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NEW TRENDS IN COMPUTER AND MOBILE TECHNOLOGIES

Хрестоматія

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Оригінальний текстовий матеріал підвищує термінологічну компетенцію студентів і сприяє розвитку навичок мовлення в межах професійного спілкування

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I. TELECOMMUNICATION NETWORKS AND SERVICES

Global Trends

Today, the fact that telecommunications are one of the most crucial infrastructures for the balanced development of a nation's economy and of society is universally recognized. It is a worldwide perception that constructing a harmonious telecommunication network through balanced development is a prerequisite for increasing public benefits and national competitiveness.

Most of the developing countries are well aware of the socio-economic importance of the telecommunication sector. This awareness has led some of them to concentrate on investing in this sector to meet the need for basic telecommunications, as well as advanced information communications. Yet, it is a fact that many countries are still unable to satisfy demand for basic telecommunications.

A communications revolution possessing new scales of values and appropriate economic technical and legal structures is coming into being. This new situation is affecting the various regions of the world in different ways, depending on their levels of development and their perception of the future. But all are faced with similar challenges in trying to meet the long-term objective of creating a "global village which, as a result of new technologies, particularly communication techniques, will become a reality in the near future.

In the gross national product (GNP) of both developed and developing countries, cross-border movements (data, economic, financial, etc.) have been playing an increasingly important role. Annual direct investment flows rose fourfold over a recent period of five years according to the International Monetary Fund (IMF). These flows reflect the globalization of economic activities, and affect both production and distribution of products and services, while making countries increasingly interdependent in all sectors of activity.

There has been a widespread move towards liberalization of economic activities, opening avenues for private initiatives and enhanced competition. Some areas traditionally reserved for State operations have attracted risk capital, even in the social sphere (e.g. healthcare and education) in some special cases, with the aim of making companies more productive and more competitive. This implies reconsidering the role of the State, to one, which focuses primarily on sound regulatory practices.

The convergence of computers, telecommunications and information technology is expected to bring new telecommunication products and services progressively within reach of larger proportions of the global population. This trend has led to new customer needs, new suppliers and operators, and is exerting tremendous pressure for changes in the traditional policy and regulatory framework of the telecommunication sector in most countries of the world. The opening-up of the telecommunication sector to private capital and competition is happening at the same time that a comprehensive multilateral trade framework for services, including telecommunication services, is building up. The General Agreement on Trade in Services (GATS) - one of the agreements negotiated as part of Uruguay Round of

trade negotiations and one of the foundations of the newly formed World Trade Organization - is opening new challenges, but also new opportunities for Arab countries.

In addition, the integration of technologies is leading to growing pressure on telecommunication administrations by large national and international users requiring access to the new services, the insufficiency of which has created incentives for these users (including State- owned enterprises) to construct their own private telecommunication networks. This in turn raises important regulatory issues for governments.

Impact on the organization of telecommunications

Many countries are now seeking ways of adapting to these trends, but they are faced with a complex set of issues relating to policy matters, planning, financing, installation and operation of the network.

The most appropriate structure for any country will depend on national circumstances. However, experience to date indicates that these trends should lead to clear separation of telecommunication operations from the policy objectives. These policy objectives will include "universal service" and special consideration for rural and less privileged areas. This sector reform will increasingly introduce competition in virtually all areas: equipment, services, network management and information services.

Impact on investment requirements

To realize the potential gains resulting from new technologies, there will be a need for substantially increased investment. A government shortage of funds and borrowing capacities often tends to constrain telecommunication investments. Consequently, favorable conditions to stimulate investment must be regarded as an integral part of a country's policy. It is then natural to consider the possibility of drawing on non-governmental funds, which is in turn linked to changes in the organization of the sector.

There is a widespread belief that if the problem of operation efficiency is solved as part of the sectoral reform, capital can be attracted to expand telecommunication systems through a wide variety of options. The clearer the separation between operational, policy and regulatory matters, the more really it is that suppliers of capital will view a venture as a viable commercial operation. This could permit a country to select the most desirable institutional structure, ranging from a specialized governmental entity to a fully privatized company. Regardless of the method of reform chosen, the leads of rural and less privileged areas should be considered as an objective to be fulfilled.

Impact on society and future prospects for rural areas

Telecommunications are increasingly recognized by all countries, including those in the Arab region, as a key factor for their economic development. Telecommunications play a vital role in emergency situations, health care, and education. Also, they reduce the need to travel and can improve the quality of life. They can be used to disseminate information of immediate importance on a national level, as a channel for education, for connecting rural and urban areas, an essential element in the development of national infrastructure.

Telecommunications can help to decrease migration from rural to urban areas. Accordingly, Arab countries have started to distinguish between urban, rural and more remote areas when programming network expansion, as evidenced by the targets set to expand coverage and increase telephone density. It is important to note that the same technological revolutions (stimulating reform) open up opportunities to expend basic services to rural and isolated areas. These opportunities may be supplemented, as needed, by adopting the necessary pricing polices for those areas where the delivery of widespread service at reasonable prices is not likely to be achieved without some form of subsidy. This is due to the fact that commercial considerations alone may not be appropriate criteria for decision to invest in rural areas, calling for a flexible pricing policy to account for the indirect benefits of expending telephone services. Owing to the importance of rural telecommunications, a separate section has been included in this chapter with more details.

Major trends in telecommunication technology

Technological change is both the cause and a consequence of economic and social development. Technology change creates new products and services, sustains demand for existing services by reducing costs of production, thereby lowering the price to consumers. At the same time, economical and social development creates a requirement for constant technological change because of the need to develop new markets and pressure to compete in the provision of services and products to those markets. **Technological Changes; Medium Term Outlook**

The telecommunication industry has undergone enormous technological changes in the past decade. Some of the major trends in telecommunication technologies showing the medium term outlook are highlighted in the table below.

Technology	***2000***	***2005***	***2010***
Transmission	Hybrid copper/fiber systems will increase use of fiber in inter-exchange networks. Extensive use of local area network. Availability of speeds up to 16 STM1	High capacity optical fiber will be in all parts of the network, DWDM will be widely used.	Integration between information, communication and broadcasting in the transmission network
Switching systems	Systems are almost fully digitalized. Extensive use of bridges and routers to link LANs and WANs ATM is used as a network technique.	ATM will be used extensively also IP -based networks shall be used, data, voice and multimedia.	IP-networks will become the natural choice for scalability of IP and QoS will be the main issue
Mobile	Digital cellular radio and PCS technique are widely used in mobile radio, and also mobile satellite communication systems are introduced. Dual band terminals are now available. WAP technology is being introduced.	GPRS technology will be widely used, IMT-2000 will be put into service, and 3G technology will take place.	IMT-200 will predominate globally utilizing 3G technology.
Satellite	Satellite for national, regional and international communications and broadcasting are launched. LEO and MEO satellite are available.	Satellite offering multimedia communications are to be launched, more LEO and MEO systems are introduced for global coverage.	More powerful satellite offering mobile computing services, intersatellite links established between satellites of different systems allowing integration of services.
Data/text communications	Frame Relay and ATM technologies are extensively used. IP -networks are widely used.	Packet mode techniques shall be widely used	Data will be integrated with other services (voice, video and multimedia) towards a multiservice platform.

Present situation

The development of telecommunications of all kinds has progressed worldwide in an exponential manner. When looking at the growth of teledensity, the Arab region has increased teledensity by 6% a year compared to an 18% increase per year in Asia. Growth has been moderate with a teledensity of 3.3% in 1990 and 4.3% in 1995.

It is clear that there have been rapid changes in telecommunication technology since the 1960's, from analogue motor-driven (step-by-step) systems to crossbar and semi-electronic switching systems and then to the fully digital systems that are being installed in all countries of the region, paving the way for the new technological services.

For many reasons, the development of telecommunications has differed greatly in the region, from one country to another. The wealth of the various countries is very different; populations vary from less than 400,000 to over 60 million. And country areas vary from 688 to over 2.5 million square kilometers. It is obvious that such differences have many impacts on the financial resources required for providing teleservices throughout a country and the rapidity with which demand can be met.

Within Arab states, there are three groups of countries in terms of telecommunication development: the Gulf countries with teledensities well above the world average and where almost every household has a telephone; the majority of the Arab countries with a teledensity between the World and Arab States average; and the least developed Arab countries with a teledensity below the Arab States average. These distinctions are mirrored by the distribution of wealth in the region; the higher a country's income, the better developed its telecommunication network. What is revealing about the Arab States is that only a few countries have levels of telecommunication development that match their incomes. This suggests that the region's level of economic development can support much higher levels of telecommunication access.

Investment Requirements

The Arab states are a microcosm of the diversities in global telecommunication development. The Gulf States have been able to finance equipment import so that their networks are most fully digital with high subscriber penetration and advanced services such as cellular radio and packet-switched data communications.

Investment funding has been crucial for the telecommunication success stories in most Arab States in the 1990's. Multilateral and bilateral loans and foreign direct investment fuelled high telephone line growth in Morocco, Syria and the rapid development of Egypt and Lebanon cellular networks. But these are rare examples. Apart from the Gulf States that have high levels of telecommunication development and are capable of self-financing their needs, few countries in the region have the financial resources for rapidly growing their networks to meet the needs of the users.

If the individual telecom development plans of the region are to be realized, then teledensity will rise from 7.25 today to 11.4 by the year 2005. This moderate growth (14.4%) will require an estimated investment of 18 billion US$. It is projected

that only 11 billion USS will be available internally from traditional sources, leaving a gap of 7 billion US$.

New Facilities for Operation and Maintenance

If the development of digital technology and computer hardware and software has created a very powerful tool to improve and economize human recourses for the operation and maintenance of network and services. With the centralization of maintenance in national or district centers of the Arab countries, supervision of services can be maintained continuously with minimal supervisory staff. Recorded trouble can be detected, often before it becomes critical, and maintenance personnel can be sent to clear the problems.

Such tools monitor all traffic and routing of calls, warn if the quality becomes critical due to call repetitions, excessive rerouting, frequent busy conditions on circuits and/or terminations, and provide a very transparent picture of how the operation of services is functioning.

Manufacturers are now very active in developing such facilities attached to the equipment delivery. It is extremely important to include this in contracts, because adding such facilities later may e complicated and will typically be more expensive.

Telecommunication Network Development and policy

Rural telecommunications

Traditionally, the term "rural" is applied to the countryside or to sparsely population areas. However, population concentration is not the only determining factors in defining rural area. A rural area, generally, consists of scattered settlements, villages and small towns, exhibiting one or a combination of the following characteristics:

A - scarcity or absence of public faculties such as a reliable electricity supply, water, access roads and regular transport;

B - population primarily concerned with several and basic needs and with an insufficient number of locally available qualified technical staff;

C - difficult topological conditions (deserts, and mountainous areas) which are obstacles to the construction of normal terrestrial links;

D - adverse climate conditions which make critical demands on the survival and maintenance of equipment;

E - the need for telecommunications dictated by socio-political considerations and not at least in the short term by considerations of profit;

F - spares and scattered population with relatively poor and temporary housing;

G - scarcity of health and education facilities, currently hindered owing to lack of communications;

H - economic activity limited to basic vocations such as agriculture, fishing and cottage industries.

Issues and features of rural telecommunications

It is generally recognized that rural telecommunications cannot produce sufficient revenue to recover capital and operational costs quickly. On average, according to an ITU study, a rural telephone costs five times more to install than urban telephone. Hence, on a purely financial basis, this part of the network is not profitable in the short term. As a result, rural telecommunication projects, which are financially less profitable in direct income to begin with but which in the long run are perhaps more important from an economic and social point of view, are given less attention. Therefore, there is often a large gap between the number of telephones in rural areas and the number in urban areas in many countries of the world.

One of the main reasons for the bias against according priority to rural telecommunications in national investment plans could be the fact that few financial analysts and probably fewer decision-makers in developing countries are fully aware of the indirect benefits of investing in rural telecommunications. Once rural telecommunication services, have been provided, the benefits to rural society will undergo a gradual but steady enhancement, leading to expanded national markets and considerable industrial growth. Studies made in various countries suggest very clearly that rural telecommunications are extraordinarily important from a socio-economic point of view.

The rural network has specific features. In general, common equipment is designed for capacity significantly above the requirements of rural areas. Therefore, specific equipment with a lower capacity should be considered in order to reduce the costs per subscriber. Despite the use of specific equipment, investment and operation costs per subscriber are higher in rural areas. For these reasons, high-level policy makers within the framework of a social and economic development program often decide investments in rural areas, 'physically, the rural network is not limited to the connection of subscriber's lines. It can include:

- switching equipment: concentrators, local switches, primary trunk center (possibly combined with a local switch);
- transmission equipment and facilitated: for the connection of dispersed subscribers (radio system mostly), and other systems to interconnect switches (such as cable, microwave or fiber-optic cable);
- outside plant network, including all types of cables (overhead, direct, buried or in ducts);
- small-capacity earth station that can serve remote areas with relatively reduced investment: in some cases, even individual isolated subscribers can serve this way.

Services offered in rural areas may not be limited to basic telephone and telex services, but new services such as data transmission and/or leased circuits may be considered.

Owing to the difficulty of forecasting long-term demand, planning may be geared to meeting medium-term needs. However, the concept of a rural network must

be envisaged as a part of the overall countrywide network to optimize design and costs.

Present and future technology and systems for rural telecommunications

The recent developments in telecommunication technology, ranging from small, low-cost digital exchanges for rural applications to satellite transmission systems, both fixed and mobile, now make it possible to build up relatively inexpensive, high quality telecommunication networks even in the most remote regions in the world. Unfortunately, there is no one single technical solution suitable to all situations. The development of rural network calls for a b

Switching Equipment

Generally, there are two different approaches, which can be used to establish the switching structure in rural networks. The first approach is based on installing a few medium or large digital exchanges with up to several thousand lines and numerous small stand-alone digital exchanges. The second approach assumes numerous small stand-alone digital exchanges) i.e. remote switching unit, RSU) of small, medium and even large capacity connected by PCM links to the nearest main (parent) exchange.

Previously, the rural network consisted of a branch structure, dividing the rural area into a large number of operationally independent zones connected by low-capacity analogue transmission systems. Now, with the advent of digital switching, it is possible to install a high-capacity parent exchange to which RSUs (with capacitates ranging from 100 to 5000 or more lines) are connected by means of digital transmission systems. This concept, which is also used in the national network, is being applied to the development of the rural switching structure. The most obvious advantage is that four-wire switching is extended through the network and brought close to the subscribers. Thus, an exchange area can be extended with a minimum cost for the subscriber-line network. In addition, identical equipment can be deployed through out the total network, giving clear advantages in operation and maintenance.

Remote Switching Units

In planning the use of RSUs in a rural network, the following points should be taken into consideration:

A - The use of integrated digital switching and transmission is essential;

B - Identical or compatible switching systems should be used in rural areas as in other parts of the network;

C - The RSU should offer the same facilities as an autonomous exchange, including the possibility of connecting all types of subscriber lines and terminals;

D - The system should be capable of handling segregated numbering and charging;

E - The possibility of placing RAUs is transport containers or in cabinets without air conditioning should be considered;

F - The RSU should be capable of conversion to an autonomous exchange when traffic demand increases;

G - The RSU should provide basic local telephone service if the line with the parent exchange is broken.

In addition, the RSU should satisfy a number of special conditions, including the following:

a) Economical operation, even for a small number of subscribers;

b) Unattended operation, self- supervision, remote supervision and remote fault signaling;

c) Environmental protection (against dust, excessive temperature, humidity);

d) Ease and speed of installation;

e) Modular design for easier maintenance;

f) Suitability of operation for different types of primary power supply;

g) Low power consumption.

Transmission systems

Rural subscribers are connected to the primary center through transmission systems consisting of distribution, transfer and trunking functions. The distribution function identifies the establishment of individual links between the subscriber of a given group and the collection point.

A transmission system is said to be employed for distribution when the voice channel terminals are located, at least in the ideal case on the subscriber's premises. The distribution function can be implemented with and without concentration, depending on whether the channels are assigned to the individual subscribers on a fixed or a demand assignment basis.

A transmission system will be identified as employed for transfer when its function is to convey two or more voice channel along the route. The transfer function may be implemented either with or without concentration depending on whether voice channels actually transmitted are equal to or less than the transferred channels.

The subscriber network in the rural are is realized by combining transfer system with distribution systems. In general, the distribution and transfer functions in the rural network will realized by two subscriber system:

a) With concentration, using point-to-multipoint radio system;

b) Without concentration, using secondary buried and aerial cables systems.

The trunking function identifies the establishment of circuits between the local exchange and a primary center, that is, between the RSU and its main (parent) exchange. The trunking function can be realized using different transmission media such as:

a) Digital radio-relay systems;

b) Satellite systems;

c) PCM cable digital multiplex system;

d) Optical fiber systems;

e) Other wire means, if justified economically.

For rural areas, digital radio-relay systems are considered to provide the best option the transmission medium although, depending on the terrain and other factors (such as existing pole routes). Optical fiber system can also provide a cost effective solution for the prevision of rural trunk circuits. Except for short routes over which metallic pairs already exist, PCM systems should not be considered. Satellite systems could be considered for the connection of extremely remote communities.

Fixed and mobile satellite communication offers a feasible alternative to digital radio conversation astern for provision of telephone service to remote and sparsely populated areas. They have three features that may offer potential advantages over terrestrial techniques for cretin applications; firstly, it can reach all parts of a country with almost equal effectiveness and for roughly the same cost. Secondly, once a signal has been beamed to the satellite, it can be received at as many locations as needed by simply adding the receiving equipment. Depending on the network size and locations, the satellite can broadcast a single more cheaply than by using a landline. Thirdly, a channel through satellite may be used between two locations, and then another location and so on, this rapid flexibility is a feature that terrestrial systems do not have.

Thin Route-on-Demand is a digital demand assignment multiple access (DAMA) solution for switching telephony services. It provides dynamic satellite circuit sharing and switching capabilities for greater efficiencies in the utilization of the space segment. These efficiencies are passed on to the user who is charged on the basis of the amount of satellite capacity actually used, on a per-minute basis. This service is being introduced on a global basis by INTELSAT. Its satellites are primarily designated to carry public telecommunications services.

Thin Route-on-Demand provides 16kbit/s ITU-T G728 LD-CELP (low Delay Code Excited Liner Prediction) voice encoding for speech, facsimile, and voice band data. Usage is tariffed on a pay-per-minute basis for answered calls. A wide range of earth station sizes is accommodated, including very small Aperture Terminals (VSATs) down to 1.8m diameter.

While international switched telephony is mainstream application. Thin route-on-Demand provides a very flexible and cost-effective solution for domestic telecommunications requirements, including rural networks. Using the DAMA platform's sub networking capabilities, domestic network operators could save implementation costs for dedicated network management operations.

Thin Route-on Demand service is therefore an ideal application, for countries that need to establish or enhance rural network services. The Arab countries can establish rural network nodes on an incremental, as needed basis. Low-cost very Small Aperture Terminals (VSATs) can be deployed to rural and remote areas, existing gateway earth stations of the Arab countries can be utilized to provide the entry points into the PSTN for voice, fax, and data communications services between the hard-to-reach sites and gateway facilities.

Thin Route-on-Demand service enables integration of a country's international and domestic rural communications requirements into one, cost-effective, reliable,

and easy to use satellite network. This network is sufficiently flexible to expand and support aggregation and incremental growth of international, domestic or both, rural communications requirements. The DAMA platform, with its low entry costs, can facilitate the development of a comprehensive rural services system, capable of supporting basic voice and other applications such as distance learning and telemedicine.

Data distribution and collection for remote areas using micro terminals

Many industries and government organizations depend critically on their ability to distribute and gather information to and from remote places. A globally interconnected satellite network which provides data and voice coordination channels between small inexpensive terminals and a large central hub would prove an indispensable tool for achieving these objectives in an efficient manner. Internet is a digital service, which is the ideal system for light traffic streams because it is based on low costs, and very small terminals (VSATs), which typically range in size from 0.6 to 2.5 m.

