ELE437 Computer Communication
Mini Conference CCMC'98

Department of Electrical and Computer Engineering
University of Rhode Island, Kingston, RI

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Vinny Vallarine, Keith Marshall

1. Simple Ethernet interface - Physical layer design
Eduardo Vigil. Dept. of Electrical & Computer Engineering,
University of Rhode Island, Kingston, RI

The objective is to design a simple Ethernet - like interface's lower layer. The Physical layer will contain the following components: Parallel to Serial Interface, Manchester encoder, transmitter, Manchester decoder, 16 bit CRC (Cyclic Redundancy Check) error detection code creation and check and a Serial to Parallel Interface. The components will be created and simulated using VHDL code. The component tests will be done using Renoir. This design will serve as a foundation for the physical realization in ELE405, where it will be model on the "10Base2" Ethernet network. This is a 10 Megabits per second baseband (not modulated), and has a maximum segment length of 185 meters (about 2 meters). It is a common bus type network, using coaxial cable as the transmission medium; all of the networks communicating devices attach to the same wire. The machines designed in ELE405 will be able to communicate with each other; this realization should bring about an agreement on the standards or specs for the Ethernet network interface. Ethernet is a broadcast network. In other words, all stations see all frames, regardless of whether they represent an agreement on the standards or spec for the Ethernet network interface. Each station must examine received frames to determine if the station is a destination. If so, the frame is passed to a higher protocol layer for appropriate processing. The simulation and test of the components for the physical layer will be done individually and later together as part of a physical layer block where similar blocks will be attached to a bus to test communication with more than two nodes.

2. Introduction to Fiber Optic Communication
David Leclerc. Dept. of Electrical & Computer Engineering,
University of Rhode Island, Kingston, RI

It is apparent that fiber optic communication will be the means of transmitting voice, video, and data in the future. That time is not far from coming since the communications industry requires faster transmission rates and higher bandwidths to support the tremendous influx of users. The increasing popularity of the Internet as a tool for personal, educational, or business use has forced the industry to find solutions that accommodates this influx. The solution that I will provide in my presentation is to adopt Fiber-to-the-Home (FTTH) communication lines. Telephone companies have fiber optic cables installed between local offices, but a bottleneck occurs
in that "last mile" from the office to the home or business. Optical fiber has many advantages over normal copper wires. Fiber offers improved voice and picture quality, while increasing data rates tremendously. Optical fiber is immune to electromagnetic interference like lightning storms, and is safer since optical fiber is not a conductor. The lines would be very secure from tapping since the fiber does not emit electromagnetic interference. Best of all, FTTH has multifunctional properties. A person could talk on the phone, watch TV, fax a document, and access the Internet all at the same time. The disadvantages include the expensive cost and the time needed to install lines from the local offices to the home. Who is going to pay for it? In the areas that already have this technology, local telephone companies have covered the expense. They are able to defer some of the cost by leasing bandwidth to CATV providers.

3 Exploring Steganography: The Art of Hiding Information
Edward Haukkala. Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI

Steganography is the art of hiding information in ways that prevent the detection of hidden messages. Steganography, derived from Greek, literally means “covered writing.” It includes a vast array of secret communication methods that conceal a messages very existence. Steganography and cryptography are cousins in the spycraft family. While cryptography scrambles a message so it can’t be understood, stenography hides the message so it can’t be seen. A message transmitted in ciphertext might arouse suspicion either during transmission or during receipt by the recipient while a message created with stenographic message would not. These techniques were explored in the Matlab environment utilizing the image processing toolbox. Text messages were successfully hidden in RGB (Red-Green-Blue) images at a rate of three ASCII characters per every seven pixels. The method of encoding the data was least significant bit (LSB) insertion. Using this method images with embedded text were not visually distinguishable from the original images. This project will present a brief discussion of how these techniques have practical application in the field of digital watermarking.

