UMTS - Universal Mobile Telecommunications System
Niels Rosenhaeger. Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI

The current mobile telecommunication systems have various problems. For Internet connections the data rate is too low, which does not allow for new applications like video telephony or fast data transfer. Moreover, there is no integration of other services and global roaming is extremely difficult because of incompatibilities with systems in other countries. The solution to the above problems will probably be UMTS (Universal Mobile Telecommunications System). The purpose of this project is to give an overview of the properties and capabilities of UMTS and its possible problems. UMTS is a new third-generation mobile telecommunications system of the IMT-2000 family and in the US and Japan also known as FPLMTS (Future Public Land Mobile Telecommunications System). It integrates fixed, wireless and satellite networks using several frequency bands between 1885 MHz and 2200 MHz. UMTS is capable of data rates on-demand up to 2Mbit/s and global roaming. Opposed to current mobile
It is also possible to have a longer time between upgrades. By being technologically advanced, they will also be cheaper and lower cost for today's Internet Service Providers. All everyday including kitchen appliances, automobiles, and stereo equipment. It also allows for protocols for wireless transmission of voice and data, and an increased capacity and lower cost for today's Internet Service Providers. All these tasks are accomplished by designing these instruments with processors that are able to adapt to future technologies without hardware or software upgrades. By using this technology, not only will products of the future be technologically advanced, they will also be cheaper and have a longer time between upgrades.

2 ICED Network Interface
Tom Filocco, Owen Martin. Dept. of Electrical and Computer Engineering, University of Rhode Island, Kingston, RI

Our project will detail the implementation of the Logical Link Control (LLC) and TCP/IP of the ICED Ethernet interface. Our implementation will consist of 2 parts. The first, a driver for the LLC that will be responsible for transmission and reception of packets. While the TCP/IP layer handles the interface between the user application. The LLC driver will interface with the MAC and the TCP/IP layer to control the flow of packets. This consists of reception of packets, transmitting data and rejecting fragments. The TCP/IP layer will manage the data once it has been received. It will interface with the application be providing the environment for communication protocols. Of course the implementation will not be as extensive as the IEEE standards, but the user will be able to reliably address and communicate with remote systems. Our goal was to to allow a machine to use familiar TCP/IP protocols and communicate with the hardware that will actually transmit onto the physical layer.

3 DIGITAL DNA from Motorola
Jason Vetovis. Department of Electrical and Computer Engineering, University of Rhode Island

With the ever-changing face of today’s technology, it is important that new technology be able to deal with the burden that will be put on it. Digital DNA from Motorola will allow today’s products to do just that. Digital DNA is currently in various types of wireless communication devices including radios, phones, and personal organizers. However this technology will soon be in appliances we use everyday including kitchen appliances, automobiles, and stereo equipment. It also allows for protocols for wireless transmission of voice and data, and an increased capacity and lower cost for today’s Internet Service Providers. All these tasks are accomplished by designing these instruments with processors that are able to adapt to future technologies without hardware or software upgrades. By using this technology, not only will products of the future be technologically advanced, they will also be cheaper and have a longer time between upgrades.

4 Television Communications
Matthew Siedzik. Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI

The field of communications has seen incredible growth during the past 20 years. Whether it is telephone or computer communications, both have undergone some extensive changes. Another often overlooked area that has seen great change is that of television communication. We are no longer locked into 8 - 10 local stations, rather we can have up to 200. No longer do we have to fine tune a set of “rabbit ears” so that we can make out Homer Simpson's head, instead we can have crystal clear digital quality so it appears that Homer's actually right there in the room with us. It's importance lies in the easy availability of a television to just about everyone, and the fact that a majority of people watch it daily for news and entertainment. With new developments like Webtv, ones own television can now bring the "internet explosion" to a whole new sect of people who may not have been able to afford a computer, or were just simply scared away from them. The following report gives an overview of television communications; it's history, how computers are playing a role in it and where we're heading in the future.