SAT terminals are in practice well suited for applications in rural and remote areas because they are all, lightweight, and easily transportable and can operate without large amounts of primary electrical power. Internet may be used for international or domestic applications.

Satellite is clearly the transmission medium for implementing data broadcasting networks. Cost-effectiveness is achieved as well as by using VSAT located on the customer's premises. Such operations ay be relatively and easily installed and modified, particularly when compared with terrestrial networks in many remote areas.

Optical fiber cable links for rural applications

The introduction of optical cables in rural areas requires fast, simple and cost-effective installation to bring the optical system with in a cost-effective range. For this, it would be possible to use the existing railway and power utility routes to install the optical fiber cable. Thus, costs would be minimized or shared. The results of installed links in some countries show that such fiber links can be opened at least with the same availability as ducts or buried cable routes.

Communication charging

Services in rural areas should not be charged on a cost basis. At most, since subscribers in such areas are some distance from their home exchanges, they may be considered merely part of the charge zone furthest away from the home exchange zone.

Introduction of New Technologies and Associated Services

Although, in some countries, telecommunication networks are basically of the analogue type, a big step has been made to digitized telephone networks. It is recommended that countries discontinue purchasing analogue equipment for expansion purposes. There are several switched telephone network digitization

scenarios and the ITU has conducted valuable studies on the subject. Each country should adopt a scenario that best suits its situation, but on sound economic analysis and fundamental plans.

All Arab countries now consolidate their digitization plan with a set of realistic targets for the achievement of complete network digitization and subsequent establishment of integrated services.

Asynchronous Transfer Mode (ATM)

Telecommunications technologies typically dedicated physical lines, circuit switching techniques, and small, fixed-size frames to carry voice traffic. This connection oriented, circuit-switching technology generates traffic of uniform length at regular time sensitive intervals.

Hence, time -division-multiplexing (TDM) technologies are typically used for handling voice traffic, TDM uses communications channels that are segment into fixed periods of time called frames. Frames are further divided into a fixed number of time slots within each frame for equal duration.

Each user is assigned one or more time slots within each frame for exclusive use. The time slot allocated for each user occurs at precisely the same time in every frame. Since the time slots allocated for each user occur at precisely the same time in every frame.

Since the time slots are synchronous, TDM is some times referred to as Synchronous Transfer Mode (STM). A user can access the TDM communications channel only when time slots allocated to it are available.

If no user traffic is ready to send when the designated time slot occurs, that time slot is simply unused. Similarly, a user sending a burst of traffic that exceeds the capacity of the designated time slots in any given frame cannot use additional slots, even if such slots are idle. Consequently, a delay will occur before the remaining user traffic can be transferred.

Carrying non-voice data over telecommunications networks is very inefficient, requiring telecommunications users to acquire more dedicated bandwidth capacity for their voice applications than they typically use on a regular basis. Thus, increasing bandwidth and adding special facilities to relive network bottlenecks create expensive idle capacity during periods of low network utilization.

ATM cell relay technology typically supports multiple traffic types (data, voice, and video) while addressing many of the pressing concerns of users of both public and private network, such as the following:

- Need for flexibility and diversity of communications applications;
- Need to integrate network services;
- Need to accommodate future network growth/enhancement.

In ATM delay-tolerant traffic (such as user data) can be freely intermixed with time sensitive traffic (such as voice or video data). In ATM communications. ATM provides transmission bandwidth to users on demand access to the channel when it is available.

Digital subscriber Line System (xDSL)

Considering the widespread existence of copper plants, and the new service requirements for higher bandwidth, digital services can be offered over existing copper wire subscriber local loop using DSL modems which can support very high speeds in both symmetric and asymmetric modes, and thus overcoming the bandwidth limitation of Co-wire lines.

The following table shows the typical distance ranges and the expected data bit rates, as well as different applications for digital subscribing line.

NAME	MEANING	DATA RATE	RANGE (KM) FOR 0.4MM DTA	APPLICATION
DSL	Digital Subscriber Line	160Kbps	5.0	ISDN service Voice and data comm.
HDSL	High data rate Digital Subscriber Line	1.544Mbps 2.048 Mbps	3.5	T1/E1 service Fodder plant, WAN, LAN access, server access
SDSL	Single Line Digital Subscriber Line	1.544Mpbs 2.048 Mbps	3.5	Same as HDSL plus premises access for symmetric services
ADSL	Asymmetric Digital Subscriber Line	16to640Kbps(UP Link) 1.5 to 9 Mbps (Down Link)	3.5	Internet access, Video demand, simplex video, LAN access, interact multimedia
VDSL	Very high data rate Digital Subscriber Line	1.5 to 2.3 Mbps (UP Link) 13 to 22 Mbps (Down Link)	0.3	Same as ADSL plus HDT

Wireless Local Loop (WLL)

The rapid dropping cost and high capability of radio technology is making wireless access increasingly attractive. It requires neither civil infrastructure non-land servitude, and consequently implementation time is comparatively very short.

There is a number of different WLL technologies. The market is sorting these into mainstream and peripheral products. In the mainstream we find three categories linked to distance, subscriber/traffic density and terrain. There are 3 main categories, each of which is dominated by different technology.

a) **Long Range, Low Density:**

This category is used for small isolated communities such as rural villages, mines and farms. The technology of choice is TDMA (time division multiple access) PMP (point to multi-point). This technology is the most expensive of all the WLL technologies but has the required range using high gain antennas. Very often where

there are clusters of subscribers, the final connection is made with copper wires. Some systems derived from an early cellular design have limited roaming capability within range of the base station.

b) **Short Range, High Density:**

Generally speaking, radio is unsuited for providing high traffic capacity due to limitations in frequency spectrum. To do it, frequencies have to be re-used often and simultaneous connections on the same often | may not interfere with one another. This is why these technologies are mostly limited to short range. Outside densely populated towns, this is seldom problem. The leading mainstream technologies in this category today are DECT& PHS. Less mature is CDMA (Code Division Multiple Access). CDMA works on the principle of spread spectrum. This was developed by the military to counter jamming. It broadcasts all he signals across the full available bandwidth and discriminates between them by attaching a code to each which is decrypted by the receiver.

c) Medium Range, Medium Density:

This category is for now the least exploited of the three for WLL access. It seems to be the best suited for CDMA technology, which is less handicapped by short-range limitations as inter-channel interference is less of a problem. Two standards for CDMA are evolving. The first, IS-95, comes from the standard used for the US digital cellular system. This is suitable only for voice and low speed data communication. The other, B-CDMA, was to replace copper leads and has wide -band capabilities up to ISDN specifications (144KB).

Telecommunication Channels During Emergencies

HF/VHF Radio

HF radio is used for communications over much longer distances, typically over 100 km. It can be used to carry voice traffic and data transmissions for office-to-office communications. To counteract the problem of fading, either space diversity (distantly separated receiving antennas), frequency diversity (simultaneous transmission of 2 or more frequencies), or polarization diversity (simultaneous transmission of different types of polarization) or a suitable combination of them.

VHP radio is widely used for local communications since the radio waves need a clear line-of-sight propagation path. VHP has the advantage of having small size equipment and antennas, which makes it I easy for the field workers during emergencies, to carry "walkie-talkie" type handsets.

Satellite Channels

Advanced technologies have made it possible to use very small aperture terminal (VSAT) that can be installed and operated within a very short period of time. These terminals are relatively of small size and weight, and hence can be used effectively and efficiently during disasters.

Mobile satellite communication networks are emerging, and advanced technologies in this field had resulted in personal mobile satellite communication systems that are excellent tools for effective and coordinated management of international humanitarian aid, since the terminal equipment are handheld. The Global Mobile Personal Communications by Satellite (GMPCS) system shall extend the number of applications available to field workers as well as reducing the cost of using fixed satellite based systems.

E-mail and World Wide Web

Electronic mail (e-mail) is a useful tool for disaster relief communication because it represents a reliable and a low cost way to keep in contact with people in the field, as well as those working in other organizations around the world, regardless of time zones. The Internet and the World Wide Web are now being used by aid agencies to disseminate information that can be revised quickly and regularly to keep everyone up-to date with the status of relief operation.

The Global Maritime Distress and Safety System (GMDSS)

The International Maritime Organization (IMO) has adopted an integrated telecommunication system for disaster relief at sea. This system is called the Global Maritime Distress and Safety System (GMDSS). It has been brought into service in i992 and become mandatory since 1st February 1999. This system makes use of advanced terrestrial as well as satellite communication technologies. It helps in search and rescue operations at sea during disasters, which results in enhancing safety of life at the sea.

Universal access means that any individual, regardless of social status, should have access to telecommunication services at affordable cost.

The more remote from urban centers the more the need for access to modern information and communication technologies.

Expansion of telecommunication infrastructure and appropriate policies are required to stimulate growth in remote areas where most natural resources are.

Access can be provided initially by means of public call offices (PCO) capable of evolving at a later stage into multipurpose community telecentres.

The concept of multipurpose community telecentres (MCIs) is to establish a shared information and communication (1C) service facility in rural and remote areas.

Community teleservice centers " telekiosks", provide information technology and telecommunication facilities, user support and training for the majority of the rural community inhabitants.

In addition to public telephone, fax and voicemail services provided by MCTs, those could also provide access to data networks (e.g. Internet), for e-mail, file transfer, access to electronic libraries and databases, market and price information, environment, as well as teletraining and telemedicine.

IMT-2000 ITU has been working long and hard to develop a flexible radio access standard known as International Mobile Telecommunications-2000 (IMT-2000). An important goal of IMT-2000 is to ensure that the various satellites, terrestrial, fixed and mobile systems being developed and deployed converge towards true global service capabilities.

As such, IMT-2000 seeks to provide universal coverage by enabling mobile terminals to roam seamlessly between multiple networks. The concept of a small lightweight and convenient "pocket communicator is a fundamental part of IMT-2000. Moreover, IMT-2000 global standards are intended to support a very wide range of terminal products, from simple messaging units to desktop multimedia terminals.

According to Radio Regulation No. S5.388, IMT-2000 systems will operate in the bands 1885-2025 and 2110-2200 MHz, with the satellite component limited to the bands 1980-2010 MHz and 2170-2200 MHz ITU World Radio Conference that was held in Istanbul -2000 the daunting task of identifying suitable bands for additional spectrum on the basis of the technical studies being carried out within the ITU's Radio communication sector (ITU-R).

With almost five million new mobile users a month, wireless access is poised to overtake fixed access to global telecommunications very early in the 21st century. However, only appropriate ITU global standards and harmonized spectrum assignment by the various national and regional authorities can propel the world from today's collection of varying mobile systems - each with its own standards, range of services and allocation of radio spectrum - to a future of global mobile personal communications can truly provide communications anywhere, anytime.

Recommendations

I. General principles

In order to ensure the harmonious development of the telecommunication network at the national, regional, and sub-regional levels, and the most efficient expansion of telecommunication services, it is recommended that the Arab States accord high priority to the following:

1. Elaboration of strategies for telecommunication development which combine the concern of "universal services" and national economic growth with the concern of specific user groups for access to national, regional and international telecommunication networks and services.

2. Development of specific strategies for extending services to rural and less privileged areas.

3. Establishment of the necessary legislation and regulatory framework to facilitate necessary investment required for service development and network expansion.

4. Removal of constrains on telecommunication operations to make service providers responsive to needs, while not neglecting the goal of "universal telephone services".

5. Definition of appropriate terms and conditions to allow domestic, regional and international private sector participation in investment and service provision.

6. Establishment of transparent "rules and procedures" as pertains to licensing requirements, trifling, interconnection, etc.

II. Development of telecommunication networks and information infrastructure

It is now accepted fact that voice, data, text; fixed image ad moving picture signals can be carried over a single transmission medium. If existing networks are to avoid playing a secondary role in the provision of multimedia services, it is recommended that measures to be taken to ensure their "migration" to new types of networks suited to the needs of electronic services (multimedia), at both the national and international levels.

III. New technologies and telecommunication network development

New technologies now exist which have the capability to make telecommunication services available rapidly and at a much lower cost. In the near future, the use of communication satellites will add to the range of mobile services available. In the Arab States, this will only be possible if proper arrangements are made to interconnect new systems with existing cellular networks and if interworking capabilities are ensured between existing fixed networks and mobile networks. Cooperation is recommended at the regional level, with a view to harmonious introduction of these services, whose roaming capabilities offer an additional opportunity for network and service interconnection in the Arab states.

IV. Interconnection of telecommunication networks

The emergence of new providers of telecommunication and multimedia services will mean increasing coexistence of public and private networks, both at the national and international level. When developing telecommunication networks, it is recommended that technical and operational measures be taken to promote an open network; such measures are essential for fair competition between development partners.

V. Regional cooperation

It is recommended that cooperation structures and mechanisms, on a regional and then international level, be strengthened to ensure sub-regional network integration, in particular, as technical interface problems can only be properly solved through active and pragmatic cooperation fall parties.

VI. Rural telephony

Comprehensive national development is only possible if rural populations are involved in the process, since telecommunications are a factor for development. It is recommended that the Arab States keep in mind the needs of the rural areas and consider the introduction of new technologies capable of bringing down the cost of telecommunication infrastructure in rural areas significantly.

II. GLOBAL SYSTEM FOR MOBILE COMMUNICATION (GSM)

When the acronym GSM was used for the first time in 1982, it stood for *Groupe Speciale Mobile,* a committee under the umbrella of *Conference Europeenne des Posies et Telecommunications* (CEPT), the European standardization organization.

The task of GSM was to define a new standard for mobile communications in the 900 MHz range. It was decided to use digital technology. In the course of time, CEPT evolved into a new organization, the European Telecommunications Standard Institute (ETSI). That, however, did not change the task of GSM. The goal of GSM was to replace the purely national, already overloaded, and thus expensive technologies of the member countries with an international standard.

In 1991, the first GSM systems were ready to be brought into so-called friendly-user operation. The meaning of the acronym GSM was changed that same year to stand for Global System for Mobile Communications. The year 1991 also saw the definition of the first derivative of GSM, the Digital Cellular System 1800 (DCS 1800), which more or less translates the GSM system into the 1800 MHz frequency range.

In the United States, DCS 1800 was adapted to the 1900 MHz band (Personal Communication System 1900, or PCS 1900). The next phase, GSM Phase 2, will provide even more end-user features than phase 1 of GSM did.

In 1991, only "insiders" believed such a success would be possible because mobile communications could not be considered a mass market in most parts of Europe.

By 1992, many European countries had operational networks, and GSM started to attract interest worldwide. Time has brought substantial technological progress to the GSM hardware. GSM has proved to be a major commercial success for system manufacturers as well as for network operators.

How was such success possible? Particularly today, where Code Division Multiple Access (CDMA), Personal Handy Phone System (PHS), Digital Enhanced Cordless Telecommunications (DECT), and other systems try to mimic the success of GSM, that question comes to mind and is also discussed within the European standardization organizations. The following factors were major contributors to the success of GSM:

- The liberalization of the monopoly of telecommunications in Europe during the 1990s and the resulting competition, which consequently lead to lower prices and more "market";
- The knowledge-base and professional approach within the Groupe Speciale Mobile, together with the active cooperation of the industry;
- The lack of competition: For example, in the United States and Japan, competitive standards for mobile services started being defined only after GSM was already well established.

The future will show which system will prevail as the next generation of mobile communications. ETSI and the Special Mobile Group (SMG), renamed GSM, are currently standardizing the Universal Mobile Telecommunication System (UMTS). Japan is currently improving PHS.

The various satellite communications systems that now push into the market are another, possibly decisive, factor in providing mobile communications on a global basis.

1.1. The System Architecture of GSM: A Network of Cells

The basic idea of a cellular network is to partition the available frequency range, to assign only parts of that frequency spectrum to any base transceiver station, and to reduce the range of a base station in order to reuse the scarce frequencies as often as possible. One of the major goals of network planning is to reduce interference between different base stations.

Anyone who starts thinking about possible alternatives should be reminded that current mobile networks operate in frequency ranges where attenuation is substantial, hi particular, for mobile stations with low power emission, only small distances (less than 5 km) to a base station are feasible.

Besides the advantage of reusing frequencies, a cellular network also comes with the following disadvantages:

- An increasing number of base stations increases the cost of infrastructure and access lines.
- All cellular networks require that, as the mobile station moves, an active call is handed over from one cell to another, a process known as handover.
- The network has to be kept informed of the approximate location of the mobile station, even without a call in progress, to be able to deliver an incoming call to that mobile station.
- The second and third items require extensive communication between the mobile station and the network, as well as between the various network elements. That communication is referred to as signaling and goes far beyond the extent of signaling that fixed networks use. The extension of communications requires a cellular network to be of modular or hierarchical structure. A single central computer could not process the amount of information involved.

1.2. An Overview on the GSM Subsystems

A GSM network comprises several elements: the mobile station (MS), the subscriber identity module (SIM), the base transceiver station (BTS), the base station controller (BSC), the transcoding rate and adaptation unit (TRAU), the mobile services switching center (MSC), the home location register (HLR), the visitor location register (VLR), and the equipment identity register (EIR). Together, they form public land mobile network (PLMN).

1.2.1. Mobile Station

GSM-PLMN contains as many MSs as possible, available in various styles and power classes. In particular, the handheld and portable stations need to be distinguished.

1.2.2. Subscriber Identity Module

GSM distinguishes between the identity of the subscriber and that of the mobile equipment. The SIM determines the directory number and the calls billed to a subscriber.

The SIM is a database on the user side. Physically, it consists of a chip, which the user must insert into the GSM telephone before it can be used. To make its handling easier, the SIM has the format of a credit card or is inserted as a plug-in SIM. The SIM communicates directly with the VLR and indirectly with the HLR.

1.2.3. Base Transceiver Station

A large number of BTSs take care of the radio-related tasks and provide the connectivity between the network and the mobile station via the Air-interface.

1.2.4. Base Station Controller

The BTSs of an area (e.g., the size of a medium-size town) are connected to the BSC via an interface called the Abis-interface. The SC takes care of all the central functions and the control of the subsystem, referred to as the base station subsystem (BSS) The BSS comprises the BSC itself and the connected BTSs.

1.2.5. Transcoding Rate and Adaptation Unit

One of the most important aspects of a mobile network is the effectiveness with which it uses the available frequency resources. Effectiveness addresses how many calls can be made by using a certain bandwidth, which in turn translates into the necessity to compress data, at least over the Air-interface. In a GSM system, data compression is performed in both the MS and the TRAU. From the architecture perspective, the TRAU is part of the BSS. An appropriate graphical representation of the TRAU is a black box or, more symbolically, a clamp.

1.2.6. Mobile Services Switching Center

A large number of BSCs are connected to the MSC via the A-interface. The MSC is very similar to a regular digital telephone exchange and is accessed by external networks exactly the same way. The major tasks of an MSC are the routing of incoming and outgoing calls and the assignment of user channels on the A-interface.

1.2.7. Home Location Register

The MSC is only one subcenter of a GSM network. Another subcenter is the HLR, a repository that stores the data of a large number of subscribers. An HLR can be regarded as a large database that administers the data of literally hundreds of thousands of subscribers. Every PLMN requires at least one HLR.

1.2.8 Visitor. Location Register

The VLR was devised so that the HLR would not be overloaded with inquiries on data about its subscribers. Like the HLR, a VLR contains subscriber data, but only part of the data in the HLR and only while the particular subscriber roams in the area for which the VLR is responsible. When the subscriber moves out of the VLR area, the HLR requests removal of the data related to a subscriber from the VLR. The geographic area of the VLR consists of the total area covered by those BTSs that are related to the MSCs for which the VLR provides its services.