4 Design of Media Access Control Layer for an Ethernet
Jeffrey Ellin. Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI

The purpose of this project is to design a Media Access Control Layer for an Ethernet. The Media Access Control Layer (MAC). This is done so that this layer can eventually be interfaced with the other layers necessary to develop a fully working network interface. This network will be eventually simulated and tested using a Xilinx FPGA that is installed in a Sun Ultra. This hardware will be used to transfer some data between prototype CPUs that were previously developed. The MAC is a sub layer of the Data Link Control layer and consists of the support necessary to achieve Carrier Sense Multi Access (CSMA), reservation, implementation of a slitting algorithm and the assigning of physical addresses. The Slitting algorithm can be First Come First Serve (FCFS) or Last Come First Serve (LCFS). Other groups will be responsible for the design of the Logic Link Control (LLC) layer, and the Physical Layer. The LLC layer will be responsible for such things as framing and implementation of ARQ and a go back N algorithm. The Physical Layer will deal with the actual connection of the Ethernet over a 10base2 type wire. The purpose of this project is to gain familiarity of an Ethernet type network and its eventual implementation.

5 Error Correcting Codes Approach
Lao Lee. Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI

This paper describes an approach to the error correcting codes in a communication system. Bits that are transmitted in blocks of fixed length is treated. Upon receiving a block, error correction/detection capability may or may not (in this case, a retransmission is requested) be performed. Zero and single error correction capability are considered only. Bits are the transmission of binary digits, from the source (transmitter) to the destination (receiver). On their way from the transmitter to the receiver, these bits pass through a medium (channel). While in the medium the bits are subject to noise, which introduces errors. In order to enable the receiver to determine whether a receiver block (dividend) contains an error (remainder), the block must belong to a given collection of blocks. Each block contains information bits and the information's parity bits. The parity bits (divisor) are calculated as a function of the information bits. Their purpose is forming the possibility of correcting error. If the transmitter transmits only code words belonging to this collection of block...

6 Multi-access Control Sublayer
Brian Mehr, Christopher Pechie. Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI

This is a joint project between ELE 437 and ELE 405. We hope to complete our specified part in order to have each ELE 405 group's digital computer communicate with each other. Our project is the point of communication between the two interfaces, the network and each individual machine. Specifically, we will be dealing with the reservation part of the three layers, so a small packet is sent before the larger data. Many signals are needed between the three layers. Between the top layer and ours a SEND/WAIT and a DATA VALID signal is needed. Signals between the bottom layer include: ACKNOWLEDGE, BUSY, ERROR, DATA READY, and READ/not WRITE. Data must also travel through the three layers in either direction. Accomplishing this task will be handled using C++ which will most likely be used by the above layer as well. The lower layer closest to the actual network line will be using VHDL, which can use C++ programs so it makes sense to use these applications. All of the projects must work together so a standard was set among the six groups, two groups for each layer. Using this standard, each groups computers will be able to efficiently communicate.

7 Hangman: A Java-Based Game Program
Matthew Fogerty. Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI

I have been working on a Java based program that implements an old game I used to play. It is a game called hangman. There would be 2 players involved. One must guess the the phrase selected by the other. A yardarm is drawn and as the game progresses, more and more of the hangman is drawn (unless he/she guesses correctly). The number of guesses is relative to the length of the string. The alphabet is displayed and letters change color as they are selected. I'm including some animations and some audio capabilities as supported by Java.
Wireless Local Area Networks
Neeraj D. Vadhan. Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI

Today, the networking industry is one of the fastest growing markets in the world. Along with the emerging technologies comes the idea of Wireless Local Area Networks (WLANs). This combination of Local Area Networks and mobile communications has been occupying the minds of many engineers. The purpose in using WLANs is to provide mobility and avoid the high costs of installation and relocation of wired networks. WLANs are usually designed by having a transceiver, called an access point that connects to a wired network. The access point usually receives buffers and transmits data between the WLAN and the wired network. Users can access the WLAN by the use of wireless adapters. There are many existing implementations of WLANs. Among the two most common are Infrared and Spread Spectrum technology. Each of these technologies has their benefits and limitations. Whether a WLAN is a useful solution can only be determined by the user(s).

