of devices called video scan converters. These converters take the form of either stand-alone instruments or plug-in cards for PCs. An example is the HyperConverter 1280, capable of converting any screen resolution up to 1,280 X 1,024, noninterlaced, 24-bit colour, to broadcast-quality composite (NTSC/PAL), Y/C (S-VHS), and component (RGB/YUV) video signals. It is available as either an ISA-compatible board for PCs or in external desktop or rack-mount versions. Developed by PC Video Conversion in San Jose, California, it works with any operating system and provides features such as adjustable picture positioning and sizing, Gen-Lock capability, and digital flicker filtering. (Source: *Machine Design*, 4 April 1996).

CAD hardware

Display controller cards work in harmony with video monitors to provide high-quality images. A 75-Hz refresh rate has been standard, although faster 85-Hz redraw rates are becoming more widely used. PC SVGA monitors employ minimum pixel densities of 1,024 x 768, corresponding to 90 dots/in. (dpi). SVGA 1,280 X 1,024 mode is generally held to be the minimum required for 17-inch monitors. Larger 21-inch screens typically demand 1,600 x 1,200-pixel controllers, corresponding to 120 dpi resolution.

Because CAD applications usually involve colour graphics, display controller cards obtained for such uses must be able to handle 8.16 and 24-bit colour modes. Also important is that the display controller be compatible with a wide variety of colour monitors—some are not.

Some display cards contain graphics accelerator circuitry for faster production in graphically intense applications, such as CAD. Products typical of this category may include a large frame buffer memory, to the order of 10 Mbytes or more, which also aids in supporting overlays. An on-board graphics processor typically takes over production of basic graphic entities from the main processor, thereby speeding the display process. One such card, for example, boasts support for up to 205k Gouraud-shaded triangles/sec and up to 750k 3D vectors/sec.

In addition, the recently released Windows 95 operating system environment includes display drivers that speed some kinds of graphics. A universal display driver in the program works with device-dependent code written by the card vendor that communicates with board circuitry. One result, claims Microsoft, is that an unaccelerated SVGA board, in 256-colour mode, may generate displays up to 90 per cent faster under Windows 95 than under Windows 3.x, which had little built-in code for working with display drivers. (Source: *Machine Design*, 4 April 1996).

Some significant systems-on-a-chip

Texas Instruments (TI) has unveiled its 0.18 μm manufacturing process, with excitement due to the potential applications TI's TImeline process promises to deliver: videophones and devices executing human recognition algorithms. However, TI is not the sole provider of such process technology: IBM Microelectronics has announced its own 0.18 μm SA12 Asic product. What TI does offer is its expertise in custom DSP technology, its ARM Risc core license, and its design libraries and support tools.

The 0.18 μm process promises to accommodate up to 125 m transistors on a single 19 mm-by-19 mm die (assuming an equal memory/logic mix), an operational voltage of 1.8V and a clocking frequency of up to 500 MHz.

TI is aiming the process at three application areas: high end computers such as work-stations, mobile communications and broadband communications. (Extracted from: *Electronics Weekly*, 5 June 1996).

FEA typifies electromagnetic performance

Finite-element analysis has been used to characterize basic electromagnetic component properties such as reluctance, force, torque, and loss. To get useful results, designers must couple these parameters both to the currents and voltages produced by drive circuits, and to mechanical dynamics in the case of moving parts such as solenoid cores and motor rotors.

Special software simulators provide connections between FEA and circuit modelling. They also accommodate equations of motion to handle mechanical interactions.

The general design of an electromagnetic component begins with roughing out a first-pass model for FEA. This model usually takes the form of a 2D cross section because electromagnetic parts tend to be axisymmetrical. Designers make several assumptions at this point which may have to change later on. These include the range of drive currents, the materials to be used and their magnetic properties. Boundary conditions would also be specified, dictating how electric or magnetic fields behave at object interfaces and at the edges of the problem.

An FEA run made on this initial design yields a map of equal magnetic potential contours for the given electrical drive and geometries. Software calculates the magnitude and direction of the magnetic field from these potentials. It can calculate field-based factors as well, such as the force on the core of a solenoid caused by coil current. (Source: *Machine Design*, 4 April 1996).

Cable modems: fastest info on-ramp yet

Though it may be years before they are widely deployed, the need for cable modems is apparent to Internet users who sit through graphics materializing at what seems like a snail's pace. Consider these statistics, compiled by Forrester Research Inc. in Boston: It can take over a minute to get a 2-Mbit image through a 28.8-k modem. A 56.6-kbps ISDN line drops that figure to about 36 seconds. But the same graphic comes through a 4-Mbps cable modem in a half second. The figures are even more compelling for down-loaded video sequences. A short, 72-Mbit clip would occupy a 18.8-k modem for about 45 minutes, an ISDN line for about 22 minutes, and a cable modem for 18 seconds.

The idea behind cable modems is to basically offer Internet access over cable TV lines. The wide RF bandwidth of coaxial lines, compared to the much more limited capacity of twisted-pair phone lines, is what makes this delivery medium attractive. There are exploratory ventures under way to develop such services, but indications are it may be some time before cable companies can provide wide access.

Speculation is that, when Internet access via cable becomes available, it will be structured similarly to cable TV service. Subscribers will pay a monthly fee which will cover access and the rental of a cable modem. It is thought

that, eventually, the cable modem will migrate to the PC motherboard. One equipment supplier has estimated that 40 per cent or more of US homes will have the opportunity to obtain such services by 1998. Before this can happen, cable TV suppliers must upgrade their central facilities with equipment such as two-way RF amplifiers and fibre-optic cable. (Source: *Machine Design*, 4 April 1996).

ISDN lines head web crawlers' wish lists

Most engineers who spend appreciable amounts of time on the Internet soon find themselves wishing for ISDN, or for anything else that might speed up the sometimes lengthy waits involved in the appearance of on-line graphics.

Dramatically growing Internet usage is one reason ISDN terminal equipment is coming down in price and becoming more widely available. ISDN plug-in cards for PCs today run about $400 to $800, and several manufacturers plan to release PC Card-format devices for laptop computers.

The cost of ISDN service varies depending on the phone company providing the lines. Some of the least-expensive rates can be found on the west and east coasts, where residential service ranges from $25 to $30 monthly. Business lines in those areas range from about $27 to $55 monthly. ISDN can be much more expensive in other parts of the country, however. Rates in the north-west, for example, can be on the order of $60 to $185 monthly.

The equipment needed by ISDN subscribers includes an NT1 device, which converts the incoming ISDN lines into a transmit and a receive pair, and adds power to the line. PCs and other computers connect to in-house ISDN lines using devices known as terminal adapters. These take the form of plug-in ISA cards. Alternatively, some of these adapter cards may include their own NT1. (Source: *Machine Design*, 4 April 1996).

Virtual reality comes to design reviews

The term "virtual reality" today can apply to what are called fly-through and immersive experiences. In fly-through mode, the viewer uses a joystick or similar controller to change the display on a video monitor to simulate the experience of walking or flying through the model depicted on the screen. More sophisticated software may support stereographic viewing glasses that make the scene seem to pop out in 3-D.

Typical hardware needed for fly-through VR includes either a high-end PC with ample main memory or a Unix workstation. Some software can also make use of graphics accelerator cards to speed up the scene frame rate and handle more sophisticated imaging.

The fully immersive experience is typically associated with traditional VR. It employs VR headgear or projection screen video monitors to give the operator an experience designed to approximate the modeled "world". The operator interacts with the virtual world through a 3-D mouse or console.

Computer hardware required for immersive VR tends toward graphics supercomputers or high-end Unix workstations enhanced with graphics-accelerating hardware.

Software for developing VR scenes ranges from basic programs for simple walk-throughs to high-end packages aimed at producing photorealistic images that can be controlled via operator head movements, and VR objects that can be moved with tracking gloves. Simpler packages let developers either construct rudimentary 3-D scenes or

import models from sources such as CAD programs and simply walk through the model. Commands typically are of the point-and-click variety.

High-end programs put more emphasis on realistic scenes and complicated interactions with the operator. To generate objects that behave as though influenced by laws of physics, developers may need to employ a programming language, typically Visual C++, and also make use of libraries containing predefined entities (such as tables and chairs for architectural models) that can be added to VR worlds for embellishing scenes. (Source: *Machine Design*, 4 April 1996).

F. SOFTWARE

Ovid platform

Eleven new databases will be launched on the Ovid platform in coming months, many of them outside the traditional biomedical area in which Ovid has long specialized. Included will be life sciences information from Cambridge Scientific Abstracts, humanities, technology and business information from IAC, political and economic data from PAIS International, and social sciences information from Sociological Abstracts. Further non-core databases are expected to be added.

The firm sees Ovid databases increasingly being integrated with other parts of the library. It is now possible to use the Ovid interface to interrogate both local OPACs and, where they are Z39.50-compatible, third-party databases from competing providers. A number of new full-text collections are also planned for launch this year: Ovid Biomedical Collection II will be released this spring, and Collection III in the summer. A mental health collection will be available in the autumn. Ovid is also licensing journals in disciplines other than biomedicine, and has plans to offer collections of engineering and nursing journals. The company is also keen to develop its international business. (Source: *Information World Review*, 12 March 1996)

Microsoft goes on-line

Microsoft Network (MSN) comes bundled with *Windows 95*, and offers little that is not available elsewhere from other consumer and professional services. It does, however, feature a powerful interface.

It includes the usual four categories of service: information database (especially for business and finance, including some "name" products), user-maintained discussion groups, transactional services and Internet connectivity. The basic organizational unit is the *Forum*. There are scores of these—grouped into a dozen broad subject categories—each containing some combination of information, communications and transactional services. Some are sponsored by third-party information suppliers, while many (especially in the hobby areas) are user-orientated bulletin boards. This arrangement imposes some degree of consistency, but sometimes makes it difficult to determine in advance exactly what the content is like. Access is either via icons or forum name, and there is a simple keyword search capability. Many of the sections are at present only thinly populated. Eventually, however, MSN should provide an impressive range of business information. Several leading business database producers are already represented on the system, or will be shortly. They include Disclosure, Information Access Company, Dun & Bradstreet, Thomson Financial Services, Hoover's Business Resources, TRW Business Information Services and MAID.

There are two pricing schemes: standard and frequent user. The standard fee is $4.95 a month, which includes three free hours, and $2.50 an hour thereafter. The frequent user tariff is $19.95 a month, with 20 free hours and $2.00 an hour thereafter. (Source: *Online*, 20(2) March/April 1996)

ScienceBase makes for simpler searching

A World Wide Web service offering access to almost 100 scientific related databases has been launched by Knight-Ridder. ScienceBase accesses many of the same sources as Knight-Ridder's Dialog, for example, the Royal Society of Chemistry, Elsevier Science Publishers and the US Patent and Trademark Office, but the new service is designed for quick access to focused scientific information, uses a simpler search language and is costed differently.

In accessing ScienceBase on the World Wide Web, information can be obtained on a range of areas, including: pertinent publications, meetings and conferences; chemical and biomedical research; research in the physical sciences; tracking competitive activities; governing rules and regulations; inventors and scientists and their works; suppliers and buyers of interest; and world-wide industry news.

Searching the database takes a very different form from the command-driven interface associated with Dialog; it allows natural language requests with pull-down menu options. However, search criteria vary significantly between subject areas. Results are presented in a list of article titles including the price in each case. This could vary from 10 cents for a small article with basic content, to $50 for a large article with in-depth coverage. ScienceBase can be used on Windows, Macintosh and UNIX operating systems and requires Netscape Navigator 1.1 or later, and an Internet connection. (Source: *Information World Review*, 12 March 1996)

Set up your own Web site

The ease of establishing a Web site means that many organizations are rushing to do so—but the results are often mediocre. There are many sites which are poorly designed and difficult to navigate, or which feature content of little utility or interest. Examples of poor practice can be found on *http://mirsky.turnpike.net/wow/Worst.html*. The first requirement is to understand exactly why a presence on the Net is being established, i.e. who the target audience is and what they wish to know. When implementing a system, one approach is to outsource the design and maintenance. If the design is to be undertaken in-house, a careful balance between text and graphics should be struck. Once established, the existence of the pages should be publicized, and the material updated at frequent intervals. (Source: *Computing*, 7 March 1996)

Information streamlining

Oxford Molecular Group (Oxford, UK) says it has a client/server software application that may transform the database of companies engaged in chemical, pharmaceutical and biotechnology research. The application, developed for companies with information management needs in drug discovery and chemical structure analysis, is the first to use the company's patented search feature with Oracle software. The new offering allows companies to manage chemical information with higher performance and greater productivity, and at lower cost, Oxford says. (Source: *Chemical Week*, 3 April 1996)

Task-aware software boasts 32-bit speed

The first CAD package to be recognized as Win 95 and MS Office 95-compatible makes use of the 32-bit capability of the operating system to provide speedy operations. Version 2.0 of Visual CADD from Numera Software employs what is called a task-aware environment that keeps track of operations already performed to better predict the operator's next step and provide features such as nested commands, matching tools, speedbar dialogues, and a context-sensitive right mouse button. Boolean operations permit adding, subtracting, or intersections of multiple entities.