5 Interactive Web Site
Derek Rusek. University of Rhode Island, Dept. of Electrical Engineering

The intent of this project is to construct a web page that can be used by an organization or individual as a means for receiving input about a product or idea by the general public. A poll could be taken, tests could be administered, or any type of information could randomly be collected. Although many different programs and database access mechanisms exist and the numbers grow, CGI scripts were employed to create a simple data base on a unix server. This was due to its availability and because of the wide range of scripts readily available. The test database was simply a list of names, email addresses, and categories of information requested. The test base was a fan club, where the different fields of information gathered were parsed into a flat-file. The information was separated by delimiters and each new entry was kept on a subsequent line. The experiment showed the huge potential available when larger and more complex relational databases are used. CGI script was chosen for the server side database as it is a compact and widely supported interface. Perl was used as the scripting language, as it is considered the most powerful and compact way to implement the code. Further work is being planned for user side programs using the ever more popular java language. Both are powerful methods of conveying information over the web, each with its own strength. User side java is good for conveying powerful programs that can be run in the user's browser, while server
side CGI script is needed where large amount of data is accessed.

6  
Spread Spectrum Technology Utilization for Wireless Communications
Greg Marcoux, Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI

Multiple access capability is essential for today's satellite communications due to the high demand for bandwidth. Popular multiple access techniques include Time Division Multiple Access (TDMA), Frequency Division Multiple Access (FDMA), and Code Division Multiple Access (CDMA). Of the three, only CDMA provides anti-jamming capabilities, interference rejection, and low probability of intercept characteristics through spread spectrum techniques. These additional capabilities are vital for military communication applications. This project identifies and compares two of the most commonly used spread spectrum techniques utilized in wireless communications, Direct Sequence (DS), and Frequency Hopping (FH). Performance characteristics such as bandwidth efficiency, energy efficiency, error rates, and other relevant parameters are also discussed. Results from a Matlab simulation are used to illustrate the effects of spread spectrum techniques in both the time and frequency domain.

7  
ADSL (Asymmetric Digital Subscriber Line)
David J. Smith, Department of Electrical & Computer Engineering, University of Rhode Island

Receiving and sending vast amounts of information is all well and good, but the data stream needs to be interfaced to the transmitting and receiving sections of the modem. The dominant form of ADSL technology is Discrete Multi-Tone (DMT). A DMT ADSL system has a maximum bandwidth supported by copper twisted pair of approximately 1Mhz with transmission rates of 1.56Mbps. This rate is available to all subscribers, compared with the more common modems presently in use that achieves a transmission rate of 44Kbps. This bandwidth is split into three distinct sections: existing (normal speech) telephony, low bit rate ADSL forward channel, and high bit rate ADSL forward channel. This is all well and good if you are connecting to a local area network, but what happens if the modem is going to hook into a network designed to pass voice signals as well as data. The delays incurred in transmitting and receiving large 1Kbyte frames will result in gaps appearing when speech is transmitted, so in these cases an asynchronous transfer mode interface is more appealing, due to its much smaller frame size of 48 bytes. As a comparison, 1Kbyte frames will result in delays of around 250ms, which is enough for full duplex speech transmission to become broken, hence the need to use ATM which with round-trip delays measurable in low milliseconds, will allow a conversation to be carried out without noticeable pauses. In conclusion, I feel that ADSL will play a crucial role over the next few years as telephone companies enter new markets for delivering information in video and multimedia formats.

8  
Time division multiplexing
Souriya Thagnabouth, Dept. of Electrical and Computer Engineering, University of Rhode Island, Kingston, RI.