Cable Modems, Here and Now?
Edward J. Zanella Jr. Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI

As Internet use becomes part of the everyday routine for so many people across the globe, one problem has arisen, the problem of speed. For so many years, the conventional telephone modem has been able to handle the needs of casual WWW users. However, now that the Internet has become so much more than what it was originally envisioned to be a new technology must be implemented in order to continue this growth. A possible solution to this problem has been in development for the past few years. A joint venture between Cable TV providers and their hardware suppliers has given rise to the exciting world of Cable Modems. Cable Modems provide the user with speeds of ~3-50 Mbit/s compared to existing modem speeds of ~50Kbit/s. A main reason that Cable Modems are able deliver such high data rates is that they have eliminated the "last mile" problem from their loop. Current modems use twisted pair wire for their connection that provides a data rate of 4Mps with a bandwidth of 250K Hz. Cable Modems will use existing coaxial wire that is already in place for cable TV by using the excess bandwidth on the lines. Coaxial cable has data rate of 500Mbps and a bandwidth of 350MHz. However, with any new technology, there are problems. The biggest of these problems are the creation of universal standards and the question of affordability. The quickness in which cable companies will address these problems will determine whether this technology will be a major player in the years to come.

ADSL Modem
Francisco Lugo. Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI

Unbelievable speed, inexpensive, easy installation no more busy signals, and works over standard phone lines could be the description for ADSL Modem. It stands for Asymmetric Digital Subscriber Line. This new modem can download 1.5 megabits of data per second over a standard phone line. It will provide the user with T1-Link speed at a price remarkably cheaper. Major company in the business will try to standardize ADSL. "56k modem are going to be found in cereal boxes in a couple of months" mentioned Hallawai Bray from the Boston Globe. This new technology is going to make us rethink about the way we communicate.

Data Encryption for Communication
James Nugent. Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI

The protection of information that is vital to one has always been a concern and with the advent of high speed electronic communication there is more information than ever to protect. Even if a computer is secure, the links it uses to connect to the outside world may not be. Various methods of securing a link are possible, some take place in hardware and some in software. These provide ways of protecting messages in transit as well as authenticating their origin. The object of encryption is to not be unbreakable but to prevent an attacker from being unable to figure out the contents without spending an arbitrary, usually high, amount of time and money. Various encryption schemes area available. Most have advantages and disadvantages associated with them, which will be explored, along with the methods used in attacking such encryption, and hopefully, why such techniques will hopefully not be successful. Most encryption relies on a key of some sort, some piece of information with which it is easy to read a message. This leads they key transfer problem, i.e. how to send the key to another party so a secure message can be sent. There are methods of doing this, which will be discussed. Various coding systems in use will be explored, along with ones that are not currently used, but could be in the future.

Remote Control Using the Internet
Michael Obara. Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI

There are many different control-related operations in the world today which people wish to achieve remotely. These may range from turning on lights in your house while on vacation to running island-based underwater vehicle tests. The internet is a medium for information transferal which can be used to perform control-related tasks conveniently. In terms of communication hardware, both the sending and receiving ends of the control system simply require a PC with internet connection. PCs are cheap nowadays, and a network connection is only as far away as the nearest phone line. As for software, the receiver needs a web server and the transmitter needs an internet browser, both of which can be acquired as shareware/freeware. For this report, a sample control system has been created. It consists of a web page with forms, a CGI script, a Visual BASIC program, a programmed Xilinx FPGA chip, and a small amount of external circuitry. A demonstration of this project will be given during my presentation to exemplify the feasibility and usefulness of this concept. In the process, it will give the audience a chance to try their hand at internet control and form their own opinions of its merits. The URL of the command page is http://ele.uri.edu/~obara/ele437. It is only operational when the Visual BASIC is running, which may only be the day of my presentation.

Data Link Control Layer
Christopher A. Piccirillo. Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI

For this project I chose to create the Data Link Control (hereto referred to as DLC) layer of our network structure. The DLC is the highest layer in our group design. It handles the conversion from raw data from the CPU and creates packets. The other side of the DLC is on the receiving end. The DLC takes the packet from a lower level (the Media Access Control layer) and if no errors are present (told to the DLC via the MAC) will strip the packet of data and pass it to the CPU. This project lent itself very nicely to C++. After meeting with the other groups and discussing standards, we chose to emulate the Ethernet style and format. I will now discuss the aspects of the design, and how I will implement them. The
Packet: This is the most crucial part of the design, and pretty much shapes the way the other layers act on their duties. I decided to use the Ethernet standard for a packet with a breakdown as follows. The destination address (DA), the source address (SA), the length (LEN), also we have 2 fields that contain controls for the "go-back-n" systems. Next comes the data portion with a pad, to keep the data on full words, as well as to keep a minimum of 64 bytes of data. I am using a "wait" loop to see when the MAC is ready to receive or send me data. If I'm sending, the packet is created, then temporarily stored, until 7 are created, then sent to the MAC. When the packet is received, and is correct, the data is stripped, and sent up.