A feature referred to as dynamic reference frames allows reference to multiple drawings or multiple views of the same drawing on a single printout. This facility allows the user to change zoom scale and integrate AutoCAD xrefs and paper space. The program is fully read/write compatible with •DWG, •DXF, and Generic CADD •GCD files. (Source: *Machine Design*, 4 April 1996)

Windows package does wire-frame/solid/surface switch

The recently released Advanced Modeler is billed as the only package available that permits designers to interchangeably design in wire frame, solids or surfaces within a single software module. It is priced at $495 as an add-on to Cadkey for Windows. The product bundle goes for a total of $1,290.

Editing features in the new package permit transparent surface-to-surface, solid-to-solid, and surface-to-solid trimming operations. Features including solid filleting, draft surfacing, and solid surface support are aimed particularly at mouldmakers. Visualization capabilities enable users to shade wire-frame surfaces and solids simultaneously to produce shaded images and STL files. Additional features include a solid-of-revolution function, the ability to dimension solid models with surfaces, and improved IGES translation. (Source: *Machine Design*, 4 April 1996)

Upcoming solid standard

The ACIS modelling kernel is a set of software algorithms used for creating solid-modelling packages. Software developers license ACIS routines from the developer, Spatial Technology Corp., to simplify the task of writing new solid modellers. A key benefit of this approach is that models created using software based on ACIS should work unaltered with other brands of ACIS-based modellers. This eliminates the need to use IGES transfers for transporting models back and forth.

For example, engineers might start a design on one modeller, transfer it for further modifications into a different brand of modeller, take it to an analysis package, and then into independent CAM software to generate tool-paths, all in native mode.

To date, over a dozen ACIS-based packages have become commercially available. Examples include the Auto-CAD Designer from Autodesk and MicroStation Modeler from Bentley Systems. Both run on PCs under Windows. In the analysis area, MSC/Nastran for Windows accepts ACIS solids for studies of stress and thermal performance. SmartCam, which generates toolpaths for milling and turning machines, accepts ACIS solids as well. (Source: *Machine Design*, 4 April 1996)

The year 2000 and after

As the second millennium draws to a close, huge numbers of computer programs will begin belching and hiccupping because they cannot properly process dates beyond 31 December 1999. The years from 2000 on start over at 00, and unless something is done, these dates will appear to precede the 1900s—or so it will seem to the many programmes that use only a year's last two digits for dates.

Applications use dates in myriad operations, from complex financial transactions to the expiration dates of drivers' licences and credit cards. Many of them also base certain calculations on dates, subtracting the two-digit years from one another. For example, the calculation of interest on a five-year certificate of deposit will be plain sailing if the CD matures in 1999. But if it matures in 2001, the same computations could result in an error message, or worse.

The same pitfall awaits invoices, payrolls, credit card transactions, bill payments, inventory systems, auto loans, databases that sort by year, and many other computer operations upon which daily life depends, according to "Year 2000: a perspective", a white paper by IBM Corp., Armonk, NY.

Using two digits for the date may seem a bit short-sighted now. Back in the late 1960s and early 1970s, though, when computers began to be used in the business world, storage space was at a premium and the year 2000 was a long way off, explained Peter de Jager, of Toronto, a noted speaker and consultant on the year 2000 issue. "Now we have to go in and look at every line of code running to make sure that it will operate correctly in the year 2000", he said.

The problem is simple to understand, and in principle not hard to correct. All that is necessary is to go into the application and change the two-digit years to four digits. What makes the situation grave is the monumental number of programs that must be searched and corrected.

The cost for correcting this code as well as programs is immense.

According to industry statistics, one programmer supports 100,000 lines of code, and changes 10—15 per cent of it every year. Changing two-digit years to four-digit years is not a full-time job for that programmer for the next three years, and many companies have probably made changes quietly over the years.

IBM Corp., for one, is not quiet about changes it has made. It is sharing its insights, as well as the paper mentioned earlier and a 180-page report, "The Year 2000 and 2-Digit Dates: A guide for Planning and Implementation", on the IBM System/390 home page: http://www.s390.ibm.com.

The Year 2000 Internet Information Center, http://www.year2000.com, is a site developed by Peter de Jager and Tanager Corp., Houston. The site contains answers to frequently asked questions (FAQs), a list of consultants focusing on the year 2000 problem, and numerous articles.

The Technical Council on Software Engineering of the IEEE Computer Society is sponsoring a 27-28 June summit meeting about the problem in St. Louis, MO. Contact Elliot Chikofsky, 617-272-8464 (e.chikofsky@computer.org), for details or visit http://www.tcse.org/year2000. (Extracted from *IEEE Spectrum*, May 1996)

Java ports

A complete Java port requires two things: a Java integrated development environment (IDE) and run time system for the target platform and Java-enabled Web browsers for the target platform. However, any computer for which a Java-enabled Web browser is available can

interact with a Java applet. The reference IDE for Java, Sun's Java Developer's Kit (JDK) is a command line environment that includes a compiler, a debugger, and an applet viewer. The JDK is currently available for Solaris, Windows 95 and NT, and the Macintosh.

Symantec has updated its Java tools suite beyond the Java version of its C++ 7.2 integrated development and debugging environment for Windows, which is called Symantec Caf. Symantec's new development environment, called Symantec Caf for Windows, improves upon the original Symantec Caf by adding an integrated, graphical debugger for standalone Java applications or applets that are embedded inside an HTML page.

Rogue Wave Software's Jfactory brings RAD capabilities, including a visual designer and a Java code generator to Java. Its Object Manager provides a property sheet interface to let you access your application's properties. Also, AimTec, a publisher of multimedia authoring software, says it will release a visual authoring tool for creating Java applets without the need for programming or scripting. (Source: *Byte*, May 1996)

Another Web site

The journal *Chemistry and Industry* is now on the Internet. In addition to articles from the magazine, three new services have been added that make use of electronic communication in ways that paper cannot offer.

Daily news uses existing news-gathering resources to publish news in chemistry, the chemical industry, biotechnology, pharmaceuticals, agriculture and food science, and the environment—every working day. Past news stories can be searched through by keyword.

Job service makes use of e-mail. The jobs database is searchable, and employers can post new job announcements directly to it for free.

The searchable meetings database contains details of over 500 forthcoming conferences world-wide, in chemistry and related subjects such as biotechnology, food science and environmental matters. Meeting organizers can add their conference details, free of charge, to the database by visiting the site.

Every fortnight a large selection of news and features from the current issue of the journal are published. These will add to an archive of stories from past issues, already standing at around 400 articles stretching back to the start of 1995. The archive is searchable.

Two online magazine sections have also been introduced: Forum and Only Connect. Forum is for our readers to air their views. Only Connect looks at the changing face of chemistry in the Information Age.

We have tried to set up a site that changes frequently, offers significant content and offers some new services that are not offered elsewhere. *Chemistry and Industry's* Web site can be reached on **http://ci.mon.org**. (Source: *Chemistry and Industry*, 3 June 1996)

Protecting Internet E-mail from prying eyes

To be considered secure, E-mail systems must prevent unauthorized viewing of messages and ensure that the recipient can be confident that the message is truly from the purported source. Unlike corporate E-mail packages, however, most equivalent systems on the Internet lack built-in confidentiality and authentication. Currently, there are five different protocols—with varying degrees of security, complexity and ease of implementation—available for E-mail encryption on the Internet.

Secure multipurpose Internet mail extensions (S/MIME) represents perhaps the most significant of these. Developed by a group of companies led by RSA Data Security Inc., it is likely to become an IETF (Internet Engineering Task Force) standard. It supports multimedia data, and offers guaranteed interoperability among implementations, as well as simple key management. On the other hand, it can be cryptographically weak. As yet, there are no commercial implementations.

Pretty Good Privacy (PGP) was released as freeware in 1991, and has since become a de facto standard. It is very strong in cryptographic terms, and offers guaranteed interoperability, but does not support multimedia data and can be difficult to use and administer. PGP/MIME combines the advantages of PGP and MIME, but lacks commercial implementations.

MIME Object Security Services (MOSS) is technically sophisticated and supports multimedia, but does not guarantee interoperability. As yet, there are no fully-fledged commercial implementations.

The Message Security Protocol (MSP) offers commercial implementations and multimedia support, but not guaranteed interoperability. (Source: *Data Communications*, May 1996)

A biotechnology Web site: towards "electronic democracy?"

The Internet, and more specifically the World Wide Web, offers the prospect of an inexpensive and convenient system providing many-to-many communication. Such a system—by enabling its users to express their opinions on significant issues—would support the emergence of a more democratic society.

It is too soon to say, however, whether the Web will in fact bring this about. The medium is still unstructured, difficult to navigate and inaccessible to the majority of citizens.

Rather than make predictions about the future, this article takes a normative approach, describing an online prototype designed to stimulate discussion, encourage learning and facilitate the expression of opinion. This Web site (*http://weber.u.washington.edu/radin*) was sponsored by the Washington Biotechnology Action Council, a non-profit organization in Seattle.

Biotechnology is a broad discipline which embraces plant engineering, embryo experimentation, food, medicine, philosophical or religious beliefs and many other topics. It is also a potentially controversial area, often provoking discussion. The level of subject knowledge among the general public is not high.

A Web site provides the opportunity of displaying concise and cogent files of information, incorporating numerous built-in, point-and-click options enabling the user to call up related material as desired. By this means, all aspects of a topic—technical, social, economic, political or ethical—can readily be explored. Comment can be elicited by providing E-mail templates for completion by the user, enabling them to address the Web sponsor or a policy maker regarding an issue of concern. (Source: *The Information Society*, 12(1) January-March 1996)

TES: a text extraction system

The advent of inexpensive mass storage such as CD-ROM has made possible the publication of intellectual properties in electronic form. A text extraction tool (TES) has been developed, which will automatically produce a

summary by extracting a set of verbatim sentences from an original document to form an indicative abstract. The objectives of TES are to produce a text surrogate which satisfies the criteria of comprehensiveness, brevity, and completeness. Sentence selection is based on sentence importance, which can be measured through sentence scoring or simple linguistic analysis of sentence structure. The extraction methods used are the indicator-phrase method and statistical methods based on the assumption that the frequency count of significant words can serve to isolate the special vocabulary used. Sentence rejection can be driven by heuristic rules on linguistic elements of the input document.

The approach is a composite method of extraction that can be applied to documents that are not subject specific. The techniques used are computation of concepts or keywords and their weights, a similar process to automatic indexing. A system overview is illustrated and two classes of documents are evaluated—computer science papers and news essays. This evaluation was a parallel comparison between human abstracting and the TES system. With the computer science papers TES scored an adequate performance against the manual results, which were between adequate and good. With the news essays, the TES score was adequate to good, against the manual results which averaged slightly above good. It is concluded that a computerized system is able to construct acceptable abstracts in a fraction of the time it takes to abstract manually. (Source: *Microcomputers for Information Management*, 13(1) 1996)

HTML for the lazy

The hypertext mark-up language (HTML) is the basis of information provision on the Internet's fast-growing World Wide Web. This medium has increasingly become both an imperative of organizational self-presentation and a part of the mass media and popular culture. The production and publishing of basic HTML is nevertheless a relatively democratizing medium, in that it is fairly simple to work with, does not require programming expertise and can be originated on minimal specification computers. It is an appropriate medium for information professionals, since the importance of the content, organization and presentation of the information outweighs the technical computing aspects. Although other options are available, or emerging, for Internet publishing and graphical browsing, HTML is likely to remain the core method for information providers. A "quick reference" of the main HTML tags and their syntaxes is outlined and discussed. Alternatives to HTML are Adobe's Acrobat software and Sun's new Java application language. (Source: *Journal of Information Science*, 22(3) 1996)

Intelligent information systems

Intelligent information systems (IIS) combine knowledge representation and storage (the "data warehouse") with reasoning support tools. As a result, they can be used to analyse poorly formalized problems. It is expected that a new generation of intelligent data-processing tools will not only be able to calculate answers but provide proofs or explanations of those results.