Today, the Internet has become part of our life. We use it to communicate with each other; to find one of the most important parts of communication systems. Time division multiplexing is done by dividing time into specific intervals, which are known as time slot. Each channel is assigned a specific length of time when the message signals should be sent. Each input message signal is first restricted in bandwidth. Nonessential frequency was removed. The multiplexed signal is applied to a pulse modulator for transforming the modulated signal into a form that will be suitable for transmission over the common channel. Each channel will be closed or open in the time sequence we assign. These channels are switched one at a time according to their time slots. To do this, the multiplexer is used to select each channel in and demultiplexer is also used in the receiving end of the system. The receiving signal is applied to a pulse demodulator, which perform the reverse operation of the pulse modulator. The value of the data in each channel at any given time is present by binary number or a code. When all channels are multiplexed, these channels together are called frame. Each frame is also assigned one bit code to make identification of the frame so that the receiver will recognized it. Time division multiplexing is highly sensitive to depression in the common channel such as the variations of amplitude with frequency. Time division multiplexing systems enable us to use a communication channel to send many source massages without mutual interference among them. The use of time division multiplexing introduces a bandwidth expansion to many channels. Many independent messages are squeezed into a time slot equal to one sampling interval. This process helps us save time.

9  
The Future of Internet Access
Billy Letourneau, Department of Electrical and Computer Engineering, University of Rhode Island

Presently, the United States government is involved in an antitrust lawsuit against Microsoft. The government claims that Microsoft is a monopoly and is using its power to stifle competition. Recently, Judge Thomas Penfield Jackson ruled against Microsoft, calling the software company an "oppressive" monopolist. One of the issues in the lawsuit involves Microsoft's practice of "bundling" its Internet
Explorer web browser with its Windows operating systems. Since Windows is the operating system used on roughly 90% of all personal computers, this “bundling” practice gives Microsoft an unfair advantage (according to its competitors) in the web browser market. Regardless of the penalty handed down by the judge, Microsoft is planning to appeal, which could take years. In these intervening years, this court case might diminish in importance as more and more internet access devices are made available. These devices offer an alternative to the PC as a means of internet access. Hand-held computers, cell phones, and television set-top boxes are three such devices. This wave of non-PC internet access is just now beginning to be explored.

10 Fiber Bragg Gratings: Theory, Concept and Applications
Jennifer Roe. Department of Electrical Engineering, University of Rhode Island

Fiber optic cable to the home is one of the solutions being considered to the "Last-Mile Problem." New technology has been developed to deal with the difficulties of an optical network: Optical to Electrical (O/E) Connectors, Erbium Doped Amplifiers. Another new technology is the use of Fiber Bragg Gratings (FBG). FBG's are based on Bragg's Law of reflection as it concerns electromagnetic waves being reflected from the atomic planes of crystalline structures. FBG's are reflection filters that are fabricated as part of the optical fiber (much like the erbium-doped amplifier). The gratings can be designed to reflect a specific light wavelength, or "color." FBG's have three main applications. First, they can be used to control a light source and maintain a small wavelength precision accuracy. Second, they allow us to combine multiple wavelengths of light onto one fiber. Third, you can add or drop wavelengths by using the FBG to route or split off specific wavelengths from the fiber. In an optical network, it is necessary to use wavelength Multiplexing to optimize the use of the available bandwidth. FBG's can be and are being used nearly everywhere in a wavelength multiplexing system: multiplexing and de-multiplexing, routing, and filtering and controlling signals.

11 Worldwide TV standards
Vatimetou Boukhreiss. Dept. of Electrical and Computer Engineering, University of Rhode Island. Kingston, RI.

Not all TV receivers in the World work in the same way. Different countries use different types of Broadcast TV system, most of which are to some extents incompatible with each other. Unfortunately video recordings retain many of the characteristics of the original signal of which there is a recording. But in general, recordings are more likely to be compatible than receiving equipment. In order to work, TV receivers require a source of field timing reference signals. These signals are the ones that tell the Television receiver to be ready to receive the picture in the stream of images. Early set designers decided to use the Mains power as this source for two good reasons. The first was rolling bars on the TV picture when the mains supply and power were not quite on the same frequency. The second one was that the televisions studios would have gotten a lot of problems with flicker on the cameras while making programs. There are still two mains power frequencies widely used in the world: 50Hz and 60Hz. This division leads directly to two distinct world's TV systems such as the 25 frames/second (50Hz) mostly used in Asia, Africa and Europe whereas the 30 frames/second (60Hz) which is used in Northern and Southern America.