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The IPv4 to IPv6 Transition
George Gong. Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI

The original Internet was designed to support simple applications such as file transfer, electronic mail, and remote access Telnet sessions. The recent popularity of the Internet has helped it become a multimedia, application-rich environment. The current Internet Protocol, the IPv4, is inadequate to handle the rapid growth of networks. The IPv6 is a new Internet Protocol designed to meet the networking demands of the future. Besides expanding the number of available Internet addresses, it provides for robust security, multicasting, autoconfiguration, mobility, quality-of-service options, and policy-based routing. IPv6 improves on IPv4 in many areas that are of great value to network dependent businesses. Unfortunately, the movement from IPv4 to IPv6 will not be instantaneous. The current IPv4 networks are well established all over the world. Thus, there will be an extended period when IPv4 and IPv6 will coexist. However, much effort is being made to ensure that the transition is done in a graceful, incremental manner. This project examines the tunneling and encapsulation techniques of the IPv4-to-IPv6 migration.

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An Overview of Cable Modem Technology
Ra Men. Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI

Traditional, the only way to connect to servers was to use the existing telephone. A dial-up networking tool used the phone line as a means of connecting to a server. No matter what speed of the modem, the highest connection speed would always be 33.6 Kbps. With heavy traffic on the World Wide Wed and slow download time, speed was the big issue. The cable modem technology can be one of the many solutions out there right now. It offers a downstream speed up to anywhere to 27 Mbps and an upstream speed up to 10 Mbps. It used the excess bandwidth on cable television line to deliver data rates. The cable network allocated one channel (50-750 MHz) for downstream data and another channel (5-42 MHz) for upstream data. An overview of the benefits of cable modem and technology will be discussed.

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ELE437/405 Cooperative Network Project (Physical Layer)Eric Ciocca, Seth Milman. Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI

For future addition to the proto-computers that we are building for ELE 405, we are going to construct a network system so that our computers may eventually communicate with each other. The network will be used for wired Ethernet networks, which can span about 200 meters on a single coaxial cable. We will not be realizing the circuit in actual hardware, but will program the system into VHDL so that it can readily be transferred down to the gate level. The physical layer of the network communicates to the computer via the computer's memory mapped I/O port. Through this port the network can either transfer data or a coded status register to the previous (software) later of the computers to decode. The outgoing data will be dedicated 32 bits at a time and shifted through a CRC generator for error detection and correction. The data passes through a Manchester encoder before passing through some analog circuitry and out to the physical medium. There is some undeclared analog circuitry that will detect network statistics such as carriers or send collisions. By coupling this with the work of other groups (which will be creating "higher layer" steps of the network), we will have a completed the lowest three layers of the OSI/ISO-7 network stack.

20
The WAN Wars
Brad R. Benson. Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI

In the emerging market of data, voice, and video integration many companies are going to "war" to be most dominant. A few of these companies, such as Cisco, Lucent Technologies, and Northern Telecom have shifted their focus away from LAN and towards the WAN space. These companies now realize the critical importance of establishing themselves in this market because of the recent demand for high-end WAN products, including product such as the BPX and IGX, which are types of ATM switches. Specific advantages obviously include greater capabilities for communicating and sharing information throughout the corporation. Also maximization of corporate throughput and minimization of costs associated with efficient operations are necessary to fend off industry competition. There are many different types of WAN services available and ATM is one of them. This service is not widely available and has some lack of standards. However it is very high speed and carries voice and video as well as data. ATM is capable of providing a throughput (before compression) of 25 Mbps to 2.4 Gbps.