Within rule-based expert systems, the chain of used inference rules validates the answer. Unfortunately, such systems tend to be restricted to carefully formalized problems susceptible to unequivocal processing. Another class of argumentation tools is based on the use of automatic deduction, where syntactic correctness guarantees

semantic validity. Once again, however, problems arise when attempting to represent all possible data in a form suitable for processing. Other approaches, recently developed, include the creation of models supporting deduction, common-sense reasoning and reasoning by analogy.

The architecture of an IIS can be illustrated by reference to an ecology monitoring system developed by the All-Russian Institute of Scientific and Technical Information (VINITI RAS). The main application of this is in the non-experimental analysis of the properties of physiologically active chemicals. There are three main groups of data analysis and decision support tools: logical and mathematical methods for causal analyses; pattern recognition and regression analysis; and programmes for quantum-chemical analysis.

An IIS such as this can find many applications in research. It can assist with the formalization of huge volumes of data, improve information search efficiency and suggest new areas of inquiry. (Source: *International Forum on Information and Documentation*, 21(2), April 1996)

Document management on the Internet

The World Wide Web is document based, which means there is an opportunity for document management systems suppliers to make their functionality available using Web technology. Among the key features is the ability to provide access to document repositories. Products such as BASIS WEBserver from Information Dimensions, Mezzanine from Saros Corporation and PLWeb from Personal Library Software provide access to document collections held within a document repository via the Web. Functionality is now being added to allow updating of document collections in some products, allowing check in/check out and versioning of documents.

It is relatively straightforward to enable a Web-based application, allowing downloading of images across a network and then using appropriate image viewing software. A relational or full text database can be used to index images and therefore an interface between the indexing and the Web is required. As the number of available documents increases, the need for programs to filter out irrelevant documents and find relevant documents automatically becomes important. Most retrieval products can be configured to act as intelligent agents, although Verity has launched Topic WebAgents already configured to carry out such searching.

In addition to the various firewall products preventing intruders, software products are being developed that increase security when using public networks. Increased security and accessibility will provide easier access to corporate networks. A far more profound effect will be for an organization's customers and suppliers to be able to interact with internal document management systems. (Source: *Information Management and Technology*, 29(2) March 1996)

Panning for data gold

Many organizations have huge databases of data: the problem is to extract useful information from them. That information can be worth millions to large organizations, but even smaller ones can benefit considerably from even modest improvements in prediction or modelling. Data mining—using techniques derived from artificial intelligence and statistical inference theory—can assist with this.

Given huge volumes of data, it might appear necessary to employ large amounts of computing power to extract

trends from it, and indeed, some data miners apply parallel processing computers to large databases. Others, however, emulate gold prospectors, and look for "promising ground" before they start operations. Much effort may be expended on selecting a sample of data for intensive analysis.

Trends, groupings and connections which depend on many variables, linked in complex ways, cannot be extracted using simple textbook methods such as linear regression. Instead, data miners employ techniques such as rule tree induction. Patterns can also be deduced using neural networks. The latter technique, although often providing very useful insights, suffers from the disadvantage of being a "black box", which makes it difficult to verify some of the conclusions drawn and impossible to explain to clients. For this reason, some practitioners have developed "genetic algorithms", essentially a series of rules which are proved by experiment to be effective in making predictions.

Use of rules-based systems, and of statistical inference, can help protect against discovering "fools' gold", or patterns extracted from data samples which are not in fact applicable to the database as a whole. (Source: *New Scientist*, 25 May 1996)

Encryption technology and international electronic trade

A report published earlier this year by a group of cryptographers and computer scientists underlined the vulnerability of information systems to intrusion. According to the paper, an investment of $400 would enable a hacker of moderate expertise to break a 40-bit code in five hours. Even the 56-bit DES could be compromised in about 19 days, given an investment of $300,000 by a criminal organization.

Effective encryption is crucial to the security of the Global Information Infrastructure, a US Government initiative intended to promote world trade on the information superhighway. Companies need to be confident that valuable data is secure if they are to entrust it to the international networks. US and UK restrictions on encryption, however, coupled with the lack of a common, international regulatory framework, are hampering the development of electronic trading.

Although there are no restrictions in the US or UK on the *import* or domestic use of encryption, the export of encryption software is regulated. According to one group of analysts, US companies stand to lose between $30,000 million and $60,000 million in revenues by the end of the decade as a result.

In addition, electronic messages crossing international borders are subject to varying regulatory environments. Encryption of data sent over the Internet is permitted in the UK, for example, but prohibited in France. Other issues which must be addressed include the question of who should hold the keys to encryption systems, what their status should be, and in what circumstances should they be required to reveal these keys to government agencies. (Source: *Computing*, 11 April 1996)

How publishers use encryption to create opportunities

Encryption is a method of coding information so that it can be read by selected people only. The very factors that make a CD-ROM attractive for electronic publishing also make it vulnerable to piracy, such as the fact that the content of a CD is completely accessible, that each disk holds very large amounts of information and that electronic

products are increasingly networked with fees dependent on the number of users. Using C-Dilla's CD-Secure2, CD-ROM publishers can protect themselves against piracy.

Using CD-Secure, the whole database is encrypted and the decryption reader bound to the publisher's specific requirements. Each user buys access only to the subject areas of the disk they are interested in for the number of network users they need. Thus smaller local customers can buy part of the disk for a reasonable fee, with the publisher only having to make one disk. The system is simple to operate. The publisher prepares the information in the usual way and just before pre-mastering, the data is encrypted.

When customers receive the CD, they run the CD-Secure2 install program which creates a licence file on their hard disk. It then generates a unique one-time request code and asks them to ring the publisher's help desk. The help desk staff put the code into the CD-Secure2 help desk program and ask the customer how many network licences and which part of the disk they wish to access. The help desk software then generates a unique one-time response code which allows customers access to the areas which they have requested. (Source: *Vine*, 101, December 1995)

Ocean marine software

Technological advances have allowed for the efficient use of computers for more and more applications within the ocean environment.

To design, analyse or optimize the performance of electro-opto-mechanical cables, Tension Member Technology (Huntington Beach, CA) produces "Cable Solver". The user inputs the cable component geometry and material properties and then computes the tension-induced cable elongation, torque and rotation as well as the stresses imparted on the individual cable components—including the strength member, electrical conductors, and optical fibres. Temperature and pressure can also be input as independent parameters so the effect of the ocean environment on the cable components can be studied.

One of the leaders in the survey-software industry is Coastal Oceanographics (Middlefield, CT), which has been supplying software to the hydrographic community for more than 10 years. The company produces the Hysweep™ multibeam data collection and processing software package, which is fully compatible with nearly every multibeam (shallow or deep water) system currently in the industry. The system allows users to create TIN models, cross-sections through multibeam data, smooth sheets of multibeam soundings, 2-D or 3-D polyline contours, solid-fill contour plots, patch testing, and volume calculations of multibeam data versus a channel or between two multibeam surveys. In addition, data can be exported to DGN, DXF, or DX-90 file formats.

Mariners can send and receive electronic mail using another product from D.F. Crane. The company's e-mail software allows the use of a standard marine single side-band radio and an IBM-compatible computer to enter and manage e-mail messages.

Vessels can send and receive e-mail using any HF SSB radio and computer. A home base (on land) can reach the e-mail system by dialling in on a normal telephone line with a standard computer modem. In this way, messages and data files addressed to a specific vessel can be sent through the home base to the mailbox and retrieved from the mailbox by the vessel—or vice versa.

The system includes equipment, software and a year's membership in the Pin Oak Safe Seas Association. Membership in the association is required for use of this

service, which utilizes a private radio station licensed by the FCC to operate in 22 assigned frequencies in the nine marine radio bands.

Unlike amateur radio communications, the e-mail system can be used with an assurance of confidentiality. And the e-mail system is more economical than commercial satellite communications.

Shallow seismic data can be calibrated and processed using several software applications including those produced by Caulfield Engineering (Oyama, British Columbia, Canada). These IBM-compatible packages compute bottom loss and estimate sub-bottom material types, layer-absorption characteristics and geotechnical parameters.

Micronautics Inc. (Rockport, ME) is a company strictly in the business of tides. The company produces World Tide™ software, which provides easy access to the best available tide-prediction information at 6,400 ports world-wide, according to a spokesman from the company. The software's predictions conform with tide tables produced by the National Ocean Service—except in cases where superior data has been acquired, according to the spokesman.

World Tide does all the mathematics to predict tide heights for every minute of the day, taking into account time zones and daylight-savings corrections around the world. Users can access this data in many forms: graphs, tables, calendars, spreadsheets and graphic files. The software is available for any of six world regions or as a complete package. It is sold with one year of data and both the program and the data are updated annually.

The program is for IBM-compatible computers and for Macintosh computers.

Vessel tracking software is available from Euronav Ltd. (Portsmouth, Hampshire, UK). The company's "SeaPro plus" vessel tracking system uses a database filing system for storing information on vessel contacts made. The system keeps two basic databases: a log database and a vessel database. The former records all the position, heading and speed information. The vessel database contains less frequently changing information about each vessel encountered including an image, additional text and messages received.

The databases can be updated manually or automatically—when a new vessel is encountered or as data on a vessel change.

To read electronic charts, D.F. Crane Associates Inc. (San Diego) produces "Master Mariner". The software reads electronic charts distributed by the National Oceanic & Atmospheric Administration, Resolution Mapping (Maptech), and D.F. Crane itself. It can be updated using the US Coast Guard's *Local Notice to Mariners*.

This product replaces "Micro Mariner", which the company had been marketing for seven years. Master Mariner includes several new features such as collision avoidance, which works with any radar to display approaching vessels' closest point of approach (CPA), time to CPA, and present course and speed. (Extracted from *Sea Technology*, May 1996)

Superdistribution draws near (copyrighted content over the Internet)

Boston's Internet World saw two announcements aimed at allowing "superdistribution" of copyrighted content over the Internet—that is distribution that allows publishers to receive a financial return each time their data is passed on, not just when it is initially uploaded. IBM is putting its weight behind its Cryptolope technology, which creates sealed "containers" for documents, and has received the endorsement of a number of publishers including Associated Press, Disclosure and Information Access Company. The catch is that to use the technology you must sign up with IBM's infoMarket Search service.

IBM claims that through infoMarket, publishers will have the ability to protect against the unauthorized mass distribution of their works over the Internet. When content comes on-stream, users who want to purchase, for example, a copy of the latest market research report from a publisher will receive the contents in a sealed "container". This secure package can be accompanied by marketing details from the publisher, including a brief abstract of the information contained in the package, the size of the file, its owner, conditions for use, pricing, and any promotions associated with the content, such as coupons.

An alternative to the IBM system is offered by EPR's (Electronic Commerce Technologies) NetTrust—a set of applications and tools, due for launch early next year, based on what EPR terms its DigiBox technology. Like IBM's Cryptolopes, this system allows content holders to seal their data into containers. These containers, say EPR, serve two purposes. One is to secure the contents from people who want to use it unfairly. The other is to let people find out how much the contents cost, possibly sample it, view it, print or purchase it and then become part of the distribution of the content—if allowed—by passing it on to someone they feel will benefit from it. (Source: *Monitor*, 178, December 1995)

G. COUNTRY NEWS

Brazil

Powerful on-campus computing for industry

One of the best-equipped computing laboratories in Latin America acts as a computational resource for Brazilian industry. It is the Laboratory for High-Performance Computing at the Federal University of Rio de Janeiro's Graduate School of Engineering (Coordenação dos Programas de Pos Graduação en Engenharia, or Coppe). The laboratory focuses on solving computationally intensive problems in two key areas of Brazil's economy: electric power and oil platform construction. Its annual income of about US\$ 500,000 flows in from several Government agencies and from private companies, which also conduct joint projects with the laboratory.

The laboratory's computer power is unusual for any university anywhere, not just Latin America. It owns three different state-of-the-art high-performance parallel computers: an eight-node Intel iPSC/860 hypercube computer, an eight-processor Cray J90, and a four-processor IBM SP2 system as well as SunSparc20 workstations for graphics and visualization.

Researchers in the university, in the computer science department, are developing a multiprocessor machine of their own design. Their NCP1 is similar to the Intel iPSC-860 hypercube machine. Its architecture is based on the Transputer microprocessor and supports both private and shared memory models. An eight-node prototype built in 1990 used the popular and widely available Transputer T800 multiprocessing chip, which has both communications and computing capabilities.