12 GSM
Joseph Janton. Department of Electrical Engineering, University of Rhode Island

My final project will be on GSM, which stand for Global System for Mobile Communications. This is a digital cellular radio network. In the following report I will include a brief history, services provided by GSM, a basic architecture of the GSM network, many data applications, and some of its future applications. One of the most interesting things that GSM has to offer is its capabilities to be used for data computing. Basically as long as you have a GSM-enabled phone and you hook that up to your laptop computer you will be able to send/receive email, fax, or even just browse the web. Making the whole system fully mobile. Because the market for mobile communications is experiencing such rapid growth, the need to have the Internet, send faxes, and send email will be at a higher demand. So when you cannot be at the office to get something done, this is just another advantage that you can use to get things done.

13 Simulation of Error Detection and Correction in Java
Scott Wiant, Ed Sujeckie. Dept. of Electrical and Computer Engineering, University of Rhode Island. Kingston, RI.

This project will show the way errors are corrected in a communication system. Blocks of data are sent from the transmitter to the receiver. Each block has a certain number of error correcting bits which are described by XORing the data before it. The error detection / correction that we will deal with is 1 bit error correction. If there is more than one bit error it will request a retransmission. We will show all of this with a java applet. We will simulate transmissions between the transmitter and the receiver while introducing various errors during transmission.
14

Logic Link Control for the ICED Network
Justin Rackliffe Dept. of Electrical and Computer Engineering, University of Rhode Island, Kingston, RI.

For my project I will be designing the Logic Link Control (LLC) layer to be used as part of the ICED network. The LLC will perform these actions: it will frame the data coming from the application layer and it will do the ordering for all transmissions. The types of Automatic Repeat Requests (ARQ) I will be looking at will be the stop-and-wait, go-back-n, and selective repeat. All of these have pros and cons; I am leaning toward the stop-and-wait for its simplicity in hardware implantation. The framing for the system will assemble the blocks for a transmission over the network. When the application layer calls the LLC it will begin to assemble the blocks. It will create the LLC header, which consists of the memory address, size of the message in bytes, and destination host address. It will then take the outgoing data and break it up into blocks and append the LLC header to the front of the blocks. The blocks are then inserted into an Ethernet frame, according to the IEEE 802.3 standard, and the frame is written to the MAC layer. When the MAC layer receives data the LLC will receive an interrupt calling it to ready for receiving data. The LLC will begin receiving data, first pulling off the Ethernet frame, and then it will begin reassembling the message. Using the sequence numbers in the LLC header it will piece together the message waiting for the LST bit to be set, representing the final block. When the LLC has received all the data it will send the finished message off to the application. The LLC will need an internal timer, which will monitor the clock between packets. If the timer runs long it will send an ARQ signal to have the packet resent.

15

Serial Network Interface
Tim Gilman. Computer Engineering

In a network environment, be it either connected via coaxial cable or twisted pair, there has to be some interface between the transceiver of data on these lines, and the actual network interface controller. This component is called the **Serial Network Interface**, and is responsible for the encoding and decoding of the data for use at the MAC layer. The Serial Network Interface must be able decode traffic that is being sent from the transceiver to the MAC layer, and encode data being sent from the MAC layer to the transceiver. An internal check is also needed, a loopback, to enable the data to continue from the encoder to the decoder directly. All encoding and decoding functions must also be synchronized with the clock of the system.