1.2.9. Equipment Identity Register

The theft of GSM mobile telephones seems attractive, since the identities of subscribers and their mobile equipment are separate. Stolen equipment can be reused simply by using any valid SIM. Barring of a subscriber by the operator does not bar the mobile equipment. To prevent that kind of misuse, every GSM terminal equipment contains a unique identifier, the international mobile equipment identity (IMEI). It lies within the realm of responsibilities of a network operator to equip the PLNM with an additional database, the EIR, in which stolen equipment is registered and so can be used to bar fraudulent calls and even, theoretically, to track down a thief (by analyzing the related SIM data).

1.3. The Main Points of This Report

Our report describes briefly the GSM subsystems, their structure, and their tasks. However, the focus of this report lies not on the GSM network elements themselves but on the interfaces between them. Among others, the following issues will be addressed:

- What signaling standards and what protocols are used to serve connection requests by mobile subscribers?
- How are the various interfaces utilized?
- What happens in case of errors?
- Although GSM uses available signaling standards, where are the GSM specific adaptations?

One has to remember that most of the signaling is necessary to support the mobility of a subscriber. All messages of the area mobility management (MM) and radio resource management (RR), in particular, serve only that purpose. Only a fraction of the exchanged messages are used for the connection setup as such, and those are all the messages that are related to call control.

A presentation of the Open System Interconnection (OSI) Reference Model is mandatory in a book in which the focus is on signaling.

Another focus of the text is on the application of the various protocols for error analysis. Which error indication is sent by the system and when? How is such an indication interpreted? What are the potential sources of errors?

A word on coding of parameters and messages should be added here: Coding of message types and other essential parameters are always included. However, because this book has no intention of being a copy of the GSM Recommendations, it deliberately refrains from providing a complete list of all parameters of all interfaces.

The value of protocol test equipment for error analysis and routine testing is indisputably high, but what help do programs for automatic analysis provide? Those questions will be answered as well. A large part of this book is taken up by a glossary, which provides descriptions of all abbreviations, terms, and processes that a reader may confront during work on GSM.

1.4. Signaling

The main focus of this report is on the signaling between the various network elements of GSM. The questions arise of what signaling actually constitutes and what it is used for. Although we do not want to go back to the basics of telecommunications to answer those questions, a number of basic explanations do seem necessary.

1.4.1. What is Signaling?

Signaling is the language of telecommunications that machines and computers use to communicate with each other. In particular, the signals that a user enters need to be converted to a format that is appropriate for machines and then transmitted to a remote entity. The signals (e.g., the identity of a called party) are not part of the communication as such, that is, they are not a payload or a revenue-earning entity.

Signaling is comparable to the pilots and the flight attendants on an airplane. The crew members are no "payload," but they are necessary to carry the payload. Another, perhaps more appropriate, illustration is to consider the now almost extinct telephone operator, whose function it was to carry out the signaling function and switching of a telecommunications system by connecting cables between the appropriate incoming and outgoing lines.

1.4.2. How is Signaling Performed?

When calls were set up manually, signaling consisted mostly of direct current impulses, which allowed a central office to determine the dialed digits. Some readers may still remember the rotary telephone sets, in which the impulses were created mechanically by the spin of the rotor. The situation changed completely with the entry of computer technology into telecommunications. The microchip utilized by telecommunications opens today, at the end of the twentieth century, a multitude of new signaling functionality, which was unthinkable even 20 years ago. Computers are the backbone of modern telecommunications systems.

This new technology makes mobile communications possible in the first place. The signaling requirements of modern mobile systems are so vast that the former technology would not have been able to manage them. Computerization, however, did not change much of the principle. As in the old days, electrical or optical signals are sent, over an appropriate medium (typically serially) and interpreted by the receiver. What did change is the speed of the transmission. The progress in this area has been exponential.

The smallest unit of a signal is called a *bit* and can, for example, be represented by an electric voltage, which a receiver can measure during a specified period of time. If the receiver measures the voltage as "low" over the specified time period, it interprets the value as a 0. If the voltage is "high", the receiver interprets the value as a 1. It does not matter which level represents which value, so long as both the sender and the receiver agree on which is which.

A sequence of bits allows the coding and sending of complex messages, which, in turn, allows a process to be controlled or information to be conveyed. Pulse

code modulation (PCM) is the worldwide process for transmission of digital signals. PCM is used to transmit both signaling data and payload. PCM is categorized into hierarchies, depending on the transmission rate. The PCM link of 2 megabits per second (Mbps) (one that is referred to frequently in this book) is only one variant of many.

By utilizing a time-division multiplexing technique, such a 2-Mbps PCM link can, among others, be partitioned into 32 independent channels, each capable of carrying 64 kilobits per second (Kbps). Another aspect of the change that the digital technology has enabled reveals its advantage only after a second look. Almost all signaling standards, like Signaling System Number 7 (SS7) and Link Access Protocol for the D-channel (LAPD) separate the traffic channel from the signaling or control channel. This is referred to as outband signaling, in contrast to inband signaling. In the case of inband signaling, all the control information is carried within the traffic channel. Although outband signaling requires the reservation of a traffic channel, it makes a more efficient use of resources overall. The reason for that lies in the reduced occupation time of the traffic channel, which is not needed during call setup. Both call setup and call release can be carried out for many connections via one control channel, since signaling data use the resources more economically. One 64-Kbps time slot out of a 2- Mbps PCM link typically is used for signaling data; a call setup consumes about 1 to 2 Kbps.

1.4.3. What is Signaling Used For?

The main task of signaling is still to set up and to clear a connection between end users or machines. Today, constantly new applications are added. Among them are automated database accesses, in which telecommunications systems call each other and which are fairly transparent to a caller, or the wide area of supplementary services, of which only call forwarding is mentioned here as an example. The glossary provides a list of all GSM supplementary services.

1.5. Representation of Messages

When working with protocol test equipment and in practical work, message names usually are abbreviated. Most GSM and ITU Telecommunication Standardization Sector (ITU-T). Recommendations list the well-defined abbreviations and acronyms, which this book also uses to a large extent. The complete message names and explanations can be found in the respective chapters.

Since a picture often expresses more than a thousand words, this book contains a large number of figures and protocol listings.

2. The Mobile Station and the Subscriber Identity

Module

The GSM telephone set and the SIM are the only system elements with which most users of GSM have direct contact. The GSM telephone set and the SIM form an

almost complete GSM system within themselves with all the functionality, from ciphering to the HLR.

2.1. Subscriber Identity Module

The SIM is a microchip that is planted on either a check card (ID-1 SIM) or a plastic piece about 1 cm square (plug-in SIM). Except for emergency calls, a GSM mobile phone cannot be used without the SIM. The GSM terminology distinguishes between a mobile station and mobile equipment. The mobile equipment becomes a mobile station when the SIM is inserted. There is no difference in functionality between the ID-1 SIM and the plug-in SIM, except for size, which is an advantage for the plug-in SIM when used in a small handheld telephone. Today, many network operators offer (at an additional cost) identical pairs of ID-1 SIM/plug-in SIM, so the same SIM can be used in a car phone and in a handheld telephone.

2.1.1. The SIM as a Database

The major task of *a* SIM is to store data. That does not mean that the data is only subscriber data. One has to differentiate between data types for various tasks. The most important parameters that a SIM holds are presented in Table 2.1. It should be noted that the list is not complete and that the SIM can also be used to store, for example, telephone numbers.

2.1.2. Advantage for the Subscriber

The SIM is one of the most interesting features for a user of GSM, because it permits separation of GSM telephone equipment and the related database. In other words, the subscriber to a GSM system is not determined by the identity of the mobile equipment but by the SIM, which always has to be inserted into the equipment before it can be used. This is the basis for personal mobility.

3. The OSI Reference Model

3.1. Reasons for Standardization

The Open System Interconnection (OSI) Reference Model was specified by ITU, in cooperation with ISO and IEC, and is documented in Recommendation X.200. Although the OSI model is applicable in many areas, it is used mostly in the area of communication between computers. Its purpose is to organize and formalize the communication method.

The basic idea of the OSI Reference Model is to separate the various parts that, in their totality, form a communications process. Separation of concerns is achieved by layering and modularization of transactions and tasks. This approach results from the following reasoning:

- The use of microprocessors in telecommunications not only allowed for the creation of new services, but at the same time increased the requirements on communications of exchanges and computers.

• When humans communicate by means of telephone or letters, they do not want to be concerned with the details of the physical transfer of the information. They just want to communicate. The same applies to the layers of the OSI Reference Model, in which each layer has a fixed role in the process of communications.

• A computer is a modular structure, which starts with the transistor on the lowest level and, with modularity built on top of modularity, ends up as a super-computer. To use such a system becomes easier when the tasks themselves can be modularized.

• Telephone systems are used for many applications. These applications became possible only because the application itself had become more independent of the process of pure data transmission. Modems and fax machines, for instance, rely on the functionality of the services of a lower layer and adapt their own functionality accordingly. The telephone network, on the other hand, is not concerned with the content or the representation of the transmitted data.

• The OSI Reference Model enables two products from different manufacturers to communicate. Each telephone set and every exchange can be regarded as network element A, B, or C. If, for example, the manufacturer of one network element implements all the functionality of a particular application and the second manufacturer implements only those functions that are necessary for a particular task, then, generally speaking, the two devices cannot be interconnected.

3.2. Layering in the OSI Reference Model

The OSI Reference Model breaks down or separates the communication process into seven independent layers. The following are the general "rules" of the OSI model:

• Two layers that lie above each other work independently. Each layer receives a service from the layer immediately below and provides a service to the layer immediately above. The lower layer does not care about the content of the received information. Consider the analogy of sending mail. The post office is not concerned about the content of a letter, which it has received to deliver. Its only concern is the address on the envelope, which it follows in order to make the delivery. This constitutes a service, which is independent of the contents of the letter;

• Each layer communicates directly only with the layers immediately below and above itself and indirectly with its peer layer at the remote end. Let us again refer to the post office analogy. Neither the sender nor the addressee is concerned about the details of the service, that is, about how the letter is routed, and neither the sender nor the addressee needs to communicate with the letter carrier. They only need to have access to a mailbox. The two parties communicate with each other by writing or reading the letter;

• If a communications process involves more than two network nodes, the intermediate network Node or nodes need only provide the functionality of Layers 1 through 3. Layers 4 through 7 are required at the end points of a

connection only. Going back to the letter delivery example, in this "communications process" all post offices and postal workers are involved only in transport and error-free delivery of the letter. All other parts of the communication process are available only at the sender and receiver sides;

- The protocols used for Layers 1 through 3 on the interface between A and B are not necessarily the same as those used on the interface between B and C. For example, Layer 2, between the BTS and the BSC in GSM, uses the LAPD protocol, while the SS7 protocol is used between the BSC and the MSC. In that case, network node B would represent the BSC.

3.3. Data Types of the OSI Reference Model

All messages exchanged between Layer *N* and Layer (N - 1) are called primitives. In practical work, except for measurements within a network element, there usually is no need to become involved in the inner workings of the primitives, it suffices to know that they exist and to have an idea of their function.

All message exchange on the same level (or layer) between two network elements, A and B, is determined by what is known as peer-to-peer protocol. Consequently, all messages that can be seen on any GSM interface between two nodes belong to the group of peer-to-peer protocols.

3.4. Information Processing in the OSI Reference Model

The tasks of the Layers 7 down to 2 mainly are to add processing information. When, for example, Layer 6 receives a primitive from Layer 7, it adds header information, which allows the "partner" layer on the other end to process the received data according to the appropriate peer-to-peer protocol. The partner layer is responsible for removing the header information. The obvious result is the increase in the data that needs to be transmitted.

3.5. Advantages of the OSI Reference Model

The major advantage of the OSI Reference Model lies in the fact that the various layers are independent of each other. What does independence in this context mean? It means that Layer N shares a common protocol with its peer Layer *N* and with the layers immediately above and below it but not with any other layers. The OSI Reference Model defines only the interface between them and not the way a certain layer is implemented. Therefore, it is, for example, irrelevant to a large degree how the physical signal transmission is achieved.

The transmission medium used for the data transfer may be cable, direct radio, satellite, or any other appropriate means.

That permits the design and use of modules on a general level, a statement that has to be tempered by the actual application. It certainly matters, with respect to the propagation delay, whether transmission is via cable or satellite, where the propagation delays may be substantial.

III. 7 LAYERS OF OSI MODEL

This chapter works with the next six chapters to act as a foundation for the technology discussions that follow. In this chapter, some fundamental concepts and terms used in the evolving language of internetworking are addressed. To the same way that this bock provides a foundation for understanding modern networking, this chapter summarizes some common themes presented throughout the remainder of this book. Topics include flow control, error checking, and multiplexing, but this chapter focuses mainly on mapping the Open System Interconnection (OSI) model to networking/internetworking functions, and also summarizing the general nature of addressing schemes within the context of the OSI model. The OSI model represents the building blocks for internetworks. Understanding the conceptual model helps you understand the complex pieces that make up an internetwork.

An internetwork is a collection of individual networks, connected by intermediate networking devices, that functions as a single large network. Internetworking refers to the industry, products, and procedures that meet the challenge of creating and administering internetworks.

The first networks were time-sharing networks that used mainframes and attached terminals. Such environments were implemented by both IBM's Systems Network Architecture (SNA) and Digital's network architecture.

Local-area networks (LANs) evolved around the PC revolution, LANs enabled multiple users in a relatively small geographical area to exchange files and messages, as well as access shared resources such as file servers and printers.

Wide-area networks (WANs) interconnect LANs with geographically dispersed users to create connectivity. Some of the technologies used for connecting LANs include T1, T3, ATM, ISDN, ADSL, Frame Relay, radio links, and others. New methods of connecting dispersed LANs are appearing everyday.

Today, high-speed LANs and switched internetworks are becoming widely used, largely because they operate at very high speeds and support such high-bandwidth applications as multimedia and videoconferencing.

Internetworking evolved as a solution to three key problems: isolated LANs, duplication of resources, and a lack of network management. Isolated LANs made electronic communication between different offices or departments impossible. Duplication of resources meant that the same hardware and software had to be supplied to each office or department, as did separate support staff. This lack of network management meant that no centralized method of managing and troubleshooting networks existed.

Internetworking Challenges

Implementing a functional internetwork is no simple task. Many challenges must be faced, especially in the areas of connectivity, reliability, network management, and flexibility. Each area is key in establishing an efficient and effective internetwork.

The challenge when connecting various systems is to support communication among disparate technologies. Different sites, for example, may use different types of media operating at varying speeds, or may even include different types of systems that need to communicate.

Because companies rely heavily on data communication, internetworks must provide a certain level of reliability. This is an unpredictable world, so many large internetworks Include redundancy to allow for communication even when problems occur.

Furthermore, network management must provide centralized support and troubleshooting capabilities in an internetwork. Configuration, security, performance, and other issues must be adequately addressed for the internetwork to function smoothly. Security within an internetwork is essential. Many people think of network security from the perspective of protecting the private network from outside attacks. However, it is just as important to protect the network from internal attacks, especially because most security breaches come from inside. Networks must also be secured so that the internal network cannot be used as a tool to attack other external sites.

Early in the year 2000, many major web sites were the victims of distributed denial of service (DDOS) attacks. These attacks were possible because a great number of private networks currently connected with the Internet were not properly secured. These private networks were used as tools for the attackers.

Because nothing in this world is stagnant, internetworks must be flexible enough to change with new demands.

Open System Interconnection Reference Model

The Open System Interconnection (OSI) reference model describes how information from a software application in one computer moves through a network medium to a software application in another computer. The OSI reference model is a conceptual model composed of seven layers, each specifying particular network functions. The model was developed by the International Organization for Standardization (ISO) in 1984, and it is now considered the primary architectural model for intercomputer communications. The OSI model divides the tasks involved with moving information between networked computers into seven smaller, more manageable task groups. A task or group of tasks is then assigned to each of the seven OSI layers. Each layer is reasonably self-contained so that the tasks assigned to each layer can be implemented independently. This enables the solutions offered by one layer to be updated without adversely affecting the other layers. The following list details the seven layers of the

Open System Interconnection (OSI) reference model:

- Layer 7 - Application
- Layer 6 - Presentation
- Layer 5 - Session

– Layer 4 – Transport
– Layer 3 – Network
– Layer 2 - Data link
– Layer 1 - Physical

Note A handy way to remember the seven layers is the sentence "All people seem to need data processing," The beginning letter of each word corresponds to a layer.

All - Application layer
People - Presentation layer
Seem - Session layer
To - Transport layer
Need - Network layer
Data - Data link layer
Processing - Physical layer

Characteristics of the OSI Layers

The seven layers of the OSI reference model can be divided into two categories: upper layers and lower layers.

The upper layers of the OSI model deal *with* application issues and generally are implemented only in software.

The highest layer, the application layer, is closest to the end user.

Both users and application layer processes interact with software applications that contain a communications component.

The term upper layer is sometimes used to refer to any layer above another layer in the OSI model.

The lower layers of the OSI model handle data transport issues. The physical layer and the data link layer are implemented in hardware and software. The lowest layer, the physical layer, is closest to the physical network medium (the network cabling, for example) and is responsible for actually placing information on the medium.

Protocols

The OSI model provides a conceptual framework for communication between computers, but the model itself is not a method of communication. Actual communication is made possible by using communication protocols. In the context of data networking, a protocol is a formal set of rules and conventions that governs how computers exchange: information over a network medium. A protocol implements the functions of one or more of the OSI layers.

A wide variety of communication protocols exist. Some of these protocols include LAN protocols, WAN protocols, network protocols, and routing protocols. LAN protocols operate at the physical and data link layers of the OSI model and define communication over the various LAN media. WAN protocols operate at the lowest three layers of the OSI model and define communication over the various wide-area media. Routing protocols are network layer protocols that are responsible

for exchanging information between routers so that the routers can select the proper path for network traffic. Finally, network protocols are the various upper-layer protocols that exist in a given protocol suite. Many protocols rely on others for operation. For example, many routing protocols use network protocols to exchange information between routers. This concept of building upon the layers already in existence is the foundation of the OSI model.

OSI Model and Communication Between Systems

Information being transferred from a software application in one computer system to a software application in another must pass through the OSI layers. For example, if a software application in System A has information to transmit to a software application in System B, the application program in System A will pass its information to the application layer (Layer 7) of System A. The application layer then passes the information to the presentation layer (Layer 6), which relays the data to the session layer (Layer 5), and so on down to the physical layer (Layer 1). At the physical layer, the information is placed on the physical network medium and is sent across the medium to System B. The physical layer of System B removes the information from the physical medium, and then its physical layer passes the information up to the data link layer (Layer 2), which passes it to the network layer (Layer 3), and so on, until it reaches the application layer (Layer 7) of System B. Finally, the application layer of System B passes the information to the recipient application program to complete the communication process.

Interaction Between OSI Model Layers

A given layer in the OSI model generally communicates with three other OSI layers: the layer directly above it, the layer directly below it, and its peer *layer in* other networked computer systems. The data link layer in System A, for example, communicates with the network layer of System A, the physical layer of System A. and the data link layer in System B.

OSI Layer Services

One OSI *layer* communicates with another layer to make use of the services provided by the second layer. The services provided by adjacent layers help a given OSI layer communicate with its peer layer in other computer systems. Three basic elements are involved in layer services: the service user, the service provider, and. the service access point (SAP).

In this context, the service user is the OSI layer that requests services from an adjacent OSI layer. The service provider is the OSI layer that provides services to service users. OSI layers can provide services to multiple service users. The SAP is a conceptual location at which one OSI layer can request the services of another OSI layer.

OSI Model Layers and Information Exchange

The seven OSI layers use various forms of control information to communicate with their peer layers in other computer systems. This control information consists of specific requests and instructions that are exchanged between peer OSI layers.

Control information typically takes one of two forms: headers and trailers. Headers are prepended to data that has been passed down from upper layers. Trailers are appended to data that has been passed down from upper layers. An OSI layer is not required to attach a header or a trailer to data from upper layers.