High-performance computing has long been viewed as a strategic area by the federal Government. In the past 10 years, it has invested heavily in the area. Today, with the goal of installing the latest computers and producing more home-grown Ph.D. solvers of industry's problems, Finep, the Brazilian Government agency, is funding at least five high-performance computing centres in Brazil, mainly in university engineering departments.

As for areas of application, power systems were an obvious choice. Brazil has a large, complex and growing interconnected power system that faces great technological challenges. One is a planned 3,000 km high-voltage transmission system from the Amazon to the south-eastern region. Also, the Government's privatization and deregulation policies in this area will certainly require improved computational tools to support planning and operations.

Coppe's first computer system for Petrobrás was completed in 1980 for the analysis and design of offshore structures. Still the only one of its kind for conditions in the tropics, it has been used to design 41 platforms and analyse 23 more around Brazil and Angola, in West Africa. Among other tasks, the system can generate structural design data, acquire and evaluate oceanographic and environmental data, and study the interaction of soil and structure. It also performs such tasks as linear and non-linear static analysis of structures, dynamic analysis in the time and frequency domains and structural fatigue analysis.

When Petrobrás discovered new oil reserves in very deep waters (800 to 1,200 metres), Coppe developed state-of-the-art expertise in yet other areas. It conducts reliability analysis of new structural concepts for deep water; develops and routinely uses knowledge-based systems for flexible pipe design; detects and diagnoses faults in petroleum production plants; and optimizes the routes of underwater support vessels. (Extracted from *IEE Spectrum*, June 1996)

Denmark

Business Networking—A transferable model for a European SME support structure

Business Networking

Business Networking finds its origins in the Danish Government's "Strategy '92" programme, which consisted of a whole series of measures aimed at enhancing the competitive edge of Danish industry in preparation for the European Single Market.

The rationale behind the Business Networking initiative was based on the recognition that in the face of global competition small and medium-sized companies, i.e. the backbone of the Danish economy, on their own are ill-equipped to deal with the challenge; however, by pooling resources—and sharing costs—SMEs have the potential to compete more effectively in international markets.

One of the major problems in Denmark at that time was that inter-firm cooperation of this nature was not a part of the country's industrial culture. So the initial network programme, and the subsequent four targeted programmes covering manufacturing, exports, environmental technology and tourism, aimed to stimulate Danish companies in large numbers, from the top down, to overcome their resistance to cooperation. In terms of implementation, the collective approach of the programme had an added advantage for its initiators: instead of working with the upgrading of individual companies, which would have been a very lengthy and costly exercise, networks of 5-10 companies offered an effective and rational alternative.

Over the five years of the network programmes' existence an impressive 5,000 companies became involved in forming networks out of a target group of 10-12,000 companies. This remarkably high rate of uptake has resulted in a fundamental change in firms' behaviour making networking a natural option to consider in the face of new business challenges.

In terms of the final results measuring up to the original aims of the programme, all indications point to the success of the networking concept as a vehicle for improved profitability and competitiveness.

What is business networking?

Business networking is the cooperation and the mechanisms of cooperation which enable small companies to compete successfully with the best of the large companies.

Three characteristics should be noted in this definition:
1. Networking is concerned with independent small and medium-sized companies. Networks are not mergers; on the contrary, they capitalize on the strength of the independent, competitive and flexible company, with the objective of compensating for some of its weaknesses.

2. The definition of a network is not formal—it says nothing about legal frameworks, number of companies, size of companies, what they are cooperating on, whether they are in a specific market, or different markets, or any other matter. This feature is intentional in its concept and it is also intended to be reflected in the administration of programmes, aiming at stimulating networking with a minimum of bureaucratic restrictions.

3. The real objective of the concept is stated in the phrase "to compete successfully". This means that three companies sharing the expenses of a telephone switchboard, or an administrative unit, do not constitute a network in the sense of the concept. Only when their cooperation specifically aims at creating new business opportunities, new markets or a new competitive edge, is it considered a network.

How does the network programme operate in practice?

Essential for the formation and success of a network is the function of the network broker, who will identify network opportunities, introduce partners, point out new cooperation areas, network participants and new market opportunities, and who will also mediate the cooperation through its critical phases.

The network centre is the administrative unit/home base for the network broker. The network centre could be a regional development/innovation centre, Chamber of Commerce or any other body responsible for implementing regional or national industrial policy.

Around these two structural features are dimensions of cooperation which are typical for all successful networks.

As mentioned above, one of the crucial elements of a network programme is the selection and training of the network brokers who act as initiators, mediators and field executives in the identification and formation of networks between companies. In establishing networks the network brokers often have the role of trainers, as the process is an action-learning programme for the company managers.

The network brokers are operated and coordinated by regional or local Network Centres (NC), e.g. Chambers of Commerce, local enterprise agencies, local authorities, etc. This implies that the Network Centres are responsible for the overall planning of the brokers' work, for the information and promotion activities to support the brokers for the current supervision of the work and finally for replying to the national coordination body on the progress of activities and problems encountered.

The brokers may either be directly employed or alternatively hired under contract by the NCs. It is crucial however that the network brokers have personal experience of small businesses and also a thorough knowledge of the local industry, i.e. the individual companies, the industrial structure and the regional conditions for industry.

The advantages offered by adopting the tried and tested Danish business networking model are numerous and may be summarized as follows:
1. Quality control and monitoring of network brokers' work at all levels.
2. Efficient assessment of companies' needs through diagnosis by tested tools based on international know-how.
3. Provision of viable solutions through networking but also through the use of experts, technology transfer and the identification of new markets/business opportunities.

4. Uniform and systematized methods for information assessment and response of networks and brokers.
5. Effective and rational liaising between local, regional, national and international levels.

(Extracted from *Technology Ireland*, April 1996)

Egypt

Bits and bytes from the Nile

Cairo has now firmly established itself as the software development centre of the Arab world. More than 200 software companies, with over 2,000 programmers, have helped to ignite an information technology revolution in Egypt. Now the fruits of Egyptian labours are seen every day in computers all over the Arab world running accounting packages, word processors, database management systems, games, and educational software, from Damascus to Dubai.

In 1986, the Government made a decision to begin integrating technology throughout the country under Dr. Hisham El Sherif as Head of the Cabinet Information and Decision Support Centre (IDSC).

The major work of the IDSC was to bring some technological order to the chaos of a bloated bureaucracy. But along the way, it became a catalyst for the whole country to adopt technology in its work, and this led to the need for computer software to streamline the work of the machines which would run the country. Courses started being offered in colleges and universities. Grant money from the United States Agency for International Development (USAID) helped provide computers at the American University of Cairo.

The mushrooming of the IDSC in Egypt dovetailed with widespread adoption of information technology across the Arab world. The Arab oil industry and its related sectors were gaining sophistication, and this meant more computers, and the need for programs to run them. At the same time, personal interest in computers led to a big demand for software, whether developed locally, or made into Arabic versions from English-language packages from the West.

This momentum has had a profound effect on Egypt's software community. Over the past three years, software development has grown by 35 per cent a year, and shows little sign of slowing. The Middle East computer market as a whole, including both hardware and software, is growing 14 per cent annually, more than double the international pace, according to Abdel Aziz Ismail of Access, the regional office of International Data Corporation (IDC) based in Cairo.

The IDSC has been active in helping promote Egypt's software development community. It now runs 600 training centres, and each year takes 200 of the best university graduates and pays for them to undergo an intensive, nine-month training course in advanced development techniques, such as multimedia and object-oriented programming. The IDSC itself hires many of these graduates for its work with the Government. Others go into the private sector, and IDC estimates that another 3,000-5,000 are elsewhere in the Arab world and the West, working as programmers.

However, many software companies see the IDSC as a competitor as well as a helper of the local software industry.

The Government has recently signed an agreement with Oracle to train 35,000 Egyptians on their platform for future development. And neighbouring Israel is now in

need of 15,000 computer programmers for its burgeoning software industry. Egyptian labour can be used at a fraction of the cost of Israeli programmers, with little or no loss of quality. With the Internet now in place in Egypt, and being expanded through a policy of deregulation, programming work can merely be sent over electronic data lines, cutting time and costs, and reducing attrition of good programmers to companies outside Egypt. (Extracted from *The Middle East*, April 1996)

Hong Kong

Hong Kong Productivity Council trains radio frequency professionals

Telecommunications is one of the most promising sectors in Hong Kong's electronics industry, having the highest sales growth rate of all sectors. Industrial sources and electronics marketing sources also expect this trend to continue into the next decade.

In order to explore this high-growth industry, Hong Kong electronics manufacturers are required to make immense investments in radio frequency (RF) measurement equipment and to recruit enough RF professionals. The huge capital outlay required to invest in RF measurement equipment has prevented many local small and medium-sized electronics manufacturers from entering the market. Similarly, a lack of experienced RF measurement and design professionals has also hindered the growth of the telecommunication electronics industry in Hong Kong.

In fact, the lack of well-trained RF professionals is a world-wide phenomenon. Local electronics manufacturers who wanted to develop RF and/or telecommunication products had difficulties in obtaining experienced project managers, design engineers, production managers and engineers. Similarly, RF component and equipment vendors also found it difficult to acquire staff with the appropriate RF expertise to provide good customer support service.

HKPC plans RF measurement and training services

To assist the various local electronics manufacturers who are entering this promising sector, the Hong Kong Productivity Council (HKPC) has decided to launch a project providing them with two types of service—an RF measurement bureau service and practical training courses for RF engineering personnel.

The project has a HK$ 7 million budget and the HKPC has been awarded appropriations of HK$ 5.7 million from the Government's Industry and Technology Deve bureau's start-up costs. The shortfall will be funded by income from the RF measurement services and training courses. The bureau's operation costs after April 1997 should be totally financed by training course income.

One special feature of the design courses is that HKPC staff will guide students through standard exercises, enabling them to acquire basic RF design techniques. Furthermore, HKPC staff will provide free consultations on the students' own design projects. (Extracted from *HKPC Productivity News*, April 1996)

Japan

Dream project

To determine what will become the seeds of future technologies for Japanese industry or what will contribute greatly to society, priority R&D (projects with a *dream*) are promoted at national research institutions as a strategic

research programme. In particular, several research projects related to structural biology (genes and the expression of their functions) and to optoelectronics (lasers and memory devices) are carried out.

Next-Generation Optoelectronics Basic Research

Towards terabyte memory (National Institute for Advanced Interdisciplinary Research (NAIR))

The media refer to the Internet every day. Owing to improved performance and reduced cost of personal computers, and construction of a global communication network, the beginning of the multimedia age is imminent.

Under such circumstances, it has become quite routine to handle an enormous amount of digitized image information, and diverse technological innovations are going to be required for achieving higher storage density, greater capacity, faster read/write speed and reasonable cost in external memory devices such as hard disks and optical CDs.

To cope with the explosively increasing requirements for information storage, the Agency of Industrial Science and Technology (AIST), Ministry of International Trade and Industry (MITI), is to start a new research and development project to drastically expand the memory capability of existing optical storage devices based on an entirely innovative principle from FY 1996. The project involves basic research for exploring the possibility of implementing terabyte (10^{12} bytes) optical memory, which is 1,000 times as high as the state-of-the-art level of storage capacity, as well as ensuring quick access. The Project is called the Next-Generation Optoelectronics Basic Research and has a research budget of ¥ 80 million ($800,000) for FY 1996.

If the storage capacity of existing optical disks (a few gigabits) is augmented by a factor of 1,000 or more through the innovative fabrication of optical memory devices, it will become possible to implement a much more sophisticated information community. Colossal progress will be expected in recording databases like a small library or in realizing storage systems suitable for multimedia data such as high definition TV.

While the goal of the Project is to provide a terabyte optical memory, AIST entitled it "Next-Generation Optoelectronics Basic Research", reflecting its intention of promoting the overall progress of optoelectronics through the R&D process of "Terabyte Optical Memory".

The present R&D project can be executed through combined interdisciplinary efforts involving not only basic theoretical expertise of physics and chemistry, but also broad ranges of technologies such as optoelectronics, electronics, material science, mechatronics, and so on. A research organization based on cooperation of researchers invited from industrial, academic and Government sectors is being planned.