16

ICED Network Interface: Logical Link Control Layer
Chris Pepper, Brian Tyler, Timothy Satgunam. University of Rhode Island, Dept. of Electrical and Computer Engineering

The Data Link Control Layer is made up of two sublayers, the Logic Link Control (LLC) and the Medium Access Control (MAC). The LLC sublayer, performing arguably the most important job in the network interface, essentially prepares the data for transmission over the network. It receives three inputs from the Application Layer, a memory address, the size of the message in bytes, and the address of the destination host. The LLC then pulls the data from memory until it has enough to fill a packet, then sticks a LLC header to the data and sends it to the MAC for further processing. The LLC header handles Automatic Repeat reQuest (ARQ) and sequence numbers, which correspond to the number of packets in the message. Our VHDL design follows very closely the functionality of the LLC. We designed a ROM file and with the appropriate specified address, we read from memory until we had forty-eight bytes of data. We implemented counters to keep track of how much data and consequently how many packets we transmitted. To test the ARQ we had to make our design transmit multiple packets and also implement the receiver part of the LLC. The receiving part performs the reverse of the transmitting part as it strips the LLC header and stores the data in memory. Additionally, when it receives the packet it sends it back to the host terminal with the 1st bit cleared to signify reception of the packet and for the host to send the next packet.

17

Network Programming with CORBA
Liqun Chen. Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI.

The diversity of modern networks makes the task of network programming very difficult. Network applications often consist of several communicating programs written in different programming languages and running on different operating systems. The Common Object Request Broker Architecture (CORBA) defines a framework for developing object-oriented network applications. It makes network programming much easier by allowing programmers to create applications that interact as though they were implemented in a single programming language on one computer. It defines a standard architecture for Object Request Brokers (ORBs). The role of ORB is to hide the underlying complexity of network communications from the programmer. An ORB allows creating standard objects whose methods can be invoked by client programs located
anywhere in the network. A program that contains instances of CORBA objects is often known as a server. CORBA supports several languages, including Java, C++ and Smalltalk. With a few calls to an ORB’s application programming interface (API), programmers can make CORBA objects available to client programs in the network. Each object has a clearly defined interface, specified in the CORBA Interface Definition Language (IDL). To invoke member methods on an object a client needs only the object’s IDL definition. A simple application example is also introduced in this paper.

18
Telephony and Media over IP and ATM Circuits: an Exploration of Process and Feasibility
Thomas E. Tamayo. Dept. of Electrical and Computer Engineering, University of Rhode Island, Kingston, RI

The current trend in telephony is to move toward VoIP (Voice over IP) or VToA (Voice and Telephony over ATM). The advantages of this transferal are a decrease in cost, an increase in quality, or both. In order to make this move feasible, however, both a decrease in cost and at least an equal quality as the PSTN (Public Switched Telephone Network) is required. ATM offers a high quality network, with QoS (quality of Service) negotiations. With enough bandwidth, ATM can easily maintain high-end streaming multimedia, let alone a telephone system. The initial cost of ATM is prohibitive, however, since no existing technology is in place. In comparison with ATM, IP is very cost effective. If telephone services were to move to an IP standard, long distance phone prices would drop dramatically. This is not yet possible because IP does not have the required QoS, and there is currently too much delay and jitter in IP networks. These economic and technical issues are examined further within this report. The major conclusion is that IP is currently more realistic because QoS problems are being resolved, and costs remain low for the already implemented IP network (or Internet).

19
ADSL (Asymmetric Digital Subscriber Line)
Thai Hok. Department of Electrical/Computer Engineering. University of Rhode Island

The final project presentation will be on ADSL (Asymmetric Digital Subscriber Line). In this report, an extensive research on its history and its latest development technology will be discussed. Also compare the cost and its capabilities of an ADSL to a conventional ones such as cable modem and fiber optic. Asymmetric Digital Subscribe Line (ADSL), a new modem technology, converts existing twisted-pair telephone lines into access paths for multimedia and high-speed data communications. ADSL can transmit up to 8 Mbps to a subscriber, and as much as 640 kbps or more in both directions. The main technologies used by the ADSL are: Discrete Multi-Tone, Code & Error Correction and Framing & Scrambling. Among technologies attempting to break the Internet gridlock are cable modems, fiber-hybrid coaxial cable and wireless cable. ADSL provides a dedicated service over a single telephone line. While cable has greater downstream bandwidth (up to 30 Mbps), that bandwidth is shared among all users on a line, and will therefore vary, perhaps dramatically with traffic. A Continuous ADSL connection will provide a maximum of 1.5Mbps/128Kbps with no usage restrictions with the telephone company installation charges of $198.00. Includes POTS splitter, Alcatel ADSL modem, and Network Interface card. The Total charge is $49 per month. ADSL will play a very crucial role in today and in the future technology especially as we move closer to the next century wireless communications.