Headers, trailers, and data are relative concepts, depending on the layer that analyzes the information unit. At the network layer, for example, an information unit consists of a Layer 3 header and data. At the data link layer, however, all the information passed down by the network layer (the Layer 3 header and the data) is treated as data.

In other words, the data portion of an information unit at a given OSI layer potentially can contain headers, trailers, and data from all the higher layers. This is known as encapsulation.

Information Exchange Process

The information exchange process occurs between peer OSI layers. Each layer in the source system adds control information to data, and each layer in the destination system analyzes and removes the control information from that data,

If System A has data from software application to send to System B, the data is passed to the application layer. The application layer in System A then communicates any control information required by the application layer in System B by prepending a header to the data. The resulting information unit (a header and the data) is passed to the presentation layer, which prepends its own header containing control information intended for the presentation layer in System B. The information unit grows in size as each layer prepends its own header (and, in some cases, a trailer) that: contains control information to be used by its peer layer in System B. At the physical layer, the entire information unit is placed onto the network medium.

The physical layer in System B receives the information unit and passes it to the data link layer. The data link layer in System B then reads the control information contained in the header prepended by the data link layer in System A. The header is then removed, and the remainder of the information unit is passed to the network layer. Each layer performs the same actions; the layer reads the header from its peer layer, strips it off, and passes the remaining information unit to the next highest layer. After the application layer performs these actions, the data is passed to the recipient software application in System B, in exactly the form in which it was transmitted by the application in System A.

OSI Model Physical Layer

The physical layer defines the electrical, mechanical, procedural, and functional specifications for activating, maintaining, and deactivating the physical link between communicating network systems. Physical layer specifications define characteristics such as voltage levels, timing of voltage changes, physical data ' rates, maximum transmission distances, and physical connectors. Physical layer implementations can be categorized as either LAN or WAN specifications.

OSI Model Data Link Layer

The data link layer provides reliable transit of data across a physical network link. Different data link layer specifications define different network and protocol characteristics, including physical addressing, network topology, error notification, sequencing of frames, and flow control. Physical addressing (as opposed to network addressing) defines how devices are addressed at the data link layer. Network topology consists of the data link layer specifications that often define how devices are to be physically connected, such as in a bus or a ring topology. Error notification alerts upper-layer protocols that a transmission error has occurred, and the sequencing of data frames reorders frames that are transmitted out of sequence. Finally, flow control moderates the transmission of data so that the receiving device is not overwhelmed with more traffic than it can handle at one time.

The Institute of Electrical and Electronics Engineers (IEEE) has subdivided the data link layer into two sublayers: Logical Link Control (LLC) and Media Access Control (MAC).

The *Logical Link Control (LLC)* sublayer of the data link layer manages communications between devices over a single link of a network. LLC is defined in the IEEE 802.2 specification and supports both connectionless and connection-oriented services used *by* higher-layer protocols. IEEE 802.2 defines a number of fields in data link layer frames that enable multiple higher-layer protocols to share a single physical data link. The Media Access Control (MAC) sublayer of the data link layer manages protocol access to the physical network, medium. The IEEE MAC specification defines MAC addresses, which enable multiple devices to uniquely identify one another at the data link layer.

OSI Model Network Layer

The network layer defines the network address, which differs from the MAC address. Some network layer implementations, such as the Internet Protocol (IP), define network addresses, in a way that route selection can be determined systematically by comparing the source network address with the destination network address and applying the subnet mask. Because this layer defines the logical network layout, routers can use this layer to determine how to forward packets. Because of this, much of the design and configuration work for internetworks happens at Layer 3, the network layer.

OSI Model Transport Layer

The transport layer accepts data from the session layer and segments the data for transport across the network. Generally, the transport; layer is responsible for making sure that the data is delivered error-free and in the proper sequence. Flow control generally occurs at the transport layer.

Flow control manages data transmission between devices so that the transmitting device does not send more data than the receiving device can process. Multiplexing enables data from several applications to be transmitted onto a single physical link. Virtual circuits are established, maintained, and terminated by the transport layer. Error checking involves creating various mechanisms for detecting transmission errors, while error recovery involves acting, such as requesting that data be retransmitted, to resolve any errors that occur.

The transport protocols used on the Internet are TCP and UDP.

OSI Model Session Layer

The session layer establishes, manages, and terminates communication sessions. Communication sessions consist of service requests and service responses that occur between applications located in different network devices. These requests and responses are coordinated by protocols implemented at the session layer. Some examples of session-layer implementations include Zone Information Protocol (ZIP), the AppleTalk protocol that coordinates the name binding process; and Session Control Protocol (SCP), the DECnet Phase IV session layer protocol.

OSI Model Presentation Layer

The presentation layer provides a variety of coding and conversion functions that are applied to application layer data. These functions ensure that information sent from the application layer of one system would be readable by the application layer of another system. Some examples of presentation layer coding and conversion schemes include common data representation formats, conversion of character representation formats, common data compression schemes, and common data encryption schemes.

Common data representation formats, or the use of standard image, sound, and. video formats, enable the interchange of application data between different types of computer systems. Conversion schemes are used to exchange information with systems by using different text and data representations, such as EBCDIC and ASCII. Standard data compression schemes enable data that is compressed at the source device to be properly decompressed at the destination. Standard data encryption schemes enable data encrypted at the source device to be properly deciphered at the destination.

Presentation layer implementations are not typically associated with a particular protocol stack. Some well-known standards for video include QuickTime and Motion Picture Experts Group (MPEG). QuickTime Is an Apple Computer

specification for video and audio, and MPEG is a standard for video compression and coding.

Among the well-known graphic image formats are Graphics Interchange Format (GIF), Joint Photographic Experts Group (JPEG), and Tagged Image File Format (TIFF). GIF is a standard for compressing and coding graphic images. JPEG is another compression and coding standard for graphic images, and TIFF is a standard coding format for graphic images.

OSI Model Application Layer

The application layer is the OSI layer closest to the end user, which means that both the OSI application layer and the user interact directly with the software application,

This layer interacts with software applications that implement a communicating component. Such application programs fall outside the scope of the OSI model. Application layer functions typically include identifying communication partners, determining resource availability, and synchronizing communication.

When identifying communication partners, the application layer determines the identity and availability of communication partners for an application with data to transmit.

When determining resource availability, the application layer must decide whether sufficient network resources for the requested communication exist. In synchronizing communication, all communication between applications requires cooperation that is managed by the application layer.

Some examples of application layer implementations include Telnet, File Transfer Protocol (FTP), and Simple Mail Transfer Protocol (SMTP),

The data and control Information that is transmitted through internetworks takes a variety of forms. The terms used to refer to these information formats are not used consistently in the internetworking industry but sometimes are used interchangeably. Common information formats include frames, packets, datagrams, segments, messages, ceils, and data units.

A frame is an information unit whose source and destination are data link layer entities. A frame is composed of the data link layer header (and possibly a trailer) and upper-layer data. The header and trailer contain control information intended for the data link layer entity in the destination system. Data from upper-layer entities is encapsulated in the data link layer header and trailer.

A packet is an information unit whose source and destination are network layer entities. A packet is composed of the network layer header (and possibly a trailer) and upper-layer data. The header and trailer contain control information intended for the network layer entity in the destination system. Data from upper-layer entities is encapsulated in the network layer header and trailer.

The term datagram usually refers to an information unit whose source and destination are network layer entities that use connectionless network service.

The term segment usually refers to an information unit whose source and destination are transport layer entities.

A message is an information unit whose source and destination entities exist above the network layer (often at the application layer).

A cell is an information unit of a fixed size whose source and destination are data link layer entities. Cells are used in switched environments, such as Asynchronous Transfer Mode (ATM) and Switched Multimegabit Data Service (SMDS) networks. A cell is composed of the header and payload. The header contains control information intended for the destination data link layer entity and is typically 5 bytes long. The payload contains upper-layer data that is encapsulated in the cell header and is typically 48 bytes long.

The length of the header and the payload fields always are the same for each cell.

Data unit is a generic term that refers to a variety of information units. Some common data units are service data units (SDUs), protocol data units, and bridge protocol data units **(BPDUs).** SDUs are information units from upper-layer protocols that define a service request to a lower-layer protocol. PDU is OSI terminology for a packet, BPDUs are used by the spanning-tree algorithm as hello messages.

ISO Hierarchy of Networks

Large networks typically are organized as hierarchies. A hierarchical organization provides such advantages as ease of management, flexibility, and a reduction in unnecessary traffic. Thus, the International Organization for Standardization (ISO) has adopted a number of terminology conventions for addressing network entities. Key terms defined in this section include end system (ES), intermediate system (IS), area, and autonomous system (AS).

An ES is a network device that does not perform routing or other traffic forwarding functions. Typical ESs includes such devices as terminals, personal computers, and printers. An IS is a network device that performs routing or other traffic-forwarding functions. Typical ISs include such devices as routers, switches, and bridges. Two types of IS networks exist: intradomain IS and interdomain IS. An intradomain IS communicates within a single autonomous system, while an interdomain IS communicates within and between autonomous systems. An area is a logical group of network segments and their attached devices. Areas are subdivisions of autonomous systems (AS's). An AS is a collection of networks under a common administration that share a common routing strategy. Autonomous systems are subdivided into areas, and an AS is sometimes called a domain.

Connection-Oriented and Connectionless Network Services

In general, transport protocols can be characterized as being either connection-oriented or connectionless. Connection-oriented services must first establish a connection with the desired service before passing any data. A connectionless service *can* send the data without any need to establish a connection first. In general, connection-oriented services provide some level of delivery guarantee, whereas connectionless services do not.

Connection-oriented service involves three phases: connection establishment, data transfer, and connection termination.

During connection establishment, the end nodes may reserve resources for the connection. The end nodes also may negotiate and establish certain criteria for the transfer, such as a window size used in TCP connections. This resource reservation is one of the things exploited in some denial of service (DOS) attacks. An attacking system will send many requests for establishing a connection but then will never complete the connection. The attacked computer is then left with resources allocated for many never-completed connections. Then, when an end node tries to complete an actual connection, there are not enough resources for the valid connection.

The data transfer phase occurs when the actual data is transmitted over the connection. During data transfer, most connection-oriented services will monitor for lost packets and handle resending them. The protocol is generally also responsible for putting the packets in the right sequence before passing the data up the protocol stack.

When the transfer of data is complete, the end nodes terminate the connection and release resources reserved for the connection.

Connection-oriented network services have more overhead than connectionless ones. Connection-oriented services must negotiate a connection, transfer data, and tear down the connection, whereas a connectionless transfer can simply send the data without the added overhead of creating and tearing down a connection. Each has its place in internetworks.

Internetwork Addressing

Internetwork addresses identify devices separately or as members of a group. Addressing schemes vary depending on the protocol family and the OSI layer. Three types of internetwork addresses are commonly used: data link layer addresses, Media Access Control (MAC) addresses, and network layer addresses.

Data Link Layer Addresses

A data link layer address uniquely identifies each physical network connection of a network device. Data-link addresses sometimes are referred to as physical or hardware addresses. Data-link addresses usually exist within a flat address space and have a pre-established and typically fixed relationship to a specific device.

End systems generally have only one physical network connection and thus have only one data- link address. Routers and other internetworking devices typically have multiple physical network connections and therefore have multiple data-link addresses.

MAC Addresses

Media Access Control (MAC) addresses consist of a subset of data link layer addresses. MAC addresses identify network entities in LANs that implement the IEEE MAC addresses of the data link layer. As with most data-link addresses, MAC addresses are unique for each LAN interface. MAC addresses are 48 bits in length and are expressed as 12 hexadecimal digits. The first 6 hexadecimal digits, which are administered by the IEEE, identify the manufacturer or vendor and thus comprise the Organizationally Unique Identifier (OUT). The last 6 hexadecimal digits comprise

the interface serial number, or another value administered by the specific vendor. MAC addresses sometimes are called burned-in addresses (BIAs) because they are burned into read-only memory (ROM) and are copied into random-access memory (RAM) when the interface card initializes.

Mapping Addresses

Because internetworks generally use network addresses to route traffic around the network, there is a need to map network addresses to MAC addresses. When the network layer has determined the destination station's network address, it must forward the information over a physical network using a MAC address. Different protocol suites use different methods to perform this mapping, but the most popular is Address Resolution Protocol (ARP).

Different protocol suites use different methods for determining the MAC address of a device. The following three methods are used most often. Address Resolution Protocol (ARP) maps network addresses to MAC addresses. The Hello protocol enables network devices to learn the MAC addresses of other network • devices. MAC addresses either are embedded in the network layer address or are generated by an algorithm.

Address Resolution Protocol (ARP) is the method used in the TCP/IP suite. When a network device needs to send data to another device on the same network, it knows the source and destination network addresses for the data transfer. It must somehow map the destination address to a MAC address before forwarding the data. First, the sending station will check its ARP table to see if it has already discovered this destination station's MAC address. If it has not, it will send a broadcast on the network with the destination station's IP address contained in the broadcast. Every station on the network receives the broadcast and compares the embedded IP address to its own. Only the station with the matching IP address replies to the sending station with a packet containing the MAC address for the station. The first station then adds this information to its ARP table for future reference and proceeds to transfer the data.

When the destination device lies on a remote network, one beyond a router, the process is the same except that the sending station sends the ARP request for the MAC address of its default gateway. It then forwards the information to that device. The default gateway will then forward the information over whatever networks necessary to deliver the packet to the network on which the destination device resides. The router on the destination device's network then uses ARP to obtain the MAC of the actual destination device and delivers the packet.

The Hello protocol is a network layer protocol that enables network devices to identity one another and indicate that they are still functional. When a new end system powers up, for example, it broadcasts hello messages onto the network, Devices on the network then return hello replies, and hello messages are also sent at specific intervals to indicate that they are still functional. Network devices can learn the MAC addresses of other devices by examining Hello protocol packets.

Three protocols use predictable MAC addresses. In these protocol suites, MAC addresses are predictable because the network layer either embeds the MAC address in the network layer address or uses an algorithm to determine the MAC address. The

three protocols are Xerox Network Systems (XNS), Novell Internetwork Packet Exchange (IPX), and DECnet Phase IV.

Network Layer Addresses

A network layer address identifies an entity at the network layer of the OSI layers. Network addresses usually exist "within a hierarchical address space and sometimes are called virtual or logical addresses.

The relationship between a network address and a device is logical and unfixed; it typically is based either on physical network characteristics (the device is on a particular network segment) or on groupings that have no physical basis (the device is part of an AppleTalk zone). End systems require one network layer address for each network layer protocol that they support. (This assumes that the device has only one physical network connection.) Routers and other internetworking devices require one network layer address per physical network connection for each network layer protocol supported. For example, a router with three interfaces each running AppleTalk, TCP/IP, and OSI must have three network layer addresses for each interface. The router therefore has nine network layer addresses.

Hierarchical Versus Flat Address Space

Internetwork address space typically takes one of two forms: hierarchical address space or flat address space A hierarchical address space is organized into numerous subgroups, each successively narrowing an address until it points to a single device (in a manner similar to street addresses). A flat address space is organized into a single group (in a manner similar to U.S. Social Security numbers).

Hierarchical addressing offers certain advantages over flat-addressing schemes. Address sorting and recall is simplified using comparison operations. For example, "Ireland" in a street address eliminates any other country as a possible location.

Address Assignments

Addresses are assigned to devices as one of two types: static and dynamic. Static addresses are assigned by a network administrator according to a preconceived internetwork addressing plan. A static address does not change until the network administrator manually changes it. Dynamic addresses are obtained by - devices when they attach to a network, by means of some protocol-specific process. A device using a dynamic address often has a different address each time that it connects to the network. Some networks use a server to assign addresses. Server-assigned addresses are recycled for reuse as devices disconnect.

A device is therefore likely to have a different address each time that it connects to the network.

Addresses Versus Names

Internetwork devices usually have both a name and an address associated with them. Internetwork names typically are location-independent and remain associated with a device wherever that device moves (for example, from one building to another). Internetwork addresses usually are location-dependent and change when a device is moved (although MAC addresses are an exception to this rule). As with network addresses being mapped to MAC addresses, names are usually mapped to network addresses through some protocol. The Internet uses Domain Name System (DNS) to map the name of a device to its IP address. For example, it's easier for you

to remember www.cisco.com instead of some IP address. Therefore, you type www.cisco.com into your browser when you want to access Cisco's web site. Your computer performs a DNS lookup of the IP address for Cisco's web server and then communicates with it using the network address.

Flow Control

Flow control is a function that prevents network congestion by ensuring that transmitting devices do not overwhelm receiving devices with date. A high-speed computer, for example, may generate traffic faster than the network can transfer it, or faster than the destination device can receive and process it. The three commonly used methods for handling network congestion are buffering, transmitting source-quench messages, and windowing.

Buffering is used by network devices to temporarily store bursts of excess data in memory until they can be processed. Occasional data bursts are easily handled by buffering. Excess data bursts can exhaust memory, however, forcing the device to discard any additional datagrams that arrive.

Source-quench messages are used by receiving devices to help prevent their buffers from overflowing. The receiving device sends source-quench messages to request that the source reduce its current, rate of data transmission. First, the receiving device begins discarding received data due to overflowing buffers. Second, the receiving device begins sending source-quench messages to the transmitting device at the rate of one message for each packet dropped. The source device-receives the source-quench messages and lowers the data rate until it stops receiving the messages. Finally, the source device then gradually increases the data rate as long as no further source-quench requests are received.

Windowing is a flow-control scheme in which the source device requires an. acknowledgment from the destination after a certain number of packets have been transmitted with a window size of 3, the source requires an acknowledgment after sending three packets, as follows. First, the source device sends three packets to the destination device. Then, after receiving the three packets, the destination device sends an acknowledgment to the source. The source receives the acknowledgment and sends three more packets. If the destination does not receive one or more of the packets for some reason, such as overflowing buffers, it does not receive enough packets to send an acknowledgment. The source then retransmits the packets as: a reduced transmission rate.

Error-Checking Basics

Error-checking schemes determine whether transmitted data has become corrupt or otherwise damaged while traveling from the source to the destination, Error checking is implemented at several of the OSI layers.

One common error-checking scheme is the cyclic redundancy check (CRC), which detects and discards corrupted data. Error-correction functions (such as data retransmission) are left to higher-layer protocols. A CRC value is generated by a calculation that is performed at the source device. The destination device compares this value to its own calculation to determine whether errors occurred during transmission. First, the source device performs a predetermined set of calculations over the contents of the packet to be sent. Then, the source places the calculated value

in the packet and sends the packet to the destination. The destination performs the same predetermined set of calculations over the contents of the packet and then compares its computed value with that contained in the packet. If the values are equal, the packet is considered valid. If the values are unequal, the packet contains errors and is discarded.

Multiplexing Basics

Multiplexing is a process in which multiple data channels are combined into a single data or physical channel at the source. Multiplexing can be implemented at any of the OSI layers. Conversely, demultiplexing is the process of separating multiplexed data channels at the destination. One example of multiplexing is when data from multiple applications is multiplexed into a single lower-layer data packet.

Another example of multiplexing is when data from multiple devices is combined into a single physical channel (using a device called a multiplexer).

A multiplexer is a physical layer device that combines multiple data streams into one or more output channels at the source. Multiplexers demultiplex the channels into multiple data streams at the remote end and thus maximize the use of the bandwidth of the physical medium by enabling it to be shared by multiple traffic sources.

Some methods used for multiplexing data are time-division multiplexing (TDM), asynchronous time-division multiplexing (ATDM), frequency-division multiplexing (FDM), and statistical multiplexing.

In TDM, information from each data channel is allocated bandwidth based on preassigned time slots, regardless of whether there is data to transmit. In ATDM, information from data channels is allocated bandwidth as needed by using dynamically assigned time slots. In FDM, information from each data channel is allocated bandwidth based on the signal frequency of the traffic. In statistical multiplexing, bandwidth is dynamically allocated to any data channels that have information to transmit.