A joint research centre, temporarily designated the "Next Generation Optoelectronics Basic Joint Research Center" will be installed at the National Institute for Advanced Interdisciplinary Research (NAIR), one of AIST-affiliated research institutes as the site of tripartite intensive joint research. (Extracted from *JETRO*, April 1996)

Malaysia

Malaysian firm to produce 200 mm wafers

MEMC Electronic Materials Inc. (St. Peters, MO) and Khazanah Nasional Berhad Holdings, a Malaysian corpora-

tion, have signed a letter of intent to establish a joint venture for the manufacture and distribution of 200 mm wafers.

The planned facility, which would be located in the Kulim Hi Tech Industrial Park near Penang, would initially be capable of producing in excess of 150,000 wafers per month. The joint venture company would be called MEMC Kulim Electronic Materials.

Khazanah Nasional Berhad Holdings is a wholly-owned subsidiary of the Ministry of Finance. It is the investment holding arm of the Government of Malaysia with specific objectives of investing in high technology and strategic industries. (Reprinted with permission from *Semi-conductor International Magazine*, May 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

Saudi Arabia

Usage pattern and productivity impact of computer-mediated communication

For almost two decades, computer-mediated communication (CMCs) has been a major management communication medium in business organizations. This paper reports the findings of a case study of a large organization in Saudi Arabia. Data were collected from 136 CMCs users who have been using CMCs for an extended period of time. The results indicate that users exhibit high- level use of the CMCs. Generally, users view the CMCs as an important business communication medium.

Almost one third of the respondents notice a decrease in their use of other communication media while the rest observe no change. Communication partners were not limited to users' colleagues (same management level) but also included their superiors (higher management level). System-oriented contextual attributes including proper training, informative documentation, awareness campaigns, and good maintenance have emerged as the most important dimensions that may encourage or limit CMCs use. Also, users emphasize the importance of features such as confirmation of receipts and message prioritization in CMCs. High levels of satisfaction and productivity impact are reported. The results provide useful insights into the management of CMCs organizations working in developing countries. (Source: *International Journal of Information Management*, 16(1) February 1996)

Thailand

Multimedia technology blooms in Thailand

Although Thailand is considered to be among the weaker Asian countries in terms of the infrastructure necessary for a true information superhighway, the computer market in Thailand is growing rapidly. 1995 was labelled the "IT Year" in Thailand. The Thai Government has launched several IT-based Government initiatives, in addition to promoting personal and business use of new computer technology. With such support from its Government, Thailand has moved onto the path following global trends of merging computers, telecommunications and mass media.

The emerging Thailand computer industry is expected to provide enormous commercial opportunities in software and services, as well as hardware and peripherals. According to the 1996 Country Commercial Guide for Thailand, the computer software sector will be the number one best prospect for US industrial exports to Thailand, while the computer hardware sector ranks number six.

Currently, the fastest growing segment in the Thai computer industry is the multimedia subsector, including both hardware and software. However, that segment is growing more than twice as fast as the overall industry. Furthermore, the multimedia sector is expected to continue growing impressively.

At the same time, Thailand has experienced tremendous demand growth in personal computers. PCs make up the biggest part of the computer hardware market. Currently, about 32 per cent of PCs in Thailand are multimedia-ready, either sold as such or due to multimedia upgrades.

Given the relatively low multimedia hardware penetration, the high share of PCs in the hardware market and the growing popularity of multimedia software, there are great opportunities for sales of upgrade kits and multimedia-ready PCs. There is also great growth potential in the provincial areas of Thailand outside Bangkok which have not yet been exposed to a wide range of multimedia products. (Reprinted with permission from *Semiconductor International Magazine*, February 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

United Kingdom

R&D investment falls steeply

UK electronics companies' investment in research and development (R&D) fell significantly in 1995, a DTI report has shown. The UK R&D scoreboard reveals that within the electronic and industrial equipment sector, the R&D expenditure as a percentage of turnover fell from 4.2 per cent in 1994 to just 3.2 per cent in 1995.

Although R&D expenditure world-wide also fell in the same period, the average remained higher than that of the UK.

The amount spent on R&D is far greater among foreign-owned companies than their UK rivals. The top five spenders in the global electronics industry were, in order, Siemens, Hitachi, Matsushita, IBM and Toshiba. Toshiba spent £1.89 billion on R&D, while GEC, which headed the UK electronics rankings, spent just £412 million. (Extracted from *Electronics Weekly*, July 3 1996)

LG Group to invest $2.5 billion in Wales

The Welsh Development Agency reported that Korean multinational LG Group will build a $2.5 billion electronics complex in Wales—the largest foreign investment project ever undertaken in Europe. LG Group will operate facilities on a 250 acre site in Newport, South Wales.

The facility will house an LG Electronics Inc. integrated TV monitor plant and an LG Semicon Co. Ltd. wafer fabrication and assembly plant. It will be LG Semicon's first operation located outside the Asia Pacific region. Ultimately, the two plants will employ 6100.

As part of the LG Group investment in Wales, the Welsh Development Agency will support a specialized semiconductor industry training centre to educate technicians, process engineers and post-graduates. (Reprinted with permission from *Semiconductor International Magazine*, August 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

Kew Gardens: a plant database for the world

Kew Gardens intends to become a key player in the dissemination of plant information and has embarked on a number of initiatives. These include feasibility studies to image and database all seven million herbarium specimens, and to provide public access to multimedia displays and information services drawing on corporate data. It aims to enhance its World Wide Web service, provide electronic publishing on CD-ROM and the Web, explore a public electronic delivery service, develop a client server front end to all of Kew's IT products, explore teleworking and radio networks, and develop field-to-base communications.

To meet this demand Kew has made a number of organizational changes. It has created a new Department of Information Systems, design services, computing, archives and publications. It has moved away from a centralized proprietary minicomputer system to a wide area network based on Novell and UNIX servers. It has also become involved in a series of international projects.

Information technology projects at Kew are grouped into five groups. The first is biodiversity databases and geographical systems based on species databases and mapping of Brunei. Projects also cover an integrated garden mapping system called Kewscape and vegetation studies and conservation in Madagascar. Applied biology is represented by SEPASAL, a CD-ROM interactive identification system for poisonous plants. Databases include a computerized library catalogue; Index Kewensis, a list of all new and changed names of seed bearing plants; Kew Taxonomic Record on the Bath BIDS service; and the Kewensia photo picture index. (Source: *Information Technology and Public Policy*, 14(1) Winter 1995)

New manufacturing intitiative in UK

A new semiconductor manufacturing initiative was launched in the United Kingdom with the establishment of a new institute to be based at Heriot-Watt University in Edinburgh. Called The National Microelectronics Institute, the centre was created by a board of nine UK-based semiconductor manufacturers to "provide a focus for coordinating the training, supply and research infrastructure for the UK semiconductor manufacturing industry". The sponsoring manufacturers are: Motorola, National Semiconductor, Seagate Microelectronics, NEC, Siemens Microelectronics Ltd., Fujitsu, Newport Wafer Fab Ltd., Philips Semiconductor and GEC-Plessey Semiconductors. (Reprinted with permission from *Semiconductor International Magazine*, September 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

Harnessing latest technology

Keen to be involved in real projects with designers who can maximize the potential of the prototyping techniques they are pioneering, UDAP (Unit for the Development of Alternative Products) at Coventry University, has been working with the industrial design consultancy Smallfry to develop exciting new products.

The most recent collaboration exercise, involving Smallfry, UDAP and the software company Streetwise Technology, is the designing of a new, global positioning system (GPS) based, personal electronic travel guide, which is due to be launched on the market later this year.

This new concept in personal travel guides—the "Streetwise Personal Electronic Guide", is a streamlined piece of equipment, the approximate size and weight of an

Apple Notebook. It fits in a coat pocket, bag or case, and is easy to use, having been designed by Smallfry to be worked by the thumb alone, while being comfortably held in either hand.

The guide, which uses the same satellite GPS already used by boats and other transport, enables the traveller— from tourist to businessman, mountain climber to long-distance runner—to instantly establish his or her exact location, anywhere in the world. By just slipping in the appropriate "data cartridge" the Streetwise Guide becomes a portable map, compass, street and tourist guide rolled into one. For use within towns it offers directions to any location, and comprehensive tourist information including sightseeing suggestions and a selection of local restaurants and hotels. (Extracted from *Industrial Design in Practice*, April 1996)

United States of America

Chip makers respond to EPA programme to reduce emissions

More than a dozen semiconductor manufacturers have joined forces with the US Environmental Protection Agency (EPA) in a voluntary Emission Reduction Partnership initiated by the EPA.

AMD, Cherry Semiconductor Corp., Digital Equipment Corp., Hewlett-Packard Co., Hitachi Semiconductor (America), Intel Corp., International Business Machines Corp., LSI Logic Corporation, Microelectronics (a business of Lucent Technologies Inc.), Motorola Inc., the National Security Agency, Symbios Logic Inc., National Semiconductor Corp., Texas Instruments Inc. and VLSI Technology Inc. gave the EPA written pledges to control emissions of fluorinated compounds, including perfluorocompounds (PFCs) and hydrofluorocarbons. (Reprinted with permission from *Semiconductor International Magazine*, June 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

US encryption block threatened by RSA

US laws prohibiting the export of powerful encryption technologies have come under renewed attack following revelations that NTT, the Japanese telecommunications company, is preparing to sell chipsets containing banned encryption algorithms.

The news was revealed at a recent cryptography conference by James Bidzos, chairman of US firm RSA Data Security, which holds the rights to some of the world's most powerful public key encryption technology. Bidzos said that NTT will use RSA technology in one of its chipsets. NTT will also produce a chipset that uses a triple-strength version of the DES encryption standard. And it is willing to sell the chipsets to anybody in the world.

The NTT chipsets make a mockery of the US Government's export controls on encryption technologies which are classified as munitions and require special export licences.

Bidzos also said that his company may resell the NTT chips in the US and that RSA's Japanese subsidiary has been working with NTT on the project.

Earlier this year, the US Government dropped an investigation of Philip Zimmerman who faced a four-year prison term for posting a copy of his program, Pretty Good Privacy, on the Internet. The program uses an encryption algorithm banned for export. (Extracted from *Electronics Weekly*, 12 June 1996)

New research centre will focus on environmental issues

One of the most concerted efforts to study the environmental, health and safety aspects of the semi-conductor manufacturing process is being initiated through a new partnership with the National Science Foundation (NSF) and the Semiconductor Research Corporation (SRC).

The new NSF/SRC Engineering Research Centre (ERC) for Environmentally Benign Semiconductor Manufacturing will be housed at the University of Arizona under the leadership of Professor Farhang Shadman of the Department of Chemical and Environmental Engineering.

In recent years, the semiconductor industry has become more committed to the development and use of environmentally conscious manufacturing processes. One focus is the large amount of highly-purified water required to rinse and clean a silicon wafer. The semiconductor industry is interested in reducing water use through innovative technology development. There is also a need to minimize the amount of energy required to manufacture chips.

The SRC reports that the overwhelming majority of semiconductor manufacturers has already voluntarily ended the use of ethylene-based glycol ethers, used as a cleaning solvent. To replace them, the industry is looking for safe solvent alternatives. Also, even though the semiconductor industry's share of total fluorocarbon use is small, the industry is still concerned with the possible impact on the Earth's ozone layer.

The ERC will work in partnership with firms from the semiconductor industry that will contribute to strategic planning of the research programme. These firms will interact with faculty and students in research and provide opportunities for student interns to learn the manufacturing process first-hand, contributing to solutions for industrial problems while they are still in school. (Reprinted with permission from *Semiconductor International Magazine*, June 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

H. AUTOMATION

Compact visual-sense mobile robot

The Electrotechnical Laboratory of the Agency of Industrial Science and Technology has developed the world's first coordinated work robot that uses a camera for confirming the world's first coordinated tasks of delivering and receiving various objects to and from partner robots. The new robot system consists of the robot mounting a charge-coupled device (CCD) camera and a computer system for processing related information. The robots are linked together with a computer and cables, but cannot engage in information exchange.

The prototype robot system is 28 cm tall, weighs 2.5 kg, mounts a pair of CCD cameras, and moves to left and right, forward and backwards on wheels at a speed of 20 cm/s. The two cameras enable objects to be observed in three dimensions, so the distance between partner robots is measured very accurately.

Further details from The Electrotechnical Laboratory, AIST, 1-1-4, Umezono, Tsukuba City, Ibaraki, Pref. 305, Tel.: +81-298-58-5310, Fax: +81-298-58-5349. (Source: *JETRO*, April 1996).