20
Implementation of the TCP/IP Layer for Ethernet
Albert Costa and Mathew Seward, Dept. of Electrical and Computer Engineering, University of Rhode Island, Kingston, RI

We implemented the TCP/IP layer for the current Ethernet standard. TCP/IP is broken down into two components: the Transmission Control Protocol and the Internet Protocol. The TCP layer deals with the host-to-host connection. The IP layer provides routing for controlling the flow through multiple networks. In this project, we implemented and simulated these two protocols using C++. The application layer sends the data to the TCP layer along with a set of conditions such as priority, source port and destination port. The TCP layer packetizes the data, places a header on each packet and sends it to the IP layer. The IP layer adds a header of its own depending on requested conditions. On the receiving end, the IP layer receives a datagram, validates the IP header and sends the data to the TCP layer. The TCP layer then unpacks the TCP header and performs some more validations. If the datagram is valid, then the original data is passed onto the Physical layer on the receiving end. If the datagram is not valid, it is discarded and the TCP layer sends a request for retransmission of that packet. In this project we implemented these protocols according to the specifications described above. The data that is originally sent through these layers is recovered and shown to be the same.

21
Implementation of a Microsoft NT Network
Michael F. Nasitka, Department of Electrical Engineering, University of Rhode Island

The goal of the project is to implement a Microsoft NT server network on a small local area network (LAN). The server will run as a file and print server, and an Internet gateway for a 4 computer home network. Operating the server will allow for centralized file back-up and archiving,
increased speed to a workstation currently serving as the print server, allow the use of the free/busy functions in Microsoft Outlook, and give the operators experiences establishing and operating an Microsoft NT server, internet information service, and Microsoft Exchange. NT Server was installed upon the computer designated as the server and assigned as a Primary Domain Controller (PDC). Once Server was installed the external hardware was configured. Minor difficulties were encountered because NT is not plug and play enabled. Two test users were then set up to experiment with various network access and profile issues. With NT Server functioning properly, Exchange server was installed and configured for a use as stand-alone mail server (no access to the internet). Once the mail, public folders, and scheduling functions were tested to ensure internal conductivity, external mail services were established to allow mail on the internal network to be transmitted to the outside world. This small network has allowed for experimentation in the installation and configuration of Microsoft NT Server and Exchange Server. A basic understanding of the power and versatility of these products has been obtained, and provides the opportunity for continued learning.

22
Data Encryption for Coast Guard Aircraft
Kevin M. Carroll, Department of Electrical & Computer Engineering, Univ. of Rhode Island, Kingston, RI

Coast Guard aircraft maintain limited communication capabilities with other units. This limited capability prevents aircraft and mission data to be reported in timely manner without monopolizing a secure channel. However, an increase in the requirement for timely and accurate data provided by aircraft become essential to mission success especially in Search and Rescue and Law Enforcement cases. The Coast Guard Academy's Electrical Engineering Section is currently working on a satellite based email system for aircraft to add a data channel. One specification of the email system is a non-classified encryption program. The encryption program should be simply for users considering the motion of the aircraft and other tasks of aircrews. The data passed through this encryption program will be limited to Law Enforcement/For Official Use Only. An evaluation of public encryption programs proved they provided the security required without the administrated burden of National Security Agency (NSA) codes. The off the self Pretty Good Privacy (PGP) program was selected for text email and attachments. An automatic position reporter required a separate encryption system. A Data Encryption Standard (DES) algorithm was written in Matlab(c) and compiled in C-language. The algorithm is used in the hardware layer connection between the Global Positioning System (GPS) and the transmitter.