Standards Organizations

A wide variety of organizations contribute to internetworking standards by providing forums for discussion, turning informal discussion into formal specifications, and proliferating specifications after they are standardized.

Most standards organizations create formal standards by using specific processes: organizing ideas, discussing the approach, developing draft standards, voting on all or certain aspects of the standards, and then formally releasing the completed standard to the public.

Some of the best-known standards organizations that contribute to internetworking standards include these:

International Organization for Standardization (ISO) - ISO is an international standards organization responsible for a wide range of standards, including many that are relevant to networking. Its best-known contribution is the development of the OSI reference model and the OSI protocol suite.

American National Standards Institute (ANSI) - ANSI, which is also a member of the ISO, is the coordinating body for voluntary standards groups within the United States. ANSI developed the Fiber Distributed Data Interface (FDDI) and other communications standards.

Electronic Industries Association (EIA) - EIA specifies electrical transmission standards, including those used in networking. The EIA developed the widely used EIA/TTA-232 standard (formerly known as RS-232).

Institute of Electrical and Electronic Engineers (IEEE) - IEEE is a professional organization that defines networking and other standards. The IEEE developed the widely used LAN standards IEEE 802.3 and IEEE 802.5.

International Telecommunication Union Telecommunication Standardization Sector (ITU-T) - Formerly called the Committee for International Telegraph and Telephone (CCITT), ITU-T is now an international organization that develops communication standards. The ITU-T developed X.25 and other communications standards.

Internet Activities Board (JAB) - IAB is a group of internetwork researchers who discuss issues pertinent to the Internet and set Internet policies through decisions and task forces. The IAB designates some Request For Comments (RFC) documents as Internet standards, including Transmission Control Protocol/Internet Protocol (TCP/IP) and the Simple Network Management Protocol (SNMP).

Summary

This chapter introduced the building blocks on which internetworks are built, Under-standing where complex pieces of internetworks fit into the OSI model will help you understand the concepts better. Internetworks are complex systems that, when viewed as a whole, are too much to understand. Only by breaking the network down into the conceptual pieces can it be easily understood. As you read and experience internetworks, try to think of them in terms of OSI layers and conceptual pieces.

Understanding the interaction between various layers and protocols makes designing, configuring, and diagnosing internetworks possible. Without understanding of the building blocks, you cannot understand the interaction between them.

IV. VOIP IMPLEMENTATION - HOW, WHY AND FUTURE

Internet Protocol (IP) telephony-also known as Voice over IP (VoIP)-is becoming a key driver in the evolution of voice communications. VoIP technology is useful not only for phones but also as a broad application platform that enables voice interactions on devices such as desktop computers, mobile devices, set-top boxes, gateways, and many devices with applications specific to certain businesses where voice communication is an important feature.

Frost and Sullivan reports note that by 2008, wholesale VoIP traffic in the Europe, Middle East and Asia (EMEA) region could reach 57 billion minutes and VoIP will account for approximately 75% of world voice services by 2007. And the

market for as IP Private Branch Exchange (IP PBX), and VoIP application servers are expected to reach almost $12 billion by 2006.

Major Components of VoIP

The major components of a VoIP network, while different in approach, deliver very similar functionality to that of a PSTN (Public Switched Telephone Network) and enable VoIP networks to perform all of the same tasks that the PSTN does. The one additional requirement is that VoIP networks must contain a gateway component that enables VoIP calls to be sent to a PSTN, and vice versa. There are four major components to a VoIP network.

l. Call Processing Server/IP PBX
2. User End-Devices
3. Media/VOIP Gateways
4. IP network

Working of VoIP

A VoIP accommodates telephone calls over a computer network or a data network like Internet. VoIP converts the voice signal from telephone into a digital signal that travels over the Internet then converts it back at the other end enabling conversation to anyone with a regular phone number. Rapid advancements in IP technology has given rise to a far-reaching, low-cost transport mechanism that can support both voice and data. A VOIP solution integrates seamlessly into the data network and operates alongside existing PBXs, or other phone equipment, to simply extend voice capabilities to remote locations. The voice traffic essentially "rides for free" on top of the data network using the IP infrastructure and hardware already in place and transfer videos, images, messages and text data. Advancements in technology have ensured that most VoIP phones like Cisco's 7940, 7960G can support all standard protocols like Packet Cable NCS 1.0, MGCP 1.0, SIP 2.0 and SCCP (Skinny Client Control Protocol) and work with HFC cable, ASDL, fiber optic cable or even wireless. Mr. Kaustubh Chandra, Senior Marketing Executive, Network Solutions feels that most contemporary technology can easily tackle problems like latency, jitter, bandwidth, packet loss even while providing good reliability, security and interoperability.

Considerations for VoIP Service implementation: Most important phase in VoIP is the implementation phase. Key questions have to be answered here. Factors like traffic parameters and network design, ease of implementation and cost are some of the issues an organization must carefully consider when deploying VoIP solutions. Sufficient bandwidth, good Internet connectivity are a must for efficient functioning of VoIP. VoIP is very useful if the company has branches in many locations. Mary E. Shacklett, President, Transworld Data feels that along with all the other factors, "staff infrastructure", readiness of the existing staff to effectively manage VoIP and return on investment (ROI) are important considerations before migrating to VoIP. Without

due diligence in planning an organization could be faced with service that does not function reliably or is financially not economical.

VoIP Implementation:

VoIP implementation should be critically planned and executed. Mr. Verghese Mathew, Principle Consultant, Cisco Systems India suggests building a Cross-Functional "Tiger" Team that has the requisite skills and technical expertise and represents users in every area in the organization impacted by the implementation. The following typical action plan will help in a smooth implementation.

– **State the vision in terms that employees can understand, describing the change from their frame of reference, and articulating the impact on behaviors and tasks.**

Resistance to change is normal and managing user expectations will be paramount in making the process run smoothly. One keyway to achieve this is to take away the mystery and uncertainty among key stakeholders through education, opens, and honest, and frequent communication.

Communicate the reasons for the change, make a strong case for why that change is necessary and explain how the organization will differ as a result

- Strong Corporate Culture:

Corporate culture is often defined as "the way we do things around here." Culture builds a common language and brings people together, enabling them to work toward a shared goal. Understanding and working with the organization's culture is critical to successfully implementing new technology on a large scale. Capitalize on what has worked in the past, and learn from the mistakes of others. A winning formula for migration success rests 80 percent on preparation and 20 percent on installation.

- Customer driven Design Requirements:

Developing a "Voice of the Client" program that consists of client-targeted surveys and focus groups to benchmark and track user-preferred services, products, solutions, and features. The survey can be a tool to identify critical phone features, validate key business needs, gauge risk tolerance and user discomfort, and identify key functionalities that are paramount to one's business.

- Conduct a pilot session with a smaller population and non-critical buildings to ensure that the plan is smooth, bugs are worked out, and a workable process is in place.

The implementation strategy should plan to progressively go faster as the experience levels become more efficient. The numbers of employees, complexity of user requirements, size of the campus, how widely all are dispersed will affect the migration strategy. Organizations are not static with employees changing locations, getting hired or leaving or working while on the move. To accommodate this ever-changing environment, organizations need to develop a migration strategy that takes into account all the variables that can change, alter, or otherwise affect implementation of a new converged voice and data network. Begin the conversion by issuing all new employees an IP phone. Whenever an employee moves his or her

location, issue an IP phone rather than moving the old PBX phone to the new location.

- Ensure a Successful Day 2 Handoff:

A successful Day 2 handoff requires a well thought out support plan (Day 2 is defined as the time period immediately following cutover of your new IP telephony solution). Four critical components are required to enable efficient operation and responsive support of the converged network.

-Support Team: Resolve all issues quickly and effectively.

-Support Process: resist the temptation to completely reinvent the support model with every new application. Take advantage of the existing support processes.

-Support Services while making the investment in an IP based network, organizations need to look closely at its ability to provide requisite services support parameters like end-to end PDIOO capabilities, expert internal and external resources, cutting-edge management tools, knowledge management and transfer, and global coverage.

-Support Tools: Attentive management and monitoring of a new network will help to catch and resolve many problems before they become visible to users.

- Keep the New Network Clean

Most large enterprises have hundreds of lines and circuits that, through the years, have either been forgotten about or are simply unused. The IP telephony implementation is an opportunity to clean out the network to start anew, as well as clean, groom, and prepare the IP infrastructure.

- Develop a strategy that will convert all the PBX-leased-equipment buildings first so that when leases come up for renewal, there is more flexibility during the migration process.

At the time of implementation, an organization may have equipment that is leased. The process of completely decommissioning the main PBX will take long and therefore assemble a project team to address the removal of all applications still running on it.

***Look Back, Move Forward, and Prepare for the Future**

Whether an IP telephony implementation involves 200 phones or 20,000 phones, careful and comprehensive planning, communication, teamwork, and knowing where the "gotchas" are hiding, will divert problems before they even arise.

Things to do immediately after implementation.

Eliminate as many unknowns as possible by documenting all the procedures, capture and incorporate lessons learned, and optimize the change management process. Make the commitment to continually support new, dynamic network by reevaluating contingency plans often, conducting ongoing audits of network performance, incorporating new features through software upgrades and reexamining the contract services that protect, monitor, and support the network.

Factors influencing speed and success of an IP telephony rollout An IP telephony rollout depends largely on the complexity of the network, number of islands or locations, features and network tuning to optimize quality and

bandwidth. The time taken to deploy IP telephony varies but it is possible to set up a 50-user network in 3 days. The factors influencing this process are:

- Availability of leased circuits or WAN links connecting the locations where IP telephony is to be used.

– Availability of suitable bandwidth on WAN links for driving voice on top of data traffic.

- An accurate user requirement plan detailing the mix of hard and soft IP phones, locations and feature mix

- Any custom GUI or Web-based interface that the customer may have demanded.

– Custom features-ring tones, music on hold, etc.

- The need to interwork with legacy PBX at remote locations.

- Pre-testing for VoIP assessment.

- Site readiness.

Why VOIP?

The scalability and flexibility of VoIP enables manufacturers, software providers, and service providers to offer and more effectively expose a broad variety of features and services that directly add value for users. The integration of voice, data, and video with IP networks and devices has made the interaction and exchange of these types of communication easier, enhancing user productivity.

Some of the most common value-added features and services for users are:

- Unified messaging
- Interactive voice recognition
- Call center administration
- Voice mail
- Conferencing services
- Database queries (for example, e-mail look-ups)
- Customer relationship management
- Instant-messaging and Web browsing

Innovations yield increased functionality and value-added services. For example, device manufacturers and service providers now use VoIP applications as competitive differentiators when acquiring and retaining customers. Some VoIP-related features and services make consumers' lives more convenient, whereas others help organizations become more efficient. For example, studies show that unified messaging-the ability for users to use a single system to access any form of a message, such as voice mail, e-mail, fax, or video-saves employees up to 25 minutes per day.

Reduced Total Cost of Ownership

VoIP technology enables the integration of data traffic and voice communication traffic into a single network, reducing the total cost of ownership (TCO) associated with a combined voice/data network. The integration of multiple media types-voice, data, and video-into a single network eliminates infrastructure and maintenance redundancies, helping to reduce capital costs and operational costs.

Another benefit of using a single network for voice, data, and video transmission is that various network elements, such as call servers, application servers (for example, for voice-mail storage), and client devices, can be more easily integrated.

Advanced client/server services also allow VoIP systems and devices to be provisioned and managed remotely. Remote management reduces costs, including expenditures that are associated with user Moves, Adds, and Changes (MACs) and costs that are related to updating edge devices with the latest customer applications and services.

Savings apply not only to enterprises but also to consumers, because service providers can pass the savings resulting from lower network deployment and maintenance costs on to subscribers. In addition, consumers and enterprises can experience savings in long-distance charges, service fees, and bundled services. With VoIP technology, the distinction between local, long-distance, and international calling largely disappears, and callers can save on long-distance and international charges (also known as toll bypass).

More Efficient Network Utilization

VoIP provides considerable gains in bandwidth efficiencies, which, in turn, reduce costs and increase quality of service (QoS). Various factors contribute to more efficiently used bandwidth for IP telephony.

Elimination of silence. PSTNs are based on time division multiplex (TDM) technology. In TDM networks, communication capacity is continuously allocated to a user, even when the person is not speaking. Approximately 50 percent of normal voice interaction is silence. This means that approximately half the capacity of TDM networks remains unused due to silence alone. In IP telephony, capacity is not continuously allocated but rather is made available as defined by the system. **Redundancy reduction.** Approximately 20 percent of human speech consists of repetitive patterns. Conventional TDM networks do not use reduction methods to eliminate redundant voice signals. Such reduction methods are omnipresent in IP telephony.

Efficient data throughput. The sophisticated analog-to-digital operations that IP telephony uses are capable of providing more efficient throughput than similar operations that traditional TDM networks use. As a result of silence elimination, redundancy reduction, and more efficient data throughput (among other methods), VoIP uses approximately 10 to 15 percent of the bandwidth required for traditional voice communications.

Greater Operational Flexibility

Another reason for the increasing adoption of VoIP is the fact that the underlying technology is more flexible and extensible than traditional voice transmission technologies. In traditional circuit-switched voice networks, the transport, call control, and application layers are grouped into single, proprietary systems. In IP-based networks, these layers are disaggregated into separate components that can each be integrated or substituted as needed in the overall system. This desegregation allows the system, applications, and services to be more dynamically designed and managed. The trend from proprietary, vendor-centric, end-

to-end solutions to integrated, open, IP-based environments results in more customizable, flexible, and extensible systems.

VoIP-related technologies, such as the extensible Session Initiation Protocol (SIP), are based on the concept that user preferences-hence client devices, services, and underlying infrastructures-will change over time. By separating the signaling from the hardware and media, SIP acts as an ideal protocol for adapting to change. For example, voice calls and video conversations can occur between infrastructures that use different hardware components.

SIP is also flexible, extensible, and scalable and therefore is well suited to a broad range of usage scenarios, applications, and infrastructures. SIP provides a uniform platform for services such as voice, instant messaging, video, and general presence information. In addition, the traditional division between network-to-user and network-to-network protocols becomes obsolete with SIP, resulting in simplified interoperability between separate systems and reduced operational costs.

Cautious welcome

Gartner Group estimates that by the end of 2007, traditional enterprise telephony-system manufacturers will cease development entirely of traditional systems. Further, many industry analysts now believe that because an end-to-end IP telephony system is inevitable, there is no reason to delay the adoption of an all-IP infrastructure. The more quickly companies embrace a common IP platform for all their communications needs-voice, video, and data-the more quickly they will realize the benefits and dramatic efficiencies of a common, standards-based IP infrastructure. This analysis is further strengthened with the fact that that all the leading traditional TDM voice players are now offering IP based PBX solutions.

Even with all the above-mentioned positives VoIP has still a long way ahead before it is accepted universally. In spite of all the technological developments it is still welcomed with skepticism. Dr. Shashi Phoha, director of the Information Technology Laboratory at the National Institute of Standards and Technology, thinks that the growth of VOIP technology brings with it some significant risks that users need to be prepared to address.

"The vulnerabilities are severe," she said, pointing to the use of personal computers in creating VOIP solutions, which is relatively easy to hack. The digital phone calls could be edited by digital voice editors to add, remove or change words without any possibility of detection. She also observed that soft phones are vulnerable to worms, viruses and Trojan horses, and could spread these problems throughout the voice network. The risk can be reduced by using encryption of the voice traffic, and VOIP-specific intrusion detection systems (IDS) and firewalls. VoIP needs the time to evolve and mature as and with so many positives it is a sure bet for success.

V. NEW TRENDS IN COMPUTER & MOBILE TECHNOLOGIES

Are You Ready For Software Freedom Day?

If you're like most folks I know, you're probably not too unhappy that summer has "unofficially" come to an end as of Labor Day.

Sure, you'll miss those great family vacations and the quality downtime you'd enjoyed out in America's great outdoors (or at your favorite recreational haunt), but you won't wax nostalgic anytime soon about this past summer's cooling or gasoline bills. Ouch! Adding insult to injury, it's likely your wallet has also recently been dinged by more than its share of miscellaneous expenses and purchases associated with that wonderful merchandising opportunity known as the "Back-To-School Sale."

So, as you're adding up your receipts, adjusting your budget, and getting ready for a diet of more beans and rice and Ramen noodles than you'd care for-and still wondering just what the heck your kids did with all of that expensive school stuff you'd bought them last year at this very same time-cheer up. You can celebrate Software Freedom Day on September 10th and, throughout this month, snag yourself some useful software without having to pay anyone a red cent.

Feeling A Little Insecure? These Can Help

ALWIL's free-of-charge anti-virus program, avast! v. 4.6 Home Edition has long ranked among the most effective and trustworthy gratis AV products I've tested and used www.avast.com. In fact, this package has kept all of my desktops and laptops (with the exception of my work PC) safe and secure for years.

Sporting a slightly updated yet still straightforward interface, the latest version of avast! remains easy to use and configure. Users can scan hard drives, removable media, and/or specific file folders simply by clicking upon an appropriate icon within the interface; scan sensitivity and protection levels can still be easily adjusted via simple slides; and the software's resident protection remains as effective as ever. Separate resident protection-modules for e-mail and built-in shields from attacks arriving by way of common IM programs and P2P applications have been enhanced, and the software now also possesses new "web shield' and "network shield" modules that further protect users from Internet-borne infections. The network shield, in fact, works a lot like a firewall and keeps worms from wriggling into your system-although it has an issue with the free version of ZoneAlarm (but, hey, if you have ZA, you're pretty much protected anyway).

The most notable benefit avast! offers to owners, however, remains its capability to conduct boot-time scans prior to launching Windows (available only for machine's running Windows NT/2000/XP). This methodology allows the AV software to eliminate viruses before they have the chance to get activated, and it also ensures that a virus(es) will not in any way adversely influence or affect the program's antiviral scan-frankly, it's the only AV freeware out there using this methodology. A plus, too, is that the software updates its viral definition file via incremental updates (meaning that you don't have to download megabytes at a time when an update is available).

Enamored as I am with avast!, though, it is not the only worthy free anti-virus software worthy of attention. Many computer users, in fact, seem to be enthusiastic fans of Grisoft's AVG Free Edition free.grisoft.com/doc/1/lng/us/tpl/v5. The latest version of this popular AV software has recently received a 100% rating in June 2005 Virus Bulletin www.virusbtn.com comparison tests, so it looks to be much better

designed and considerably safer than it was in the past. Check out the website for details and, if you like what you see, give it a shot.

When I built my first Athlon XP-based PC back in May 2001, I entrusted it into the care of H+BEDV's free AV software, AntiVir. While this program appeared to work well, it proved inadequate to the task, missing worms and viruses which avast! later had to deal with. However, recent releases of AntiVir have also lately fared quite well in Virus Bulletin evaluations, and feedback on the web, too, has been relatively positive. Although I can't personally say I'd eagerly give it a second chance, if you want to give the improved product a try, download the latest version of AntiVir PersonalEdition Classic at www.free-av.com…but also back it up with the product mentioned below-and be aware that the AntiVir freeware site is awfully slow for some strange reason, so downloading can be a bit tricky if you aren't using a good download manager.

When it comes to virus protection, I admit that I take a belt-and-suspenders approach. Despite finding avast! dependable and secure, I also hedge my anti-virus bet by backing it up with Softwin's equally capable BitDefender 8 Free Edition www.bitdefender.com, a virus scanner with no resident- or e-mail-protection modules. Now, some might view this as a deficit, but this actually makes BitDefender a useful second line of defense, for there really isn't anything within it that could generate conflicts with your main AV program's components. Download it and use it once a week to make sure your system is truly free of pests.

Protecting yourself from viruses today, alas, is only part of the PC security story. Adware/malware/spyware can cause grief, too, and it is becoming harder and harder to deal with. Should you be concerned that "scumware" has somehow found its way into your computer, the good news is that you don't have to spend a lot of money on an expensive, retail, anti-spyware program to give it a well-deserved heave-ho.