Mobile robot using ciliary propulsion

Prof. A. Ohsato and Prof. K. Nakamura and their research team from Nagaoka University of Technology have developed a metre-sized mobile robot that is an application of the principle of ciliary motion, which generates friction in only one direction.

The research team focused attention on the ciliary drive as a method for moving robots running on floors that are uneven, stepped or have protrusions, with the aim of commercializing a mobile robot with minimal vibration when bearing heavy loads at low speed. The propulsion is based on the cylindrical cam system, the robot can move with numerous ciliary legs repeating cam-driven reciprocating motions. Research on millimetre-sized ciliary-driven mobile robots for inspection inside pipes have been reported, but this is the first large-sized, ciliary-driven mobile robot. The research team plans to apply the technology to transportation and mobile inspections inside industrial plants.

The leg part of the new mobile robot consists of eight groups, each consisting of roughly 2,000 ciliary slant legs made of vinyl chloride resin. The legs move smoothly in the direction of normal flow, and friction is generated in the opposite direction. The groups coming into contact with the floor are driven simultaneously and alternately, so a forward drive is generated due to the frictional difference in the normal and counter directions. As a result ciliary motion is achieved. The cylindrical cam system is adopted for the drive, so the leg groups are attached to eight cylindrical cams, and the rotary force of the cylindrical cams is converted into the reciprocal motions of the leg groups via cam grooves. By changing the positions of the cylindrical cam's angular fixation on the rotary shaft, the leg groups can provide various motional patterns. Experiments verified that running is possible on a floor with an unevenness that is up to roughly one-fourth of the leg length, and that the robot can bear loads of up to several dozen kilograms by increasing the number of revolutions of the cylindrical cams with a stepping motor.

Further details from Nagaoka University of Technology, 1603-1, Kami-Tomioka-machi, Nagaoka City, Niigata Pref. 940-21. Tel.: +81-258-46-6000. Fax: +81-258-46-6504. E-mail: ohsato@pms. nagaokaut.ac.jp. (Source: *JETRO*, February 1996).

I. STANDARDIZATION AND LEGISLATION

Standardization

Information technology: Production begins on tool for electronic commerce

The technical work began recently on defining the baseline units of an internationally agreed Basic Semantic Repository (BSR), with multilingual application, which will ensure the compatibility of present and future developments in electronic communications and thus facilitate the growth of electronic commerce worldwide.

While businesses and administrations are replacing paper-based transactions by electronic communications such as EDI (Electronic Data Interchange), the full potential for improved performance, cost-saving and customer satisfaction on a global scale is only possible if all industries and national or regional EDI developers use the same semantics in describing the data.

Government, industry and standardizers are therefore harnessing their efforts at the international level within the BSR project to ensure the worldwide interoperability of future electronic communication developments, without jettisoning the pioneering work already accomplished by initiatives which have achieved wide regional or national acceptance, such as UN/EDIFACT, developed under the auspices of the United Nations Economic Commission for Europe (UN/ECE), and ASC X12 in the USA.

The project is coordinated by the BSR Management Committee which includes representatives of ISO (International Organization for Standardization) and the UN/ECE—which are the founder partners—and the IEC (International Electrotechnical Commission). The committee met recently in the United States and, having reached agreement on the methodology and content of the BSR, decided to launch the technical work.

A production team will therefore begin development of the first series of Basic Semantic Units (BSUs) and bridges. A BSU is the smallest unit of data in the Basic Semantic Repository, while a bridge is a cross-reference allowing interoperability between applications, including existing EDI ones like UN/EDIFACT and ASC X12.

The first production cycle will concern data in support of four UN/EDIFACT/ASC X12 messages/transaction sets: Purchase Order, Invoice, Despatch Advice and Delivery Schedule. A second cycle will commence later this year, followed by three more in 1997, with the aim of completing the BSUs and bridges needed for cross-referencing between the BSR and the most common EDIFACT/X12 transactions.

When completed, the Basic Semantic Repository will provide an internationally agreed database for use by developers of software for a wide range of applications including EDI and Electronic Commerce, and users in industry. BSR will constitute a tool for:
- Cross-referencing between different directories/ repositories maintained by different agencies;
- Defining new data in a directory, or redefining existing data when brought up for modification;
- Acting as focal point for the development of new concepts. (Source: *ISO Bulletin*, June 1996).

Information technology: ISO/IEC JTC 1 programme ensures availability of standards for the evolving global information market

ISO/IEC JTC 1, *Information technology*, is implementing several key measures to improve further its development and delivery of International Standards that meet the rapidly evolving needs of the global information market.

The measures were agreed by representative delegations from 18 countries at the 11-15 March 1996 meeting of JTC 1 in Sydney, Australia.

They include a major re-engineering programme, the launch of the GII (Global Information Infrastructure) Special Working Group, the establishment of a new technical subcommittee on Automatic Data Capture, and agreement on the normative reference of Publicly Available Specifications from within JTC 1 standards and international standardized profiles (ISPs). Each of the measures, represents a major step in the evolution of JTC 1 and contributes to advancing the committee's goal of meeting the needs for international information technology standards. (Source: *ISO Bulletin*, June 1996).

Groups plan to improve JPEG

JPEG 2000, a new still image compression standard, is being proposed by the Joint Photographic Expert Group (JPEG) and the Joint Bi-level Image Experts Group (JBIG).

The intention is to improve on the current JPEG standard in several areas, including low bit-rate and bi-level (text) encoding performance.

JPEG is said to introduce unacceptable subjective distortion of detailed grey-level images at low bit-rates (less than 0.25bpp). It is also optimised for natural images, and does not perform well on bi-level and computer generated images. This poor performance has precluded the widespread acceptance of JPEG for use on compound documents. (Source: *Electronics Weekly*, 31 July 1996).

NAFTA prompts a new code system for industry—the death of SIC and birth of NAICS

From 1997 onwards, the familiar Standard Industrial Classification (SIC) codes used by US government agencies and information publishers will be replaced by new codes. The new system, the North American Industrial Classification System (NAICS), is being introduced as part of the North American Free Trade Agreement (NAFTA). It will allow reports created by the three signatory governments to share a common coding system, making for easier comparisons of trade and production statistics.

In the US, responsibility for the development of the new system rests with the Office of Management and Budget (OMB). The OMB has instructed the Economic Classification Policy Committee (ECPC) to work with corresponding bodies in Canada and Mexico in developing the new codes. The "clean slate" approach of the ECPC will be subject to a number of guidelines, including those referring to maintaining times series continuity and compatibility with the two-digit level of the UN International Standard Industrial Classification as far as possible.

It has not yet been determined whether the system will be alphabetical, numeric or a combination of the two, but the hierarchical structure will extend to four digits, with an optional fifth digit. The system will be published in the *Federal Register* by July 1996 and the intention is to use NAICS in the US 1997 Economic Census.

The changes bring opportunities for companies to define their activities so as to bring them into an NAICS category with the most favourable regulatory environment. They also mean commercial opportunities for publishing, consultancy and conversion. (Source: *Database, 19(2)*, April/May 1996).

Information technology: JTC 1 creates a new subcommittee on automatic data capture

At its plenary meeting in Sydney, Australia, last March, ISO/IEC Joint Technical Committee 1 (JTC 1) established a new Subcommittee, SC 31, on Automatic Data Capture (ADC). The first SC 31 meeting was held in Brussels, Belgium on 17-20 June 1996 and drew membership from the many national bodies that had expressed an interest in ADC technologies.

The Secretariat for SC 31 will be provided by the Uniform Code Council in the United States under the auspices of ANSI, ISO member body for the United States. The Uniform Code Council is a non-profit, membership organization devoted to the development and administration of supply chain management standards. It currently administers the Universal Product Code (UPC) standard as well as several other standards.

ADC technologies are vital elements in existing commerce and are among the basic enablers for electronic commerce in the Global Information Infrastructure. They provide timely and cost-effective data on the sales realization business processes that include ordering, back office operations, manufacture, distribution, sale, use, warranty, and return of products. ADC serves many different applications (e.g., product and/or item identification, distribution product identification) in such market sectors as retail sales, health care, supply chain distribution, transportation and manufacturing.

Currently there are duplicating and sometimes conflicting specifications from national and regional activities addressing these issues, and no effective means for international harmonization of multi-industry requirements. This creates confusion for users and can impede international trade. SC 31 will provide an international harmonization mechanism that will draw upon existing national and regional standardization efforts as well as new initiatives to facilitate global commerce using ADC techniques.

Initially, the SC 31 programme of work will concentrate on data content and data carrier standards, principally as they apply to bar-code technologies. Subject to multi-industry business requirements, it is expected that the work programme will be extended to other ADC areas with the intent of providing uniform data content standards for multiple data carrier technologies. (Source: *ISO Bulletin*, July 1996).

Quality standards for FEA

Formal guidelines for applying FEA are laid out in a supplement to the ISO 9001 quality standard. Document R0013 relates to assessing the quality of FEA used in the design and integrity demonstration of engineering products. It interprets ISO 9001 requirements in the context of FEA. It was produced by the National Agency for Finite Element Methods and Standards (NAFEMS), Birniehill, East Kilbride, Glasgow G75 0QU (Scotland).

Among the dictates spelled out in the document's quality-system requirements is that analysis reviews be carried out by personnel independent of those performing the actual FEA. It also says an FE quality system should include documentation of validated analysis procedures, and documented work instructions for both technical and administrative tasks.

Also spelled out in the standard is that analysis activities be recorded with controlled documents to allow modification, restarting, and transference of work. Documentation is supposed to include analysis work plans, analysis specifications, reports, secured computer data files, qualified analysis procedures and reference validation analyses, and an audit trail of the analysis. The standard also ranks FEA use into three areas.

Other requirements relate to purchases of analysis software. Documentation that is supposed to be retained for purchased analysis packages includes that pertaining to numerical algorithms, a user manual covering applicability, limitations, and assumptions; a programming manual; verification problems, recording and notification of errors, and notification of software revisions. (Source: *Machine Design*, 4 April 1996).

ITU approves new standard for international free-phone

The International Telecommunication Union has recently approved a new standard which will allow users to make "freephone" calls internationally. The new ITU-T Recommendation, number E.169, will allow International Freephone Service customers to be allocated a unique Universal International Freephone Number (UIFN) which will remain the same throughout the world, regardless of country or telecommunications carrier.

"Freephone" is a service which permits the cost of a telephone call to be charged to the called party, rather than the calling party. Pioneered in the USA in 1966, the freephone service now carries around 100 million calls per day in that country alone. US companies currently hold around 90 per cent of the world's 9 million freephone numbers.

Freephone has proved particularly popular with business subscribers, who are often willing to bear the cost of a telephone call in order to promote their services or to encourage customers to order their products by phone. Recent estimates by AT&T indicated some US$100 billion is currently traded over the freephone service every year. Until now, however, companies have been restricted by only being able to use their freephone number in one country. Those organizations wishing to offer services or products to customers on an international basis have had no choice but to register a separate number in each country, which has proved unwieldy and often inefficient.

The ITU's new standard for international freephone will greatly free-up companies' ability to operate across international markets, and will benefit consumers by allowing them to obtain information or to "shop around" for goods and services at no personal expense. It is hoped the new standard might also stimulate the market for freephone services in Europe and Asia-Pacific, regions that until now have been slow to take up the service.

The potential market for the new international freephone service is expected to be considerable. The "globalization" of markets via new technologies such as the Internet means that many companies are now able to offer

their products and services to users in different countries, and will benefit from being able to advertise a single "toll-free" number to potential customers all over the world. Calls to the new global number can also be routed to different destinations, allowing companies to direct their incoming calls to the most appropriate location for efficient handling.

While perhaps not as glamorous as "sexy" new technologies such as multimedia or video-on-demand, freephone services are nevertheless expected to represent a more important source of revenue in the foreseeable future.

For additional information, please contact Telecommunication Standardization Bureau, Mr. Zoltan John Tar, Fax: +41 222 730 5853, Internet: tar@itu.ch; Mr. Ah-ho Mafat, Fax: +41 22 730 5853. Internet: mafat@itu.ch. More information about the ITU is available on the World Wide Web at http://www.itu.ch (Source: *Press Release, 4 June 1996*).

Where STEP is better than IGES

STEP, the Standard for the Exchange of Product Model Data, is being heralded in some circles as a boon to concurrent engineering because it provides one neutral format that can apply to CAD data throughout the life cycle of a product. Even with restrictions, STEP offers features and benefits that are absent from IGES.