23
Error Correction and Detection
Michael Zinni, Giulio Lugini. Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI.

In all forms of digital communication, data reliability has always been important. Whether you are emailing a file to someone, or talking on your cellular phone, you want the information sent to be accurate. Depending on the type of information, different error detection/correction techniques are employed to ensure proper transmission/reception. This project deals with one of the less complicated algorithms for this task. Before data is sent over a network of any kind, additional bits are added to it for the purpose of error detection. These bits are calculated using an XOR process. While in the transmission medium, electrical noise may subdue the data to errors. Once received, the additional bits that were added previously can be used to identify, and possibly correct any discrepancy in the original data. By comparing received values and re-calculated values for these bits, errors can be found and corrections can be made. This project will approach this algorithm from both a software and hardware point of view using a program specifically created for ECC simulation and VHDL.

24
Optical Fibers: Structure & Bandwidth Capabilities
Sambit Bohidar, Dept. of Electrical and Computer Engineering, University of Rhode Island, Kingston, RI

The purpose of this project was to analyze the structure of an optical fiber and understand why it has such high bandwidth capabilities. Fiber optic communications is extremely important and gaining wide acceptance in the industry as well as home use. There are many advantages this has over communication using regular coaxial cables; an extremely high bandwidth can be achieved, the cables themselves are smaller in diameter and lighter in weight, there is no chance of crosstalk between parallel fibers, there is immunity to inductive interference that is present in copper wires, fiber optic cables have a much longer life span than conventional cable, they have a high tolerance for temperature variations and harmful fluids, and they use a common natural resource (sand) rather than an expensive metal (copper). The structure of an optical fiber basically consists of a central cylinder or core surrounded by a layer called the cladding, which is covered by a jacket. The light wave propagating travels inside the core and the cladding enables the light wave to remain in the core. The material used for both the core and the cladding is typically either glass (silica) or plastic. The jacket provides protection against moisture and external damage. The basic reason for such high bandwidth is that the signal carrying the information is light (photons), which has very low attenuation compared to electrical signals (electrons) used in regular communication. The ever-increasing need for
bandwidth, the popularity of the Internet, and a worldwide videophone system all require fiber optics. So, it is evident that the future of communication lies in fiber optics.

**25**

**Logical Link Control Layer**

Michael Patterson, Steve Milburn, Mark Fondi. Department of Electrical & Computer Engineering, University of Rhode Island, RI

The TCP/IP protocol allows for most internet communication to exist. With the growing reliance society has on the internet, TCP/IP has become essential to our everyday lives. Our final report will model one of these layers, the Logical Link Control Layer for the ICED Network, a simplified version of TCP/IP. This layer is responsible for taking application data and preparing it for the Media Access Control Layer. It takes data from an application and breaks the data into blocks suitable for transmission and adds a header. This packet is then framed and sent to the MAC layer. After sending a packet, the LLC waits for acknowledgement before sending another packet. During this time, it will not receive an unrelated packet. When receiving data, the LLC works in the reverse manner doing primarily the same things. The interfaces between the application, MAC layer, and Memory proved to be a smooth design, giving us little problem at all. The most difficult challenge to our design was the variable length of the data. Since it can range from 46 to 1500 bits, it took some time to devise a method storing and dividing it up into 16-bit segments suitable to send to the MAC layer. When finished, our design utilized a synchronous state machine with 3 adders, approximately 12 counters implemented through the adders, and 19 states. Our finished LLC was simulated in Modelsim to ensure behavioral functionality. Network use is growing tremendously; thus, working knowledge of network protocol is an essential tool in understanding networks.

**26**

**WPAN: A Personal Area Network for Individual Users**

Peter Scucces, an undergraduate student in the Department of Computer and Electrical Engineering at the University of Rhode Island.