One of the best products anti-spyware products is available completely free-of-charge: Spybot Search & Destroy v. 1.4 www.safer-networking.org/en/index.html. Not only can SS&D easily and safely dispose of any unwanted adware/malware/spyware, it also immunizes your computer from future infections. Like quality anti-virus software, it has regular downloadable updates of adware/spyware definitions to keep up with the latest snoops making their way round on the Internet. And it's also updated from time to time, meaning that it is evolving to make sure that it'll be up to the task in the future.

After downloading SS&D, it's also good to get a free copy of Ad-Aware SE Personal www.lavasoftusa.com/software/adaware/. This free program scrutinizes your machine for all known ad-related privacy-invaders. Once its scan is completed, it gives you options as to how you'd like to dispose of the flagged components by ranking their risk-level. Updates to Ad-aware appear regularly, so the software can deal effectively with all pests, both old and new.

JavaCool Software's free SpywareBlaster www.javacoolsoftware.com is worth downloading, too, for this simple little program can shield a PC from troublesome software downloads, intentional and otherwise, as well as protect you from a number

of known hazardous websites. It works with Internet Explorer as well as Mozilla-based browsers.

Finally, it's also good to have a free "beta" version of Microsoft AntiSpyware www.microsoft.com/athome/security/spyware/software/default.mspx on your PC. It's not yet perfect hence the beta designation-and it does have some weaknesses both in terms of ferreting out snoops and keeping them out-but it doesn't cause any real headaches and is a good complement to the aforementioned anti-spyware products.

And to keep spam from arriving and potentially depositing unwanted digital detritus on your PC's hard disk via e-mail, try the free-of-charge program xTerminator

www.artplus.hr/adapps/eng/xterminator.htm.

Of course, to keep most online troublemakers at bay, a dependable firewall is a must-have item on the PC these days, and the free version of ZoneAlarm 5.5 www.zonealarm.com is designed to make it easy for you to protect your PC from hackers. The basic software hasn't changed much since I'd written about it last year-yes, it's been updated, but it looks and handles the same as it always has.

ZA includes four interlocking security services: a firewall, an application control, an Internet lock, and so-called "zones." The firewall controls the ports and connections leading to your computer and allows only that traffic which you actually approve of and desire. The simple to set-up application control allows you to decide which applications can and cannot use the Internet, and the "Internet lock" cuts off all Internet traffic instantly (it can also be activated automatically with your computer's screensaver or after a set period of inactivity). Zones monitor all activity on your computer and alert you when a new application attempts to access the Internet. All in all, it remains an effective yet easy to use package.

Sygate Personal Firewall 5.6 smb.sygate.com/products/spf_standard.htm is also free-of-charge and it provides very effective protection with advanced protocol driver-level protection and code-insertion prevention. This firewall ensures your personal computer is kept completely protected from malicious hackers and other intruders while preventing unauthorized access from your computer to a network-in fact, it makes your PC pretty much invisible to the rest of the world.

To keep private information hidden from other prying eyes that have access to your PC, give Cryptainer LE v. 6.0.1 www.cypherix.co.uk a try. This handy software makes protecting your sensitive data simple and straightforward. In fact, encryption of any PC files you want to keep safe is as simple as dragging-and-dropping them into a password-protected, 128-bit vault. Cryptainer LE can also be used to send secure e-mail attachments. It's an effective package-just don't forget your password-and to decrypt stuff encrypted by Crytainer, also get a free copy of DeCypherIT at the same website. The two make a wonderful ensemble.

And if you are really paranoid about keeping data away from prying eyes, especially potentially troublesome deleted information, you might find SureDelete v. 5.5.1 www.wizard-industries.com/sdel.html a terrific tool for "shredding" your digital information and making it irretrievable from your hard drive. Just choose a job from

its easy-to-use menus, and say goodbye to any all information you don't want falling into the wrong hands.

Utilities

My primary desktop has over 1 GB of RAM, so it can pretty much deal with any of the demands today's computer software can throw at it. My laptop, however, gets by with 512 MB of memory, and because it doesn't have a separate video card, there are times when it handles rather sluggishly. As a result, I've opted to install FreeRAM XP Pro www.yourwaresolutions.com/software.html#framxpro to better control and manage my system's limited memory resources.

Although it's simple and straightforward, the software is quite customizable, which makes it an ideal tool for newbies and old-hands alike. If you've a machine with limited RAM and/or which lacks a separate video card, FreeRAM XP Pro can restore the performance of that PC without requiring the addition of memory modules.

Motherboard Monitor v. 5.3.7 is also a handy tool available free-of-charge mbm.livewiredev.com/. Not all PCs come with software that provides you with important information about the operating temperatures within the machine's case (i.e., the CPU, disk drives, etc). Yet such details can be critical in diagnosing potentially heat-related performance issues and they can be vital to a system's longevity. MBM provides you with such temperature data allowing you take preventative action should the heat inside your PC's case be too high.

MBM, good as it is, will not work with the motherboards of some laptop computers or proprietary desktop motherboards. These, alas, just don't have temperature sensors built-in. The only real way to tell for sure is to download and install the software. If it doesn't report any temperature data, you'll have to uninstall it-sorry.

Should you be seeking some free utilities, tweaking tools, a decent download manager, or a nice media manager check out the Fresh Devices site www.freshdevices.com. Fresh Diagnose 7.05 can scan your system and give you a complete report on its hardware spec and performance numbers. It's pretty useful and informative, especially for those who want to compare pre- and post-hardware modification performance numbers.

To make sure that your system is performing well, safely and utilizing the latest and greatest updates and patches, consider adding BigFix to your list of free goodies www.bigfix.com. It often picks up where Windows Update leaves off. Just subscribe to the "Fixlet" site you need, and let BigFix do the rest.

Fresh Download is a handy tool that allows you to resume lengthy downloads should your dial-up, DSL, cable or wireless Internet connection be interrupted mid-stream. It's simple, works quite well, and offers the useful option of letting you scan a download for viruses using your AV software once it arrives. Fresh Devices software is updated from time to time, too, so the program gets tweaks and updates regularly. If you need a download utility and don't have one, consider this one for your software arsenal.

If you want another powerful download manager that works equally well but offers more bells and whistles, go to www.wellget.com/introduce.asp and download the latest version of WellGet.

Seek And Ye Shall Find

Should you now be finding that you favorite search engines are no longer providing you with the sort of results you'd expected, head on over to www.copernic.com and give either Copernic Agent Basic 6.12 or Copernic Meta 1.5 a try. Both are quite handy, powerful, free search tools that let you simultaneously and most effectively query multiple search engines, newsgroups, and e-mail directories for any and all information you might be seeking. Copernic Meta not only integrates itself into the Internet Explorer browser, but it also allows you to add a very practical "search" query-box to the Windows taskbar from which you can search the web, ferret out particular types of files, and/or even set-up one-click access to a favorite Internet search engine.

Copernic Agent Basic can also be launched via the Copernic Meta taskbar. This separate stand-alone tool allows you to conduct much more effective Internet searches for any particular projects you might be involved with. It also allows you to save your Internet searches for later use and cull out broken links. Both Copernic products are must-haves for students and anyone who uses the Internet for research.

Browse Better

As much as I like Internet Explorer-especially when coupled with the free MSN toolbar that gives it tabbed browsing capability-I no longer use it. I have, in fact, become a big fan of Mozilla Firefox 1.0.6 www.mozilla.org. It doesn't seem to pick up the sort of junk IE does, it's safer, faster and transitioning to it is painless. The Mozilla Suite is also available at the same site and offers users more bells-and-whistles than the basic version of Firefox.

I must admit that I also like the way the new Mozilla-based Netscape 8 browser looks and works, although I haven't opted for it in lieu of Firefox www.netscape.com. It offers lots of nice features and I recommend folks give it a shot.

Other Goodies

Go to www.picasa.com get a very nice photo-imaging program, Picasa, which is now available free-of-charge thanks to Google. It's a nice tool which you can use to tweak your favorite digital or scanned photos.

Visit www.skype.com to get yourself the free-of-charge and free-to-use Skype software with which you can talk to friends around the world without worry that you'll eat up precious cell minutes or have to pay a fiendishly high long-distance bill.

IrfanView is another terrific photo/imaging tool, one that doesn't require a great deal of disk-space or PC resources. That said, it is quite powerful-get it at www.irfanview.com.

Serif's free PhotoPlus6 software is also worth checking out www.freeserifsoftware.com/software/PhotoPlus/default.asp. If you don't have a good software package to tweak your photos, this "digital darkroom" will address any potential need you might have.

Office Suites, Word Processors And DTP

If you already own a recent version of a Corel, Lotus, or Microsoft "home" productivity suite, you have a word processing package that likely meets all of your basic "typing" requirements. In our increasingly demanding, work-from-home world, though, you might find that some of the must-have features of your at-work office productivity suite are not supported by your favorite consumer-oriented software.

But before you go out to buy several hundred dollars worth of business-oriented software that you might wind up using rather infrequently, consider downloading the quite comprehensive and "free" OpenOffice.org Office Suite www.openoffice.org. Offering many of the same features and functions available in better-known, expensive, office-oriented productivity suites in a compatible, free-of-charge package, OpenOffice.org Office Suite allows you continue working on presentations, spreadsheets, and other critical work-related documents and projects on your favorite "home" desktop and/or laptop without taking a massive bite out of your wallet or limiting your legal use of the software by way of some restrictive EULA. Just don't get anything that's in beta/development-these products can cause headaches.

If, however, you lack any word processing/productivity software on a new "budget" desktop or laptop-heck, even some high-end hardware comes with little else but the OS these days-check out the latest free version of EasyOffice www.download.com/3000-2079-10054140.html.

For a good, free desktop publishing program-as well as other nice freebies-head on over to www.freeserifsoftware.com and download Serif's PagePlus SE. Granted it might not have all the goodies and features of today's latest-and-greatest, high-end and pricey DTP software, but it is sufficient to get any basic project completed without too much hassle and expense. For most home users, it'll be more than enough.

And if you want to compare Serif's DTP offering to another package, get the free version of Ragtime Solo www.ragtime-online.com/. It, too, is capable enough to do any job you throw at it.

An Incomplete List

Sadly, this is likely a rather incomplete list of the useful products that one can find out on the Internet free-of-charge. These programs, though, are free from the burden of spyware and they aren't plagued with the bugs and incompatibilities characteristic of some of the gratis software that's available online.

That said, I hope that you at least find a product or two that'll prove beneficial-and if you do, please tell a few friends so that they, too, can save a few bucks and take advantage of the goodies you found enjoyable.

Computer Recycling for Education

Computer Recycling for Education announced a partnership and licensing campaign targeted to the solid waste industry to educate and promote their theme character, Ewaste Eddie for the Solid Waste Association of North America's (SWANA) Wastecon 2005 to be held September 27-29 at the Austin Convention Center in Austin, TX.

The campaign features Ewaste Eddie's proclamation: "Remember to Ecycle-it." Ewaste Eddie was created to partner with and help municipalities, local jurisdictions, waste haulers, e-waste recyclers, business, government, nonprofits and education to increase computer recycling and ewaste recycling through public awareness.

Solid waste professionals, landfill operators, waste haulers, recyclers, nonprofit recyclers, processors/brokers, environmental groups, colleges, and government agencies are encouraged to look for Ewaste Eddie at Booth #292. Ewaste Eddie partnerships are available through trademark licensing for bill inserts, redemption coupons, posters, banners, fliers, comic books, curriculum, environmental education, educational software, consumer education campaigns, plush dolls, toys, board games, cartoons, apparel, public service announcements, theme parks, and much more. Ewaste Eddie is also available in costume through rental agreements for ewaste collection event, classroom appearances, assemblies, and community service special events nationwide.

Computer Recycling for Education will also have a drawing for a copy of their book titled “Computer Recycling For Education” (ISBN: 0-9658664-0-8) at the Wastecon 2005. This is the only book written on the Best Practices for starting a computer recycling/refurbishing program or business and is distributed by Barnes & Noble.

Molecule Walks Like a Human

Using linkers for feet (shown in red), the molecule "9,10-dithioanthracene" moves in a straight line on a flat surface, such as a copper sheet shown here, by mimicking a human walking. (Photo credit: L. Bartels). A research team, led by UC Riverside’s Ludwig Bartels, is the first to design a molecule that can move in a straight line on a flat surface. It achieves this by closely mimicking human walking. The “nano-walker” offers a new approach for storing large amounts of information on a tiny chip and demonstrates that concepts from the world we live in can be duplicated at the nanometer scale – the scale of atoms and molecules.

The molecule – 9,10-dithioanthracene or “DTA” – has two linkers that act as feet. Obtaining its energy from heat supplied to it, the molecule moves such that only one of the linkers is lifted from the surface; the remaining linker guides the motion of the molecule and keeps it on course. Alternating the motions of its two “feet,” DTA is able to walk in a straight line without the assistance of nano-rails or nano-grooves for guidance.

The researchers will publish their work in next month’s issue of *Physical Review Letters*.

"Similar to a human walking, where one foot is kept on the ground while the other moves forward and propels the body, our molecule always has one linker on a flat surface, which prevents the molecule from stumbling to the side or veering off course," said Bartels, assistant professor of chemistry and a member of UCR's Center for Nanoscale Science and Engineering. "In tests, DTA took more than 10,000 steps without losing its balance once. Our work proves that molecules can be designed deliberately to perform certain dynamic tasks on surfaces."

Bartels explained that, ordinarily, molecules move in every unpredictable direction when supplied with thermal energy. "DTA only moves along one line, however, and retains this property even if pushed or pulled aside with a fine probe." Bartels said. "This offers an easy realization of a concept for molecular computing proposed by IBM in the 1990s, in which every number is encoded by the position of molecules along a line similar to an abacus, but about 10 million times smaller. IBM abandoned this concept, partly because there was no way to manufacture the bars of the abacus at molecule-sized spacing.

"DTA does not need any bars to move in a straight line and, hence, would allow a much simpler way of creating such molecular memory, which would be more than 1000 times more compact than current devices."

The UCR research team is now trying to build a molecular ratchet, which would convert random thermal oscillation into directed motion. "It would be similar to an automatic watch that rewinds itself on the arm of the bearer – except that it would be just one nanometer in diameter," Bartels said.

A nanometer is one billionth of a meter. A nanometer is to a meter what an inch is to 15,783 miles, more than half the distance around the Earth's equator.

Bartels was assisted in the study by Ki-Young Kwon, Kin L. Wong and Greg Pawin of UCR; and Sergey Stolbov and Talat S. Rahman of Kansas State University. The US Department of Energy funded the research. Additional support came from the Petroleum Research Fund and the Air Force Office of Scientific Research. The San Diego Supercomputer Center provided computational resources.

Reducing Computer Power Consumption

Completing an era in enterprise computing and signaling the beginning of a new generation of platforms and capabilities, Intel Corporation announced availability of its last planned single-core Intel Xeon processor. Intel also announced new low voltage versions of its Intel Xeon processor line as the company shifts to enterprise platforms with processors having two or more cores.

As part of its strategy to improve power efficiency, Intel introduced low voltage versions of its Intel Xeon processors. They include the 64-bit Intel Xeon processor LV 3 GHz1 with only a 55W processor power envelope and the 64-bit Intel Xeon processor MV 3.20 GHz with a 90W processor power envelope. Both processors are targeted at server rack and blade designs where space is constrained and power-efficiency is a priority.

Intel also introduced a new 64-bit Intel Xeon processor with 2MB of L2 cache running at 3.80 GHz that is drop-in compatible with the previous Intel Xeon

processor platforms and continues to offer power-saving features with Demand Based Switching, enhanced performance and flexibility with support for Hyper-Threading Technology‡, DDR2-400 memory and PCI Express*. Additionally, Intel introduced a 64-bit Intel Xeon processor 2.80 GHz with 2MB L2 cache for servers used in small and medium business environments.

In the coming weeks, Intel will introduce its first dual-core Intel Xeon processor, codenamed "Paxville." Originally scheduled in 2006, Paxville will deliver improved performance for both dual-processor (DP) and multi-processor (MP)-based servers.

In early 2006, Intel will deliver another server platform, codenamed "Bensley," including a dual-core Intel Xeon processor, codenamed "Dempsey," a chipset optimized for dual-core, codenamed “Blackford,” and technologies that will improve performance, manageability, reliability and productivity. At that time Intel will bring to market a dual-core Intel Xeon processor-based workstation platform, codenamed "Glidewell," also including the Dempsey processor, and a new chipset, optimized for workstations, codenamed "Greencreek."

To further efforts in reducing server power consumption, in 2006 Intel also plans to deliver a new dual-core processor, codenamed "Sossaman," targeted at power-constrained environments.

Later in 2006, Intel will introduce a dual-core Intel Xeon processor-based platform, codenamed "Woodcrest," designed on Intel's advanced 65-nanometer technology manufacturing process. Woodcrest, based on the company’s next-generation, power-optimized micro-architecture, will offer dramatically improved performance and greatly reduced power consumption.

4. Gigabit Fiber Channel Storage Array

To address soaring demand from users for more powerful storage solutions, Silicon Graphics has unveiled the SGI InfiniteStorage TP9700 RAID storage array. This marks the industry's first Fiber Channel storage array equipped with a 4Gb/second (gigabit per second) Fiber Channel interface, doubling the performance of SGI's previous offerings. The increased performance of the TP9700 means that users need far less infrastructure -- adapters, cabling, switch ports, etc. -- to access and manage their storage. Bottom line, this results in lower cost of ownership and far simpler configurations to manage.

IT managers are experiencing 80 – 200 percent annual growth in data. For these users, faster data access means greater productivity and shorter time to discovery. The TP9700 array can significantly reduce the time and complexity required to interact with these increasingly large data sets.

Based on the new 6998 Fiber Channel controller that is built on the XBB high-density storage architecture from Engenio Information Technologies Inc., the TP9700 delivers across-the-board performance improvements with eight 4Gb/s Fiber Channel host -- double previous models. This gives customers flexibility in how they chose to use the 1600 MB/s of sustained bandwidth the system delivers. These performance

improvements will be integrated into the SGI InfiniteStorage Storage Area Network (SAN), Network Attached Storage (NAS) and Data Lifecycle Management (DLM) platforms.

The two companies demonstrated the first 4Gb/s Fiber Channel Storage Area Network (SAN) at the Supercomputing 2004 exhibition in November 2004. The demonstration incorporated two TP9700 systems, each with 5.8 terabytes of raw storage and connected via a 4Gb Fiber Channel SAN running the SGI filesystem XFS(R).

64-Bit Transition

With the introduction of the Intel Celeron D processor 351, Intel Corporation now has Intel Extended Memory 64 Technology (Intel EM64T), or 64-bit memory addressability, available throughout its entire desktop and server processor lines.

With appropriate 64-bit supporting hardware and software, PCs based on an Intel processor supporting Intel EM64T can enable the use of extended virtual and physical memory. For example, on digital media applications 64-bit desktop computing enables faster performance with its ability to process more in main memory, also referred to as RAM, due to less data caching to and from the hard drive. Also, Intel processors supporting Intel EM64T provide headroom for processing high-definition video by enabling improvements in both speed and quality of workflow with its ability to handle large amounts of data.

Support for Intel EM64T on the Intel Celeron D processor family is just one of several value-orientated features as Intel bolsters its value PC platform. The Intel Celeron D processor 351, when combined with an Intel 915 or 910 Express chipset-based platform, delivers a balanced level of technology and value for desktop PCs while also expanding 64-bit support. With such features such as Intel High Definition Audio supporting 7.1 surround sound and the Intel Graphics Media Accelerator 900 (Intel GMA 900) for improved graphics capabilities, consumers can experience crisp pictures and theater-quality sound when doing such things as surfing the Web, playing basic games, doing e-mails, creating word-processing documents, tracking home finances and using education software.