STEP, unlike IGES, is a collection of standards. Users can pull out an IGES spec and get everything in one document. STEP is more encompassing than IGES, and is also an international standard. IGES calls the US home, though other countries use it. Germany and France have developed their own standards and Japan has defined an IGES subset, though it is still eyeing STEP.

The Japanese Automobile Manufacturers Association (JAMA), for example, is working with Milford, Ohio-based ITI on integrating STEP into the Japanese automotive industry. ITI will develop AP203 translators for four Japanese CAD systems in a pilot project.

STEP users will be able to transfer B-rep solids between CAD systems. This is in the gray (unofficial) pages of the IGES spec, but most CAD vendors have not implemented such capabilities in IGES.

STEP differs from IGES in how it defines data. In IGES, a user pulls out the spec, read its, and implements what it says. STEP has a paper version as well, but the data definitions themselves are in electronic form. The implementor takes these definitions and runs them through a special compiler which then delivers code. This process assures that there is an unambiguous understanding of the data among implementors.

Finally, conformance testing for STEP will eventually be built into the standard, unlike the case with IGES. In contrast, nothing prevents vendors from issuing translators that implement only a part of the IGES spec. (Source: *Machine Design*, 4 April 1996).

Legislation

Intellectual property rights

As information becomes one of the most important forms of power and wealth, everything from the pattern of purchases by credit card to DNA patterns will become information bytes that can be bought and sold in the market place. The first effect of this transformation is that intellectual property rights will become very important as they are being expanded dramatically in surprising direc-

tions. To date, there are no politics for the information age as there is no perception of linkages between issues or a common interest in apparently disparate situations. Many groups are influenced by the politics of information property. Some of the most innovative software engineers have objected to the extension of patents to cover their products.

The US Congress is currently considering the Clinton's administration proposal for intellectual property on the Internet, which aims at "saving" the medium. The proposal would turn browsing into an Internet document into a copyright violation. It would transform the current law of fair use and would make online service providers liable for their customers' copyright violations. The proposals are very far-reaching and have been criticized by educators, librarians, writers, civil libertarians and entrepreneurs, who fear that the Net will become a pay-as-you-go information toll road.

The information land grab is not confined to the Internet, as it also ranges from software to biography and biotechnology to court reporting. The ground rules of the information society are currently being laid down by lawyers employed by the biggest players in the field. There is little or no press scrutiny or public debate. This is bad politics in the thrall of worse economics. What is needed is a politics and a press of the information age. (Source: *Computers in Libraries, 16(5)*, May 1996).

Patent information on the Internet

Patent data available on the Internet tends to be fairly basic, and as such is unlikely to be of interest to the professional searcher. Nonetheless, there is sufficient material to answer the questions of occasional browsers looking for technical information in broad subject areas.

One of the better Net directories is provided by Yahoo: its subdirectory for industrial sectors currently lists 14 sources of information. These include the *Patent Portal*, which offers hypertext links to various broad classes of resource, such as patent news, patent law and patent agents. Most of the information relates to US patent documents. Two databases—*The Shadow Patent Office (SPO)* and STO's *Internet Patent Search Service (IPSS)*—offer little more than lists of patent numbers.

SPO offers free searches of recent US patent titles and more extensive searches for a fee. *IPSS* provides a free news service on a weekly basis, supplied to about 1,900 sites around the world. The mailing comprises three files, one each for mechanical, chemical and electronic patents.

MicroPatent also offers a limited free service. Users must register (which is free of charge) and are then allowed to search the full text of US patents published in the current or previous week, or English translations of recent Japanese patent titles relating to specific technologies. Full copies of a patent are available via downloading, fax of E-mail, for a fee. New databases are appearing all the time. A recent addition is Questel-Orbit's fee-based QPAT-US.

Newsgroups also represent an important source of information. Of particular interest is the PIUG/PATMG Patent Information Discussion List. (Source: *World Patent Information, 18(1)*, March 1996).

Some legal issues for electronic information

Copyright is central to the electronic information industry and under the definition of literary work virtually anything printed or recorded can be subject to protection.

While the copyright law states that no one may copy, information scientists and librarians manage to copy machine-readable work under the concept of fair dealing. Copyright has to be considered in terms of making abstracts from original works, and the question that needs to be considered is whether a database is a literary work. The European Union has issued a number of directives, a recent one currently being considered by the Council of Ministers is a draft directive on database copyright. This directive has several key components—a clear and unambiguous definition of a database; a statement that databases are to be protected as a literary work under copyright law; and it introduces a *sui generis* protection for databases whose individual contents do not merit copyright protection. In addition the directive allows for the compulsory licensing of certain databases offered by public bodies.

It can be expected that by the late 1990s, multimedia will become a standard facility and the copyright issues in this area are so complex that it may be some time before multimedia really takes off. All items placed on the Internet, including e-mail messages, are copyrighted. One result of the Council of Europe's Convention for the Protection of Individuals with regard to Automatic Processing of Personal Data issued in 1981 is that many countries have introduced data protection legislation to cover personal information. Data protection legislation makes no difference between personal information, which is confidential, and information in the public domain. This means online and CD-ROM databases; OPACs and other computerized catalogues; downloaded records from an online or CD-ROM search; library circulation records; and library ordering systems are covered and creators must register that they hold such databases, correct errors, etc. To date only seven EC countries have ratified the Convention and it was decided to force the pace by issuing a Directive on Data Protection which lays down how personal data should be recorded and processed in any type of file.

With respect to information providers' liability when supplying electronic information, there is in principle no difference between the legal liability respecting print and computerized information. A liability claim is based on the content of the database, and could be concerned with inaccurate or erroneous information. Waiver clauses can be used, but countries vary in their approaches to such clauses. In addition, libel and slander has to be considered. (Source: *International Forum on Information and Documentation, 21 (1)*, January 1996).

J. RECENT PUBLICATIONS

Simulated voyages

Major shipping accidents have focused public attention on the performance of marine pilots and deck officers and, as a result, more attention is being paid to the training, performance evaluation, and licensing assessment of mariners. A new report by a National Research Council committee says that computer ship-bridge simulator training, a tool that has been used for several years, could be made much more effective in training and evaluating mariners.

The US Coast Guard should develop and promote standardized training and testing methods for ship-bridge simulators; and it also should establish a research base to measure the effectiveness of simulation in training for specific tasks, the report says. The study was requested by the Coast Guard in response to the Oil Pollution Act of 1990.

Simulators have been used for mariner training since the 1960s. Their capabilities range from radar screens to full-scale devices that can create a 360-degree view from a ship's bridge. The technology can be used for many types of vessels to create real scenarios or generic operating conditions that occur in ports or harbours. The devices offer several significant advantages, most notably a safe environment where mariners can train without worrying about inclement weather conditions or other hazards. Mariners can be trained in a number of skills, from "rules of the road" and emergency procedures to bridge team and resource management. Instructors can terminate or repeat scenarios at any time.

However, instructors often insert simulation into existing courses rather than customize them to enhance computer-based learning. The committee said that a more structured approach to simulation training would offer the most benefit. Instructors who use simulation as a tool should themselves be trained and certified to ensure that the course objectives are being met.

Testing mariners for licensing with simulated programs offers an effective method for assessing not only the candidate's knowledge, but also his or her ability to apply it, the committee said. Ways of approaching tasks and aptitudes for performing several duties simultaneously also can be evaluated. The Coast Guard needs an understanding of the nature of those tasks, the committee said, and a detailed plan for effective, structured assessment. Before undertaking more extensive use of simulation in marine licensing, the Coast Guard should develop a framework for integrating accurate, consistent simulation into its licensing program. Since there are no industry-wide standards, the Coast Guard should develop its own, and monitor systems regularly.

Simulated Voyages: Using Simulation Technology to Train and License Mariners. Committee on Ship-Bridge Simulation Training, Marine Board, Commission on Engineering and Technical Systems (1996, 284 pp.; ISBN 0-309-05383-8; available from the National Academy Press, Tel. 1-800-624-6242; $38.00 plus $4.00 shipping for single copies). (Source: *NewsReport* of the US National Research Council, Spring/Summer 1996)

Major newspapers launch on the Web

Three items of news relating to developments in on-line publishing are described here. They illustrate the variety of new projects and approaches currently in evidence.

Recently, World Wide Web versions of *The Times* and the *New York Times* have gone online, as well as a full-scale version (replacing a limited prototype) of the *Wall Street Journal*. The UK publication is full-text, and free of charge, whereas the US ones impose charges. The decision to make these charges appears surprising in the light of what happened when *USA Today* attempted a similar approach, only to make it subscription-free after six months.

KD Technology's Macintosh-based *eNews Publisher* software automates various aspects of digital publishing. The product has a showcase in the *Luton and Dunstable Evening Post*, which KDT has launched as the UK's first regional daily newspaper published solely on the Web. Over 90 per cent of the content is provided by local news agencies, and the production process is automated to the extent that the *Post*, and its companion publication *UK Today*, require only the part-time efforts of three staff.

The third article briefly reviews a number of Intranet (internal implementations of Web technology within closed-user groups) developments. PC DOCS has announced its intention to add support for Web browsers and Adobe *Acrobat* to its document management system. Attachmate Corporation, which recently acquired the Wollongong Group, is to launch the *Emissary Workgroup* and *Emissary Host Publishing* systems. (Source: *Digital Publisher*, 1(2) February 1996)

Journals face the electronic future

The scientific journal publishing programme has been rocked to its foundation with the impact of the Internet, which seems to offer many opportunities at a minimal cost. Librarians and scientists have combined in revolt against journal publishers. A new paradigm has started in which the individual scientist retains copyright and does away with dependence on print-on-paper. It has been estimated that the international research journal publishing business is worth about US$ 2.5 billion. With the tremendous growth of scientific output after World War II, scientific journals increased in both number and size so cost rose proportionately. While publishers have increased prices to respond to inflation and overhead costs; growth of the literature; and subscription erosion, information technology grew exponentially in terms of memory, bandwidth, resolution, speed, etc. In June 1994, Steve Harnard made a proposal that all esoteric (non-trade, non-market) scientific and scholarly publication should be published free on the Internet. His claim that esoteric information has no market value negates the functions of scientific journals and assumes that scientific publishing aims to inform only a few other scientists.

In mid-1991, Ginsparg set up an e-print archive for scientific preprints, and it has been claimed that for some fields of physics, e-print archives will become the primary

means of communicating research information. The new technology is very seductive for solving immediate, short-term problems. US learned societies have started a number of projects to respond to electronic challenges. Academic Press has established the International Digital Electronic Access Library (IDEAL) in which all its US and UK journals are on the World Wide Web since January 1996. The Academic Press Print and Electronic Access License (APPEAL) permits consortia of libraries limited access to IDEAL with individual library members entitled to addi-

tional paper subscriptions of journals at very reduced prices for the first three years. The aim is to create a relatively quiet period in which both the consortium and the publisher can experiment with value-added services customized for groups of individual end-users. An advantage of such a scheme is that it comes under contract, not copyright law. If successful, the result could be greatly enhanced access for the research worker and a secure financial base for the continued building of the scientific archive. (Source: *LOGOS*, 7(1) 1996)

TECHNOLOGY AND INVESTMENT OPPORTUNITIES

SELECTED TECHNOLOGY REQUESTS

COMPUER AIDED DESIGN

An engineering and management consultancy organization is seeking to introduce computer aided design and draftings, software and hardware to improve quality and speed of delivery of their services. The estimated total project cost is US$ 450,000. Eighty per cent of their work is directed towards the domestic market.

Specification of technology requirement: Know-how; training; equipment and managerial skills.

Preferred mode of cooperation: Joint venture; subcontracting and equipment supply

(For further information, please contact: Mr. M.B. Munyagi, Managing Director, EM Consultants Ltd., P.O. Box 5579, Dar-Es-Salaam, Tanzania. Tel: +255-51-30215; Fax: +255-51-112754)

ELECTRICAL INVERTERS

A new project to import and assemble inverters to provide electricity to rural areas and small towns where the power grid is not present. The current supply of electricity meets only 5 per cent of rural demand. Initially, the company intends to assemble 1,000 inverters to test the market. They also wish to import 1,500 solar panels. Estimated total project cost is US$ 2,319,900.

Specification of technology requirement: Product/process know-how, training, managerial skills, technical services and equipment.

Preferred mode of cooperation: Joint venture; equipment supply and technical services.