Many people today are likely to have a number of different digital devices that may be networked together within the near future. The digital user of today spends a lot of time coordinating information between these various devices, such as cellular telephones, pagers or laptop computers. This is why the idea to tie these devices together with packet based wireless connection is rising to the surface. This connection would be called WPAN, Wireless Personal Area Network, which is a personal network for individual users. This specification will likely be implemented as a low-power, single chip solution that can be integrated into the existing designs of products or form the basis of future products.

**27**

**Logic Link Control Layer**

Willie Hayden and Jeremy Bailey. Dept. of Electrical and Computer Engineering, University of Rhode Island, Kingston, RI.

There were many contenders for our project; MAC, TCP/IP and so on, but only one caught our fancy. Welcome to the wonderful world of Logic Link Control Layers. This is the layer we chose to implement and simulate. This layer consists of a Source sending data to a specified Destination address. For the sake of networking, the data must be broken down into packets that will be under a specific length. The total length of the data in a packet is sent with that packet so that any unused data bits will be ignored by the Destination. The Destination sends an acknowledgment flag back to the Source to let it know that it received the packet and is waiting for the next packet in the sequence. The Frame Check Sequence will be assumed to be done at another layer. We will also assume that the packets are being received in the correct order. When the Source sends the last packet in a sequence of data it will send the Destination a flag telling the Destination that all the data in that specific message has been sent. The Destination sends back the information that the Source sent it, along with the acknowledgment flag. The Source will check the packet for errors. If an error is detected the Source will resend that packet.

**31**

**Implementation of the Medium Access Controller (MAC) Layer of ICED Design**

Jonathan Short, Nathan Short. Department of Electrical and Computer Engineering

The Medium Access Control(MAC) Layer in the OSI Model bridges the gap between the Logic Link Control( LLC) and the Physical Layer(PL). The MAC Layer arbitrates when data can be written onto the bus. If the network is idle, the data is written onto the bus. If another machine writes to the bus at the same time, a collision occurs, utterly destroying the CRC. If this happens, a delay of time random is used, and then a retransmission is done until the data is successfully sent without collision. The hardware for this was designed using Renoir, and simulated with qhsim. The results were, and continue to be, promising.

**32**

**The World Wide Web**

Greg Rich, Dept. of Computer and Electrical Engineering, University of Rhode Island
The Internet has revolutionized the computer and communications world like nothing before it. The invention of the telegraph, telephone, radio, and computer set the stage for this unprecedented integration of capabilities. The Internet is at once a world-wide broadcasting capability, a mechanism for information dissemination, and a medium for collaboration and interaction between individuals and their computers without regard for geographic location. This report will focus on the WWW. It will discuss the technology including bandwidth, protocols, and a history of the WWW.

33
Simulation of Application Layer of ICED network in Java
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The application layer of the ICED network is the actual part of the network that the user interacts with. In the ICED network the user is allowed to enter an IP address of the CPU they want to communicate with. The user enters the message they want to send to the other CPU and then formats it so that every host in the network will be able to understand it. It then sends this data to the LLC, which then transmits it to the other CPU. In this Java the user is prompted for an IP address, the program then checks if it is a valid address (since this is just a simulation any address will do as long as it is in the form of xxx.xxx.xxx.xxx). The user will then be prompted for the message it wants to send to another CPU. The program will take this message and translate it into byte code so that all machines can read it (in an actual network this byte code would be sent to the LLC) and then from the byte code it will translate the message back to what the user originally typed in.

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On-Line Chat Room
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In the past few years, Java has become one of the most popular Internet programming languages. Today, Java servlets is taking Java to the next level as a web development language. Java servlet programming is a standard extension to Java that provides a generic mechanism for extending the functionality of any kind of server. However, servlets are most commonly used to extend web servers, performing tasks traditionally handled by CGI programs. Servlets execute within the web server’s process space and they persist between invocations, which give them tremendous performance benefits over CGI programs. In order to get acquainted with Java servlets programming, I created an on-line chat room. In this virtual chat room, there is a large text area component to display the running conversation, with a small text input component underneath where the user can post a new single-line message. As each guest composes a message, it’s sent to the chat server and distributed to the other chat clients in various ways.