Based on Intel's industry leading 90nm process technology, available in the LGA775 package, the Intel Celeron D processor 351 features a 256KB Level 2 cache, a 533 MHz system bus, a processor speed of 3.20 GHz, and support for the Execute Disable Bit.

Intel also announced that it is shipping the Intel Celeron D processors 346, 341, 336, 331 and 326 in the LGA775 package with support for Intel EM64T and the Execute Disable Bit. Intel communicated earlier this year it would be transitioning customers to the Intel Celeron D processor with Intel EM64T. By mid-2005, Intel had completed this transition.

Lastly, Intel announced the Intel Celeron D processor 350. The Intel Celeron D processor 350, available in the mPGA478 package, features a 256KB Level 2 cache, a 533 MHz system bus, and has a processor speed of 3.20 GHz. This processor does

not support Intel EM64T and is compatible with Intel 910 Express chipset-based platforms as well as Intel 845 and 865 chipset-based platforms.

The new Intel Celeron D processors 351 and 350, in addition to the new Intel Celeron D processors supporting Intel EM64T, are available now.

A First Course in Phone Systems by Voice123

The telecommunications industry has experienced many important and revolutionary developments in recent years and it's sometimes hard to keep up to date with these never ending innovations. Almost no time at all has passed after we learn about a new technology when its improved version is being launched. In the middle of thousands of new technologies, products, and services that we find everyday, it's not easy to be an expert in SIM cards, podcasting, VoIP, bluetooth, WiFi, and such. However, there is a loyal friend that will hardly disappear because it is now inherent to us: the phone.

We can live without many of the recent technological gadgets, but it's hard to live without a phone or run your business without one. Just imagine what your day would be like without your cell phone. To many, it doesn't matter if their cell phone doesn't play MP3s or take pictures as long as it makes and receives calls. Moreover, phones are a primary alternative to avoid going to the bank, the store, or online. In consequence, the phone will remain as one of the easiest and most reliable technologies to be used in telecommunications.

Companies have a big challenge to offer outstanding phone services, such as sales, information, and customer service in order to take advantage of its wide usage and stand out from competitors. In this process of providing a superior service, companies rely heavily on technology to maximize resources, which include human and physical resources. As a result, users end up distinguishing two types of phone service agents: humans and machines.

You've probably heard the famous phrase “People don't want to talk to machines, they want to talk to other people.” Well, it would be more accurate to say “Some people prefer not to talk to machines, they prefer to talk to other people”. The truth is that there are a lot of people who prefer not to talk to agents, they prefer to talk to automated systems. This is because users can interact with automated systems at their own pace and because sometimes the wait time to talk to agents is annoying. The best solution for this is to give customers both options, so they can choose, and with exceptional service.

If you or your company is considering or currently offers some type of phone service, make sure you have the automated system option. The technology is out there and the benefits are huge. It will help you reduce costs and improve service. Your phone service can be intelligent enough to competently interact with your customers. To help you figure out this better, here is a brief summary of the technologies that you can have:

Answering machines: answering machines automatically answer phone calls and recorded voice prompts giving users instructions on how to leave voice messages. They generally have a default recorded greeting, some allow the owner to create their own phone greetings, but the ultimate option is to have a customized professionally recorded greeting.

Voice mail systems: more complex than an answering machine, voicemail systems are a one-way communication technology that manages the telephone messages of a large group of people. Telephone messages can be received, saved, erased, or forwarded independently for each individual. Recorded voices help the callers browse through the voicemail system menu. Customized voice prompts and phone greetings are very common in this technology.

IVR (Interactive voice response): an interactive voice response system is similar to a voice mail system, but it is not limited to manage telephone messages. IVR systems require a touch-tone phone to interact with a voice menu and retrieve from or enter information to a database. A very important advantage is that up to date information is instantly provided to users. Examples of IVR systems include banking transactions, cell phone customer service, and airline ticket booking.

On hold messaging: it refers to what a caller hears when placed on hold during a phone call. Its main objective is to avoid the caller hanging up, which usually happens if the caller is listening to dead air. It is commonly used in features like call waiting or call forwarding. The on hold message could be playing music, a radio station, or just a message thanking the caller for waiting on the line.

On hold marketing or on hold advertising: on hold marketing is a specific type of on hold messaging. Callers that spend time listening to on hold messages, are a very specific audience that companies can target on the spot. On hold marketing takes advantage of this time and attention to advertise products or services, promote special offers, or communicate company news. This can reduce call abandonment and improve corporate image.

Most of these telephony technologies are widely used in corporations and businesses. These companies sometimes use systems with computerized voices which sound really poor. Technology enhancements have helped to improve phone messaging designs and create more helpful phone systems. Currently, real voices are used to create the prompts of these systems. Complete sentences, single words, or even fragments of them are recorded and then put together before being played. The result is a smooth interaction with the callers who, in turn, decide how to interact with the system.

One of the most important factors you should keep in mind when setting up your phone system to be ahead of your competitors, is to have a custom system, this means, designed for your company with professionally recorded messages. You don't

need to buy a system with factory-made recorded messages when you can have a custom system.

Whether you are a company in search of a phone system or a phone system solutions company, you now have a company that helps you get the best voices to record your custom phone system prompts. Voice123 is the world's largest online voice over marketplace where you will be able to find thousands of professional voice over talents who will provide you with qualified voices for any type of phone system.

With a simple and fast search process, listen to voice demos online and choose the right voice or voices for your project. No matter the type of image you want to portray, at Voice123 you will find warm, friendly, smooth, energetic, deep, teen, corporate, or any kind of voice you want. Furthermore, with Voice123 you will not only find voice overs for phone system projects. Their website also includes voices for any type of voice over recording, ranging from radio and television commercials, to movie trailers, corporate presentations, cartoon characters, audio tours, amongst others. What's more, you will find voice talents of almost every foreign language and in thousands of locations around the world.

To really succeed, don't think about just having a custom phone system. Think about having your own, unique phone system with the voice that will make you different from your competitors. Remember, it's not just what you want to say, it's also how you say it.

Exploring Capabilities of Molecules in Computing

A major breakthrough in the use of molecules as information processors is to be announced at this year's BA Festival of Science in Dublin.

Nanotechnology experts are exploring the capabilities of molecules that act like conventional computers but can operate in tiny places where no silicon-based chip or semiconductor can go. Now, for the first time, they have used these molecules to perform logic operations and process information in spaces a few nanometers across.

This advance has been achieved by chemists at Queen's University Belfast, with funding from the Engineering and Physical Sciences Research Council (EPSRC). Professor Amilra de Silva, Chair of Organic Chemistry at the university, says: "Computing isn't just confined to semiconductors. Molecules have been processing information ever since life has been around on our planet. Harnessing this remarkable ability really does have the potential to make a big difference to people's lives."

Molecular information processors placed in nano-spaces can gather, process and supply valuable data on how chemistry and biology function at this tiny scale. Molecules can also be used as information processors in medical and other applications. Portable blood gas analyzers incorporating early breakthroughs in this field are already in use, with total sales of relevant sensor components already reaching US$35 million.

When the right chemical inputs (e.g. sodium or potassium ions) and ultra-violet, blue, green or red light are applied, the artificial molecules used by the team respond by emitting light. This 'signal' can be analyzed using a fluorescence spectrometer or even the eye to provide data about the molecule's environment. Different types of these information processors respond to different chemical inputs and different colors of light.

The underlying principle is based on photosynthesis – the process whereby plants use sunlight to produce food for themselves and for us – and is known as photo-induced electron transfer (PET). In PET, light causes electrons to move from one place to another. The speed of this process can be controlled by chemical means.

The Queen's University Belfast team is now focusing on improving the complexity of the logic operations that can be performed. Professor de Silva will be discussing the team's work and illustrating current capabilities at the BA Festival on 7th September.

HotChalk Learning Environment

On February 28 HotChalk introduced the HotChalk Learning Environment, a new Web-based collaborative software solution for secondary school teachers, students and parents. The software automates much of the time-consuming administrative work for teachers by offering curriculum management; lesson plan development; secure e-mail; and automated assignment distribution, collection, and grading. It is provided to participating schools as a hosted service, along with a campus-wide wireless network and up to ten laptop computers for teachers -- all at no cost to the school. The solution is funded by online advertising, which schools can control by using the patent-pending HotChalk Community Standards Engine.

A recent consumer survey commissioned by HotChalk and conducted by Harris Interactive suggests that the debate is not whether corporate sponsorship of schools should be allowed, but rather how corporate sponsorship should be managed. In the survey conducted earlier this month, 76 percent of U.S. adults agreed that corporations have a responsibility to support public schools because they depend on employees having the education and skills that schools teach. Moreover, more than half of adults think that advertising in the classroom is acceptable if schools and local officials determine which ads are displayed (54 percent) and ads are restricted to after-school hours only (53 percent). By contrast, only 22 percent think that it is acceptable to show advertising inside the classroom.

Educational Collaboration Supports NCLB

The HotChalk Learning Environment is a comprehensive application that enables secondary schools to create a productive learning environment and produce measurable academic results. It includes curriculum management, lesson plan development, and secure e-mail, as well as automated assignment distribution, collection and grading. The collaborative environment makes it easy for teachers to add supporting materials so that all students have access to the resources they need,

and teachers can share lesson plans and other information in order to get more done in less time. HotChalk harnesses the power of enterprise-class computing and online advertising to address the demands that financially squeezed schools face to meet the No Child Left Behind (NCLB) mandate of the US government. No prior technical experience is necessary. All that is required for a school to participate is for a teacher to complete ten hours of free online training in order to become HotChalk- certified.

The benefits to schools also extend to students and their parents. Since the HotChalk Learning Environment is a Web-based application, it is accessible through any standard Web browser from any computer -- whether at home, the library or local community center. Teachers can set up assignments so students receive reminders about their homework every time they log in. Meanwhile parents benefit from knowing what is expected from students in the days and months ahead, and can easily stay in touch through private, secure email with teachers about their children's progress.

School-Controlled Advertising and No Strings Attached Technology Grants

With HotChalk, schools and the local community can benefit from the online marketing budgets of corporations and local businesses while gaining access to enterprise-class software, wireless networking and security while controlling the advertising at all times. The patent-pending HotChalk Community Standards Engine allows secondary schools to choose which companies can advertise, what advertisements are acceptable, and who can see them. For example, schools can determine that students will only see ads if they log on during non-school hours. If they log on during class time, they simply see online public service announcements. HotChalk gives 10 percent of advertising revenues back to participating schools in the form of technology grants and offers fundraising programs for schools. To date, school-approved categories of advertising on the HotChalk Learning Environment include print and online media; retailers of clothing, books, music, groceries, and electronics; travel and financial services.

HotChalk Brings Enterprise-Class Performance and Security to Schools

The HotChalk Learning Environment is provided as a hosted service; the application and all of its data reside on secure servers that are accessed by its users through a standard Internet Web browser. By moving the HotChalk application out of the local schools and into a data center, it becomes economically possible to provide the necessary tools for ensuring 99.9 percent uptime, including redundant servers and network connections, backup power systems, and enterprise-class network security. Equally important, by hosting the application, HotChalk manages all ongoing administration and eliminates the need for the school technology coordinator to be a database administrator, developer, or integrator.

HotChalk WalkAbout Wireless Network

Participating schools are provided with the HotChalk WalkAbout Wireless Network, unlocking the benefits of wireless Internet access for the entire school community. The campus-wide, industrial-strength wireless network enables teachers and students to access the HotChalk Learning Environment from anywhere on campus and eliminates the need for schools to spend scarce educational funds on networking infrastructure. With a simple two-day installation, the wireless network is up and running.

Methodology

Harris Interactive conducted the telephone survey on behalf of HotChalk in the U.S. between February 4 and 7, 2005 among a nationally representative sample of 1,028 adults aged 18 and older. Figures for age, sex, race, education, number of adults, number of voice/telephone lines in the household, region and size of place were weighted where necessary to align them with their actual proportions in the population. In theory, with a probability sample of this size, one can say with 95 percent certainty that the results have a sampling error of plus or minus 3 percentage points of what they would be if the entire U.S. adult population had been polled with complete accuracy.

How the Internet influenced Indonesian politics

Merlyna Lim investigated the relationship between the Internet and political protest based on two model situations from Indonesia. From these two examples she drew general conclusions about the role of the Internet in the formation of public opinions and the consequences of this for political relations.

The Internet facilitates creative interaction between people and between people and their environment. Due to its openness, this technology is less sensitive to domination by a small number of elite groups. Although the Internet has the potential to generate and support collective protest, Lim believes that the worldwide web will never replace the importance of cultural and interpersonal contacts in collective actions.

The researcher based her findings on two historical situations. The first was the use of the Internet during the 'reformasi' of May 1998. The 'reformasi' is the political renewal movement which forced former president Soeharto out of power in 1998. Lin discovered that in this period, the Internet made a unique contribution to the political activism which led to the fall of Soeharto. There was a flurry of messages between the Internet and the conventional media, and with student activists, taxi chauffeurs and ordinary citizens in the so-called warung – kerbside food stalls.

Moluccan conflict

The second example was the use of the Internet by the Jihad Troopers, a radical militant group involved in the Moluccan conflict. This example illustrates how the Internet became the place where the original ethnic-religious and social identity was relived and deployed as a mobilisation strategy. This local identity could be enlarged and made more aggressive by directly providing information about violent incidents elsewhere in the Islamic world. As a result of this the conflict grew in size and lasted longer.

Although the researcher has drawn general conclusions, the Indonesian cases studied are not universal. More research in non-Western countries is necessary to gain a fuller picture of the social, historical, political and cultural dimensions of the Internet's role. Lim's research results can already be used to inform public organizations in developing countries about the relative importance of the Internet for the process of democratization.

IBM Sees Collaboration Driving New Systems Paradigms

IBM has detailed new computing systems, initiatives and a planned collaborative community aimed at helping meet the rising demand by businesses to collaborate with each other more efficiently. The company said the demand is global in nature and will require that traditional transaction processing by computers be augmented by a collaborative processing approach that more tightly integrates technology, processes and personnel.

According to IBM, companies once isolated by disparate technologies are increasingly collaborating to create more on demand operations. This requires that each firm's computing systems must be linked more intelligently.

Collaborative processing means using technologies like virtualization, open standards and encryption to share information real-time inside a business and helping to enable companies in various industries to work seamlessly on business applications ranging from designing automobiles and aircraft to discovering new medicines. Collaboration between companies and institutions has begun to blur the traditional lines of information technology.

To help meet the surge in business demand for collaborative processing, IBM announced:

– IBM System z9 mainframe – a sophisticated computing system, the IBM System z9 mainframe provides advanced security and virtualization capabilities that the company said is designed to enable it to support collaboration and to act as the hub of a new era of collaborative computing.

– IBM Virtualization Engine 2.0 – IBM's latest advance in virtualization technology with unprecedented interoperability across systems, storage and networking. Open interfaces and implementation of standards allow premier companies such as Cisco, VMware, Network Appliance and others, to participate in this infrastructure.

– The intention to form Blade.org – Blade.org is planned be a collaborative organization focused on accelerating the expansion of solutions for BladeCenter, developed by IBM and Intel. The organization is aimed at spurring development and innovation around blade technology with the intent of supporting BladeCenter innovation in Voice over IP, industry specific solutions, security and many other technologies.

Collaborative Processing Drives Innovation

Opening the IT infrastructure, expanding intelligent components and allowing customers to highly integrate their systems for broader sharing of data is the core of the collaborative processing trend. For example:

– With the NYSE, IBM Engineering and Technology Services designed custom, handheld systems that linked to the back-end IBM mainframe systems to extend transaction and collaboration capabilities onto the trading floor. Connecting disparate IT systems enables a free flow of information across the enterprise. Now NYSE traders can access mainframe-based data in the palm of their hands from hundreds of PDA devices to ensure accurate decision-making at record speeds.

– GHY International, a leading provider of professional customs brokerage, teamed with IBM to develop a highly virtualized and simplified IT computing environment by replacing and reducing the number of servers from four down to one. The company uses the IBM eServer i5 model 550 with IBM xSeries servers to help reduce the miscellaneous use of x86 servers. . GHY runs 17 virtualized servers and four operating systems, i5/OS, AIX, Linux and Windows – simultaneously on one physical machine.

– Mercury Computer Systems expects to enhance the compute performance and image quality of MRI, CT and digital x-ray devices, and other demanding applications. Utilizing the strength of the Cell processor-based technology's processing power and IBM's expertise in design engineering, Mercury says it expects to significantly improve system performance, delivering precise images of stunning clarity in real time for radiologists and others.

– BlueCross BlueShield of Tennessee, the state's largest not for profit health plan and a pioneering force in Tennessee's healthcare delivery system, has significantly increased the volume of data over the last 9 years and expanded system capacity from 500 Gigabytes to 110 Terabytes over the same period. Working with IBM, BlueCross BlueShield of Tennessee adopted a scalable and highly secure infrastructure, including eight IBM TotalStorage Enterprise Storage Servers, an IBM eServer zSeries mainframe, nearly 200 IBM eServer xSeries, a dozen IBM eServer pSeries, IBM TotalStorage Enterprise Tape Drive 3592s and IBM Tivoli Storage Manager. BlueCross said The IBM solution helped the company to significantly save in the last year and a half.

– The customers of Reynolds and Reynolds, an automobile dealer services company, are benefiting from the self-managing capabilities of IBM eServer xSeries, BladeCenter servers, IBM TotalStorage DS4500 storage-area network (SAN), IBM Tivoli Storage Manager and IBM Director systems management tools. Using this

infrastructure, Reynolds created a new delivery model -- Applications on Demand -- that delivers applications and services to car dealerships from fully managed remote servers. Applications on Demand provides pre-scheduled, automatic and instantaneous systems backups for dealerships. In addition, all critical dealership data is copied and stored off-site. According to Reynolds, about 40 percent of the car dealers in the U.S. and Canada rely on Reynolds' systems to help run their businesses.

Internet & WiFi Camping

Campgrounds, and later RV Parks, have swept the country as a way to get out on and off the road. From solo trips to family outings to snow birds, people are getting out there and away from every day life between walls. Cell phone service at the campsite has steadily improved and you may register a few bars at the fire pit. But can you register a new domain name and get the important email you missed before wheeling down the old highway?

A new amenity is rapidly being added to campground and RV Park listings these days. Internet access. It may be high-speed wifi, crawling dial-up or a single computer in the corner of the park manager's office but it's there for you. "It's a fast growing service that is requested in RV parks these days," says Adam Longfellow of AllStays.com. "We responded to our customers by adding a directory of campgrounds and RV Parks that offer this service. The number of listings has tripled in just the last few months. I think more and more people want to stay connected while traveling."

Guests of these new service oriented parks and campgrounds want to be able to check information, stay in touch by email or do a little work while away from home. "They may be living in a RV park for weeks or months out of the year and don't want to have to run out to a library or coffee shop. With more and more parks offering Internet service, one could run an online business or auction shop from almost anywhere."

Wireless or "WiFi" service seems to be the fastest growing for Internet campgrounds. A RV park can share a hi-speed internet connection with a router for whoever logs on. There are some that use a dial-up service but that is a bit more complicated. Any park office can add a computer or two in the corner for guests to use but limited access, privacy issues, and scheduling can be more difficult and a hassle at times.

Costs vary from campground to campground but many are free. Some owners choose to offer this as a free perk to lure more guests away from other parks. Or they may charge for the access time. Still others are part of a network of parks using a particular service. A guest can pay a monthly fee and then connect at any park in the country that is on that network. "You could travel the country and have Internet access at your campsite most of the time if you plan it out," says AllStays.com.

"We're staying on top of it and adding more places all the time. Most of the U.S. states have places in our directory right now and we would expect every state to have Internet campgrounds by the end of the year. Even a number of state and

national parks are getting into this service. We are currently working on listings for Canada and around the world as well," adds Adam Longfellow at AllStays.com

So throw the Wi-Fi enabled laptop in the car or RV and hit the back roads. You never know when your fingers will itch for the keyboard. Just make sure your fingers are clean after those roasted marshmallows.