(For further information, please contact: Mr. P.A. Lyatuu, Executive Chairman, Environment Press Foundation, P.O. Box 246, Arusha, Tanzania. Tel: +255-57-4149; Fax: +255-57-8170)

FACILITIES FOR DIGITAL IMAGING/ANIMATION SOFTWARE SOLUTIONS AND VOICE TRANSCRIPTIONS FOR BACK OFFICE OPERATIONS

The company is seeking to expand production of current facilities, improve the quality of current products, introduce new products and establish new facilities, etc. For both projects collaboration in the form of joint ventures with equity participation and technology tansfer is required. The latter is very important as the projects are in high technology areas. International market access is also required as the scope for the services are very limited in India. Market access can be in the form of buy-back arrangement or sub-contracting.

Specification of technology requirement: Diversification.

Preferred mode of cooperation: Joint venture; technology transfer; market access.

(For further information, please contact: Mr. Ajit Narasimhan, Managing Director, Brainware Infotech (P) Ltd., 92 North Anjaneya Temple Street, Basavanagudi, Bangalore 560 004, India. Tel: +91-80-6616895; Fax: +91-80-6616895; E-mail: ajitn@giasbg01.vsnl.net.in)

MANUFACTURE OF SYNCHRONOUS DIGITAL HIERARCHY RANGE AND WIRELESS IN LOCAL LOOP SYSTEMS FOR TELECOMMUNICATIONS APPLICATIONS

The company is already making passynchronous digital hierarchy range of test equipment and instruments for telecommunication application. The proposed project seeks superior technology for applications in telecommunications. As these technologies are quire sophisticated, only developed countries need be approached for possible arrangement.

Specification of technology requirement: Expansion and diversification.

Preferred mode of cooperation: Technology transfer; joint venture.

(For further information, please contact: Mr. P. S. Ramesh, Measurements and Controls, 1757 East End 'A' Main Road, 9th Block, 36th Cross, Jayanagar, Bangalore 560 069, India. Tel: +91-80-6635353; Fax: +91-80-6635352)

MANUFACTURE OF ANY ELECTRONIC PRODUCT FOR EXPORT

A well established company with a very good R&D lab for testing products is available. The proposed project covers manufacure of any electronic product, i.e., industrial instrumentation, test and measuring instruments or office automation products for export. The company primarily requires market access, subcontracting facilities and buyback arrangements. They have the capability of offering products to the requirement of the foreign partner, but market acessibility is lacking. The company envisages an investment of approximately US$ 2 million.

Specification of technology requirement: Expansion and diversification.

Preferred mode of cooperation: Market access; technology transfer; compensation agreement.

(For further information, please contact: Mr. H.S. Nagaraj, Managing Director, Instrument Research Associates Pvt. Ltd., Instrumentation House, P.O. Box 2304, 19 Mysore Deviation Road, Gopalapuram, Bangalore 560 023, India. Tel: +91-80-337391; Fax: +91-80-3301969)

SELECTED TECHNOLOGY OFFERS

INFORMATION TECHNOLOGY

Customised software and hardware development and services offered. These services can be used in the fields of Internet and WEB solutions, commercial software, commercial electronics and space electronics.

Status of technology offered: Commercialized

Preferred mode of cooperation: Joint venture/know-how

(For further information, please contact: Mr. S. Balachandran, Ob-Vision Technologies, 55,C1st floor, 3rd cross, C.R. Layout, Bangalore 560 078, India; Tel: +91-80-6635962; Fax: +91-80-603396)

SOFTWARE TECHNOLOGY PARKS

Technology is offered in creating software and development facilities of high standards and establishing training and development centres for software and in financial structuring of new enterprises.

Status of technology offered: Commercialized

Preferred mode of cooperation: Licensing; know-how; technical expertise.

(For further information, please contact: Ravichandra Systems and Computer Services Ltd., 1029 Avanashi Road, LIC Building (2nd Floor), Coimbatore 641 018, India. Tel: +91-422-211961; Fax: +91-422-214844)

RURAL RADIO TELEPHONE – MARR SYSTEM

Provides technology for the assembling and testing of single channel radio telephone and 2/15 shared radio system. This product is used for extending the telephone facility for remotely located or thinly populated areas. Cost of project: US$ 0.3 million; Machinery: US$ 0.15 million.

Status of technology offered: Commercialized

Preferred mode of cooperation: Licensing; know-how; technical expertise

(For further information, please contact: Electronics Corporation of Tamilnadu Ltd., Industrial Estate, Perungudi, Chennai, India. Tel: 91-44-4925662; Fax: +91-44-4926692)

HYPERMEDIA COMPUTER SOFTWARE

WEB is a new approach to managing information based on a concept of threads which represent particular topics of interest to the user. Information can be linked to a number of relevant threads to allow users to model their ideas. The first product WEB – Information Assistant runs in a multi-window environment on IBM PC and compatibles. Information can be keyed in or imported as a text file and moved from point to point within a WEB or between WEBs providing a powerful HYPERTEXT envrionment for general information. Links to the users existing word processor, spreadsheets, etc.

Status of technology offered: Commercialized

Preferred mode of cooperation: Licensing; joint venture

(For further information, please contact: Mr. Brian Padgett, Managing Director, The Technology Exchange Ltd., Wrest Park, Silsoe, Bedford, MK45 4HS, UK. Tel: +44-1525-860333; Fax: +44-1525-860664; Tlx: 825808; E-mail: tech-ex@dial.pipex.com)

PHOTOVOLTAIC LIGHTING AND PUMPTING SYSTEMS

Manufacture of street lights, lanterns, domestic lights, ec., which convert sunlight into electricity using photovoltaic modules. The resultant electricity is stored in batteries and used when power is required for lighting, etc. The technology can also be applied directly to drive a motor pump set to lift water. The production of the cells is carried out by manufacturing various parts and sub-units in different shops of the factory and integrating them into the final product in the assembly line. This facility is quite useful as it provides basic electric light and other consumer amenities in rural/remote areas, hamlets, etc., using photovoltaic energy from the sun and helps in pumping water or irrigation and drinking purposes. Cost of project: US$ 0.32 million; Machinery and equipment: US$ 0.2 million; Know-how: US$ 40,000.

Status of technology offered: Commercialized

Preferred mode of cooperation: Joint venture, know-how, licensing.

(For further information, please contact: Mr. Ramesh Kannan, Kaynes Technology, No.23-25 Belagola Food Industrial Estate, Metagalli, P.O. Mysore 570 016, India. Tel: +91-821-511612; Fax: +91-821-512701)

CAD/CAM AND GIS RELATED SOFTWARE DEVELOPMENT

A full rance of digitization and conversion services and CAD/CAM and GIS related software development expertise is offered. Cost of machinery: US$ 100,000; Know-how: US$ 50,000; Training: US$ 20,000.

Status of technology offered: Commercialized

Preferred mode of coopertion: Joint venture; Know-how.

(For further information, please contact: Mr. Ranga Mohan, Infotech Enterprises Ltd., 42 Nagarjuna Hills, Panjagutta, Hyderabad 500 082, India. Tel: +91-40-398190; Fax: +91-40-310841)

UNIDO

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

EMERGING TECHNOLOGY SERIES

(incorporating the Technology Trends Series and Industrial Technology Monitors)

If you would like to receive any of the following publications in future, please complete the list below and return to the address indicated. Please note that all publications are available in English only, and are free of charge to readers in developing countries; for readers in developed countries a handling fee of US$ 40 per annum is imposed for Genetic Engineering and Biotechnology; Information Technology and New and Advanced Materials.

For new subscribers only

- ☐ GENETIC ENGINEERING AND BIOTECHNOLOGY (four issues per year)
- ☐ INFORMATION TECHNOLOGY (formerly Microelectronics) (four issues per year)
- ☐ NEW AND ADVANCED MATERIALS (formerly Advances in Materials (four issues per year)
- ☐ MARINE INDUSTRIAL TECHNOLOGY (two issues per year)
- ☐ HIGH-TECHNOLOGY SPIN-OFFS (two issues per year)

Special issues

- ☐ ADVANCED MATERIALS No.1 (Advanced Materials in High Technology and World Class Manufacturing
- ☐ ADVANCED MATERIALS No.2 (New, Advanced and Improved Traditional Materials and Processes)
- ☐ TRENDS IN PARALLEL PROCESSING
- ☐ ENVIRONMENTALLY SOUND MANAGEMENT OF BIOTECHNOLOGY (The Task Managers' Report on Chapter 16 of Agenda 21)

FAMILY NAME AND GIVEN NAMES	
TITLE OR POSITION	
ORGANIZATION OR COMPANY	
STREET AND/OR P.O. BOX NO.	
CITY AND TEL./FAX NO.	
COUNTRY , TEL./FAX NO. AND E-MAIL	

Return to:

UNIDO, Industrial Information Section, P.O. Box 300, A1400 Vienna, Austria
Fax: (+43) 1-21131-6843

UNIDO

INTECHMART

Bahia (Salvador), Brazil
11 – 13 June 1997

INTERNATIONAL BUSINESS FORUM

Organized jointly by the Government of the State of Bahia and UNIDO, the Bahia Intechmart will be held in the State's capital Salvador. The main purpose of this Intechmart will be to match the investment and technology requirements of Bahian enterprises with the assets of potential foreign partners and thus facilitate business transactions, such as joint ventures, licensing agreements and technology transfer arrangements. This is the first Intechmart staged by UNIDO in Latin America, following a string of successful similar events in Asia and Africa since 1991, when this promotion formula was adopted.

Over 70 projects identified, evaluated and profiled by UNIDO are currently being advertised worldwide by the Organization's Investment Promotion Service Offices and its other honest-broker conduits. Most projects, whether they entail new ventures or the expansion or upgrading of existing ones, are in the chemical/petrochemical, agro industrial, tourism and mining sectors. The project profiles include information on the business background of the Bahian companies and local promoters involved, the main features of the projects, and the foreign resources sought by their proponents.

Direct negotiations between potential investors and Bahian project proponents of their choice will be arranged by the Forum organizers upon request. Representatives of financial institutions, business associations, contracting companies and Government agencies will also take part in the event to provide support services.

For further information, please contact:

- Project Manager, Investment Services, Latin America and Caribbean Unit (ITPD), UNIDO, P.O. Box 300, A-1400 Vienna, Austria. Tel: (43-1) 21131-4830, Fax: (43-1) 21131-6808, E-mail: bahiaforum@unido.org

- UNIDO Office in Brazil: SCN, Quadra2, Bloco A, Ed. Corporate Financial Centre 6^0 andar, 70712-900 Brasilia – DF, Brazil. Tel: +55-61-329-2171; Fax: +55-61-329-2179; E-mail: waleska@undp.org.br

- Promoexport-Bahia: Av. Estados Unidos 14, Ed. Suerdieck, 9/10^0 andares, Comercio, 40010-020 Salvador – Bahia, Brazil. Tel: +55-71-326-0411; Fax: +55-71-326-0520; E-mail: bahiaforum@promoba.gov.br

ITMIN   UNIDO

ENTER A WORLD OF INFORMATION

What is ITMIN?

The Industrial Technology and Market Information Network (ITMIN) is a network of databases on industrial technology and market information within Sri Lanka, with on-line international access.

Who is ITMIN?

ITMIN Limited is a public limited liability company with shareholders, set up with the help of UNIDO, UNDP and the Government of Sri Lanka to implement and operate the ITMIN project.

What can ITMIN offer?

The Business Intelligence Unit offers:
Trade information and listings;
Market research;
Company matching;
Selective dissemination of information;
Employment opportunities.

The Technology Transfer Unit assists in:
Increasing production, sales and profits;
Improving product quality;
Reducing operating costs;
Adopting up-to-date manufacturing techniques;
Accessing wider markets;
Obtaining financial assistance.

The Electronic Publishing Unit provides:
Access to electronic publications in CD-ROMs and diskettes that will help search for precise information, saving valuable time.

The ITMIN Database contains:
In-depth information on Sri Lankan companies;
Technology & research organizations;
Consultancy and expertise;
Technology and machinery offered and sought.

Apart from the above, ITMIN offers specialized integrated training in information skills for professionals, corporate staff and decision makers. And to complement all this, ITMIN is Microsoft's Internet Partner in Sri Lanka and is hence in a position to offer Microsoft Internet solutions and packages.

More information on ITMIN's services can be provided by contacting:
ITMIN Limited, P.O. Box 2151, 121 Independence Square, Colombo 7, Sri Lanka.
Tel: +941-683948; Fax: +941-683945; E-mail: info@itmin.com;
WWW: http://www.itmin.com