AllStays.com, online since 2000 and based in Arizona (US), lists all kinds of lodging, from bed & breakfasts to yoga retreats and luxury hotels, from primitive campgrounds to motels, haunted hotels and spa resorts. AllStays also links directly to official websites to make sure you have the real scoop on the latest and most accurate information from around the world.

Research, Browse, and book online to stay anywhere on Earth.

Nanotechnology Tool

Nanolithography results in patterns of tiny circuits in semiconductor chips. A new nanotechnology tool that will dramatically cut the cost of leading-edge nano research at the sub-50nm scale has been developed by European Uion (EU) researchers. It could lead to Next Generation Lithography (NGL) technology.

The commercially available first generation tool is low cost compared to sub-50nm alternatives. For example, electron beam lithography costs Ђ2m per machine, whereas the Soft Ultraviolet (UV) Imprint machine developed by the IST-program funded SOUVENIR project costs in its basic version well below Ђ200,000. It will be used to produce novel and experimental nanotech devices in universities and research institutes.

Later generations, however, could be used for small manufacturing runs. Further generations still could cause a fundamental shift in the semiconductor and nanotechnology industries.

"In principle, this new technique has the potential to be used for mass manufacture by the semiconductor industry. One approach we use can already form patterns down to the 10nm scale," says Dr Markus Bender, researcher at German company, Applied Micro- and Optoelectronics (AMO), and coordinator of the SOUVENIR project.

The semiconductor industry's holy grail

This is a big deal. Next Generation Lithography (NGL) is the holy grail of the semiconductor industry. It will allow rapid, large-scale manufacture of modern microchips at a sub-50nm scale. Industry giant Intel has spent 15 years and millions of dollars looking for it. A small team, but brilliant team of dedicated researchers in Europe may have found the solution in three years at a cost of $2,300,000.

It will take a few years more research to know whether SOUVENIR's work will lead to viable NGL, but even with its first generation tool the SOUVENIR team have already generated remarkable results and a new product on the brink of commercialization.

Photolithography works by casting light through a mask to produce a pattern on a chemically-coated substrate. The light changes the chemical structure of the substrate. Depending on the type of photolithography, either the lit or shadowed

chemical is washed away in the next step. In either case the result is a pattern etched into the substrate.

With nanolithography the patterns are invisible to the naked eye and the vast majority of the world's microscopes. The result is the tiny circuits in semiconductor chips.

The SOUVENIR project developed a new technique to create those patterns, one that is low cost and, comparatively, low tech. In a first step the substrate was coated with a low viscosity, UV-curable resist. The resist is simply a UV-sensitive chemical layered onto the substrate. They then used a soft polymer mould, called an elastomer, pressed against the resist-coated substrate, called imprinting, followed by the UV photopolymerisation, or curing, of the resist.

This costs less than other photolithographic techniques. Because the mould is pressed against the resist, the system does not require the extremely expensive 'deep' UV light sources used in the semiconductor industry. These light sources can only work properly in a vacuum. Finally, the elastomer mould is considerably cheaper than those used in microchip manufacture. The result is a low-cost pattern process at the sub-50nm scale.

However, the low cost comes at a price. Currently, the system is too slow and unproven to replace the current industrial photolithography processes. What's more, the elastomer moulds used in the SOUVENIR process at the moment need further improvements for high-resolution alignment processes, essential for mass manufacturing semiconductors.

But ultimately it has the potential to become the next generation lithography. Thanks to research completed by the German government's Federal Ministry of Education and Research (BMBF), it is possible to use the same imprinting technique using a hard mould, based on quartz, which does have the required precision for semiconductor manufacture.

"There a still problems with that particular technique," says Dr Bender. "The quartz approach only works with a substrate of one square inch, but we can use the elastomer mould on a six inch wafer," says Dr Bender. Furthermore, while quartz could address the precision issues the technique is currently too slow for large-scale semiconductor companies.

But Dr Bender believes that with a commitment to research these hurdles could be overcome. "This is the first generation of the tool we developed and, with work, we can in principle get much better, faster and more scalable results," says Dr Bender.

If he is right it could provide a viable alternative to the costly high-tech approach taken by Intel for Next Generation Lithography. The highly specialized light sources, mirrors and ultra-high vacuum used in Intel's Extreme Ultraviolet Light (EUVL) technique impose almost unconquerable and enormously expensive scaling constraints. After years and millions of dollars there is still no commercially viable EUVL system available.

"I think there's the same potential with our technique as with the EUVL. UV imprinting is still an under-investigated area, and if it wasn't for the EU this research wouldn't get funded. Companies are not researching this field," says Dr Bender. "We

are working in close cooperation with an Austrian company, Electronic Vision Group (EVG) to develop tools for the two approaches. I think next year we'll have a step and repeat tool for 300mm wafers on the market," says Dr Bender. This first generation tool is designed for small volume production, for example for chemical sensors and in biotechnology applications at small companies and research centers. Right now, small companies can't afford their own tools for sub-50nm nanotech devices.

But ultimately, this research could change how the semiconductor industry works.

"This is a totally new technique and we've got to prove that we can reliably reproduce the results. That's what we'll be doing now," says Dr Bender.

Next Generation Silicon Germanium Technology

IBM announced the availability of its fourth generation silicon germanium foundry technology, named 8HP – with over 2X performance of the previous generation. The new 130 nanometer (nm) silicon germanium (SiGe) bipolar complementary metal oxide semiconductor (BiCMOS) foundry technology can reduce the cost of mobile consumer products, advance high-bandwidth wireless communications, and help enable innovative new applications such as collision-avoidance automobile radar.

Along with 8HP, IBM is offering a lower cost variation (8WL) specifically targeted at wireless applications that can enable longer battery life and increased functionality in cellular handsets in order to help proliferate wireless local area networking and global positioning satellite (GPS) technology.

IBM was the first foundry in the world to offer SiGe BiCMOS technology and since 1995, has shipped hundreds of millions of SiGe devices. CMOS chips are the foundation for digital computing applications, while silicon germanium (SiGe) BiCMOS chips provide enhanced radio frequency communications and analog functions in addition to the core digital computing capabilities.

IBM's new 130nm SiGe BiCMOS technology's application to products includes:

– Emerging safety systems for automobiles, including radar at 24 GHz for blindside detection and at 77 GHz for collision warning or advanced cruise control.

– 60 GHz Wi-Fi chips, for next-generation wireless personal-area networks and backbone nets.

– Software defined radios for cellular handsets which convert signals from the antenna directly into a digital form. A single-chip can be applied across multiple standards and various global mobile networks to transmit voice, data, and video signals.

– High-speed A/D and D/A converters for data acquisition, direct-to-baseband radio receivers, signal synthesis, and more.

At 130 nanometers (or 130 billionths of a meter), IBM's new SiGe BiCMOS technology delivers higher performance, lower power and higher levels of integration than current 180nm SiGe offerings. The technology maintains compatibility with

IBM's application specific integrated circuit (ASIC) technology platform, enabling foundry clients to port a wide range of intellectual property circuit blocks and standard cell library elements. The 130nm foundry platform also includes an RF CMOS technology option, giving IBM foundry customers a broad range of technology choices for RF and mixed-signal applications.

Additional technical specifics include:

– 130nm Lithography based SiGe BiCMOS.
– Advanced SiGe NPNs, Emitter width= 120nm, Ft = 200 GHz (8HP), Ft=100 GHz (8WL).
– 130nm CMOS FETs, 1.5 / 2.5v.
– Copper Global Wiring Levels + Thick Aluminum Top Level Metal.
– Full Suite of Passives-Resistors, Varactors, MOS and MIM Capacitors, High Q Inductors.
– Process Design Kits featuring precision RF device models.

Silicon Technologies

On March 1 at the Intel Developer Forum Intel Corporation provided the first glimpse of a set of silicon technologies that speed the interaction between network data and server applications by up to 30 percent. Intel also announced an agreement with Microsoft to support the technology in forthcoming operating systems.

The breakthrough, known as Intel I/O Acceleration Technology (I/OAT), is Intel's newest "*T" technology, a collection of premier silicon innovations. The technology comes at a time when the demands of applications - such as Web commerce, messaging, storage and server clustering - are beginning to chronically overwhelm servers' responsiveness and the ability to deliver network data to applications quickly and reliably.

While server CPU performance and network bandwidth has improved over the years, the primary method for moving data has not changed. Today, the processor in a server shoulders the total burden of processing, accessing memory and making protocol computations on every piece of data or packet. As a result, much of the processor's operation is diverted and response time, reliability and the end-users' experience can suffer.

Intel I/O Acceleration Technology takes a platform approach to addressing this problem by breaking up the data-handling job among all of the components that make up the platform - the processor, chipset, network controller and software. This platform approach reduces the workload on the processor while accelerating the flow of data. The processor's job is reduced by giving the chipset and network controller responsibility for moving data in and out of memory. Intel also optimized the TCP/IP protocol - an open "etiquette" that enables all types of computers to exchange data via a common language - for Intel-based servers, which cuts the processor's workload in half, further freeing it to work on other jobs.

Overall, this platform approach achieves at least a 30 percent faster data exchange between the platform and applications, and enables the processor to spend more time on other computing tasks.

The platform approach behind Intel I/OAT also remedies inadequacies in existing technologies, such as TCP offload engines (TOE), designed to offload the processor of TCP/IP processing. TOE dedicates a specialized and costly chip to offload the protocol computation, but it does not fully address system overhead or memory access, the two largest burdens on the CPU. As a result, TOE is effective only when packets payloads are large, such as those in high-performance database and data-warehousing applications.

Microsoft Pledges Support Microsoft will provide native support for Intel I/OAT in future Windows Server releases. Those releases also will include technology that balances network TCP/IP traffic streams across multi-core CPUs.

Intel I/OAT is the newest in Intel's family of premier silicon platform technologies, known as "*T" technologies, that will deliver new and improved computing capabilities for home and business users, and IT managers. Other Intel *Ts include Intel Active Management Technology (management), La Grande Technology (security), Extended Memory 64 technology (memory addressability), and Intel Virtualization Technology (virtualization), all of which are available today or under development.

Storage Acceleration Last month, Intel introduced a storage feature of Intel I/OAT that enables RAID-6 storage acceleration. The RAID-6 acceleration technology enables a system to operate at the highest performance levels possible, even when recovering from multiple disk failures. This storage acceleration capability provides Intel I/OAT with faster throughput and increased reliability for data as it moves in and out of hard disk drives. While the new TCP/IP data handling functionality of Intel I/OAT will not be available until forthcoming platform introductions, the storage feature was recently introduced on the new Intel IOP333 storage processor.

Wireless Phones Versus Landline

One in ten (9 percernt) U.S. adults have abandoned their traditional telephone service completely and now use their wireless phone exclusively. This trend is expected to grow as five percent of all adults say they are "seriously considering" going exclusively wireless within one year.

Another 47 percent say they are "somewhat considering" this switch.

These are some of the results from The 2005 Telecommunications Report, a study conducted quarterly by Harris Interactive. The most recent study was conducted online in April 2005 among a sample of 1,088 U.S. adults.

Barriers to switching to wireless exclusively

While the trend is expected to grow, there is still a segment of the population (39 percent of all adults) who say they will never abandon their traditional phone line.

Among these adults, the top reasons given for never wanting to make this switch include:

- Safety of a traditional phone (26 percent)
- Need for Internet access (20 percent)
- Pricing not attractive enough (12 percent)
- Cell signal at home is weak or unreliable (7 percent)
- Coverage is not good enough (6 percent)
- Want/need multiple extensions/phones (6 percent)

Factors that could influence exclusive wireless phone use

Results show that there are steps that wireless providers can take to possibly change the minds of those who say they would never go exclusively wireless. These include:

- Reduced pricing plan (34 percent)
- Coverage improvement plan (30 percent)
- Money-back guarantee (24 percent)
- Wireless broadband for home or office (23 percent)
- Great deal on "multiple extension units" for home (20 percent)
- Free trial (30 days) (16 percent)
- Testimonials from friends and neighbors (10 percent)

"These results show that many consumers are actively seeking out alternative telecommunications services and the options are out there," states Joe Porus, chief architect for the Technology Research Practice at Harris Interactive. "While the majority of consumers are happy with their landline service, the movement toward wireless replacement options clearly shows that consumer sentiment is changing. Telecommunications service providers (wired and wireless) need to be prepared!"

Legs for Laptops'

Laptop manufacturers once included flip-down legs. Though a good idea, customers would send back perfectly good laptops for warranty work on these inexpensive legs when they broke. LapWorks has developed a durable solution for the legs the manufacturers no longer include. They are the only such Laptop Legs on the market today.

The peel-n-stick Laptop Legs for PCs and Mac Feet for Macs attach to the bottom of any standard notebook (2 per computer), then flip down to elevate it to a choice of two heights – 1" or 1 3/8" – for improved typing ergonomics and increased cooling and ventilation underneath the laptop.

The legs sell for $24.95 in packages of four (two sets) each of either the Laptop Legs or Mac Feet. The Laptop Legs are PC gray and the Feet are Mac white. Until April 30 they are only $19.95 direct from LapWorks.

Enhanced Cellular Functionality

Whether in an airport or on campus, many consumers want to tap into wireless local area networks (WLAN) without carrying a heavy laptop. Taking another step toward true converged platforms, Freescale Semiconductor Inc. and Marvell announced plans to offer WLAN solutions for mobile devices through Freescale's wireless platforms and applications processors.

Users want to quickly download large music files, pictures, presentations or emails while they are on-the-go and without sacrificing battery life. A cellular handset or portable device enabled by WLAN lets the user experience the expanding benefits of IEEE(R) 802.11 standard-based networks in global hot spots where they can download large amounts of data at faster speeds, saving precious time.

Together, Marvell and Freescale plan to provide WLAN capability into mobile handsets, smartphones and entertainment devices. Freescale customers will receive Marvell's IEEE 802.11 reference designs, ICs, software and tools to simplify customer development and time-to-market. Complementing Freescale's market-leading 3G Innovative Convergence (TM) and EDGE Mobile Extreme Convergence platforms, as well as i.MX applications processor family, Marvell has a complete multi-mode, lower power IEEE 802.11 product line enabling connectivity using 802.11b, 802.11g or 802.11a/b/g.

Low power features include:

- Power save modes
- Ultra-low standby current
- Non-pre-emptive host O/S support
- Field upgradeable security and quality of service (QoS)

Looking at Organic Electronic Materials

Although still in the qualifying rounds, U.S. researchers are helping manufacturers win the race to develop low-cost ways to commercialize a multitude of products based on inexpensive organic electronic materials--from large solar-power arrays to electronic newspapers that can be bent and folded.

In the on-line issue of *Advanced Materials*, researchers from the National Institute of Standards and Technology (NIST) and the University of California at Berkeley report success in using a non-destructive measurement method to detail three structural properties crucial to making reliable electronic devices with thin films of the carbon-rich (organic) semiconductors. The new capability could help industry clear hurdles responsible for high manufacturing development costs that stand in the way of widespread commercial application of the materials.

With the technique called near-edge X-ray absorption fine-structure spectroscopy, or NEXAFS, the team tracked chemical reactions, molecular reordering and defect formation over a range of processing temperatures.

They then evaluated how process-induced changes in thin-film composition and structure affected the movement of charge carriers (either electrons or electron

"holes") in organic field effect transistors, devices basic to electronic circuits. With NEXAFS measurements taken over the range from room temperature to 300 degrees Celsius, the team monitored the conversion of a precursor chemical to an oligothiophene, an organic semiconductor. The molecular organization and composition achieved at 250 degrees Celsius yielded the highest levels of charge carrier movement and, consequently, maximum electric-current flow. As chemical conversion progressed, the researchers calculated how the molecules arranged themselves on top of an electrical insulator. Top transistor performance corresponded to a vertical alignment of molecules. In addition, they used NEXAFS to determine the angles of chemical bonds and to assess the thickness and uniformity of film coverage, also critical to performance.

NEXAFS has the potential to be the "ideal measurement platform for systematic investigation" of organic electronic materials, says lead investigator Dean DeLongchamp, a NIST materials scientist. "A straightforward means of correlating chemical and physical structure to the electronic performance of organic semiconductor films is a much-needed tool."

The research was conducted at the NIST/Dow Chemical materials characterization facility at the National Synchrotron Light Source. Funding providers included the U.S. Department of Energy, Defense Advanced Research Projects Agency and the Microelectronics Advanced Research Corporation.

Destructive power of mobile viruses could rise fast

The dream of a connected world where PCs and mobile phones can communicate with the digital home and other devices is supposed to make life easier. But it could instead make life far more dangerous if malware developers have their way.

And it’s not just the possibility of losing a credit card number. With microchips and software becoming more and more a part of life, such as in cars, homes and mobile phones, the threats multiply dramatically.

Simple programs available already could be a good start. Mobile phone services in some countries allow people to view what’s going on inside their house during the day via a Web cam connected to motion sensors. The Web cam can snap a picture and send it to the user if anything seems awry.

But that same Web cam could be used by a hacker to see if anyone’s home. If nobody’s in, it may be a good time to break in. Or, a hacker could use the Web cam to take pictures of what’s going on in the house, invading privacy. In a more ominous example, what if someone could hack into a user’s mobile phone while they’re driving and use it to shut down certain automobile systems, like the brakes?

Scenarios like these are becoming increasingly possible as more gadgets, such as mobile phones, become connected to the Internet, said Dhillon Kannabhiran, founder of the Hack in the Box Security Conference being held in Kuala Lumpur, Malaysia, this week.

Part of the problem is that stronger security in personal computers and on servers has made it more difficult to attack such devices.

“These kind of exploits are getting fewer and far between, so people are looking for new platforms to attack,” said Kannabhiran, adding that hackers will take far greater interest in 3G (third-generation) phones because being connected to the Internet all the time makes them more accessible.

The threat of malware attacks on mobile phones has already increased dramatically over the past year as smarter phones that use more software, allow Internet surfing and act as personal digital assistants gain popularity.

“Vendors are concerned with the alarming rate smart phone viruses are starting to come out now,” said Anthony James, senior product manager at security specialist Fortinet Inc., in an interview.

F-Secure Corp., another antivirus software vendor, says the current total count of known mobile malware stands at 87, up from less than 10 early last year. A total of 82 of those viruses were written to run on the Symbian series 60 operating system.

Symbian is the world’s most popular mobile phone OS (operating system). The large number of virus attacks on Symbian don’t mean it’s less secure than other operating systems, it just shows how popular Symbian devices are, and thus “they are the most interesting target for malware authors,” says F-Secure, on its Web site.

The Symbian OS led the global smart phone market with a 62.8 percent share at of the end of the second quarter, followed by Microsoft Corp. at 15.9 percent and PalmSource Inc. with 9.5 percent, according to industry researcher Canalys.com Ltd.

The trouble with the connected world is that faster download speeds for mobile phones and other devices increase the possibility of infection and spreading, said Todd Thiemann, director of device security marketing at Trend Micro Inc., speaking at the 3GSM World Congress Asia in Singapore.

He said the mobile malware seen so far has been done by hackers testing their mettle against current mobile phone security, and that the threat will increase as more virus authors get into the game.

The latest example is the Cardtrap virus, which targets handhelds running the Symbian OS. The virus is slightly more advanced, in that its goal is to infect a user’s PC. When the phone’s memory card is inserted into a Windows-based PC, which a user might do to clean the virus, a worm on the memory card automatically installs and runs the virus on the PC, according to Thiemann.

Expect viruses like these to become more common and more destructive as devices link up to the Internet.

Навчальне видання

Чугунова Неллі Володимирівна
Кузнєцова
Середенко

NEW TRENDS IN COMPUTER AND MOBILE TECHNOLOGIES

Хрестоматія
для студентів 2-3 курсів
технічних факультетів