21
Wireless LAN's : Advantages and Disadvantages
Joel Betancourt. Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI

Wireless technology in LAN's has emerged as a viable alternative to the traditional wired network structure. Wireless LAN's in general offer some key advantages. Users can move around the vicinity of the network while remaining continuously connected, provided that the range of the access points overlap. In addition, wireless networks require little interference with the structure in which they are being installed. The three main types of available wireless technologies are infrared laser, microwave, and spread-spectrum. The main advantage of infrared laser is its speed. However, it is susceptible to atmospheric conditions. Microwave provides a dedicated link, but it requires an FCC license for use of the frequency. Spread spectrum using radio-frequency technology is best used in for complicated structures because the waves can penetrate walls and floors. Spread spectrum also offers greater range. Although Wireless LAN's can be highly beneficial when their strengths are exploited, they also have some performance issues which are an inherent property of the technology. These issues (which include throughput, frequency allocation, and reliability) need to be addressed when a decision is made between wired and wireless networks. A specific wireless network setup, Proxim's RangeLAN2, was evaluated in a manufacturing environment in which automated test fixtures report yield data to the network. The mobile Proxim system proved to be equivalent to being made to ensure that the transition is done in a graceful, incremental manner. This project examines the tunneling and encapsulation techniques of the IPv4-to-IPv6 migration.
We have designed an interface and protocol for the ICED-NET physical layer for the pseudo-Ethernet communications between systems. The system includes a hardware CRC encode and decode circuit as well as a Manchester encoder. While we are unable to simulate collisions, we have created a simulation with Renoir to run on the QuickHDL simulator. Our design has a collision detector circuit to simulate a collision. A one-bit input will cause the system to interrupt and restart the data shifting. Another one-bit input creates an 'in use' condition to test the CSMA/CD circuit. We will present the circuit design, the timing diagrams, the interface to the DLC layer, as well as the protocol for the Ethernet link. This work is important because our design will be able to work with any design when the connections for the data and status register are memory mapped in the computer.

Steganographic Developments in Digital Communication
Peter Barek. Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI

The movement from analog to digital methods of data storage and communication, while providing for faster, cheaper and more efficient ways of manipulating and transferring mass amounts of data, has had an adverse effect on the level of privacy and security of the data transmissions. Traditional encryption methods protect data from unauthorized access and manipulation by converting the secret data into some unreadable form. With the difficulties of its implementation and government restrictions on steganographic methods, data securers are more and more turning to steganography, a close relative in the data security hierarchy. Literally "covered writing" from Greek, steganography adds another layer of protection by hiding a secret, possibly encrypted, message inside another innocent-looking cover message. Although steganographic methods have been employed for thousands of years, it is only recently that information hiding has enjoyed a surge in popularity in the field of digital communications. This report, while providing an overview and short history of steganography, concentrates on the current research into its digital communications implementations and applications. More specifically, the report describes the methods, practical usefulness and limitations of the digital watermarking of multimedia data and digital marking of documents. With a rich history behind it, information hiding now has an exciting future ahead of it in the area of digital communications. In such a wide and rapidly growing field, this report can only aim to wet the reader's appetite for a more in-depth study of the subject.

WWW Server Security
Brian Clayton. Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI

The security of web servers is an increasingly complex topic, as the web is constantly and rapidly evolving. Web security is increasingly important with the advent of electronic commerce. It encompasses computer and network security, authentication methods, and cryptography, as well as many other topics. Almost every major web server software package (Apache, Microsoft IIS, Netscape Commerce, NCSA, etc.) has had known security holes at one time or another. I intend to examine these, as well as general improvements/advancements made in more low-level areas, such as HTTP1.1 digest authentication and Secure Sockets Layer (SSL). Additionally, operating system security risks in Unix and Microsoft Windows NT operating systems will be looked at. Topics discussed include CGI, log privacy and security. Some client side risks will be discussed as well. Time permitting, I will touch on some basic cryptography topics as well, such as public-key and secret-key cryptography, the RSA algorithm, and the Data Encryption Standard (DES). Additionally, I am writing a Java application to probe common web server software and configurations for known security flaws. This program will not be fully complete for some time, but should work for Apache (the most popular web server software) relatively soon.
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Physical Layer of an Ethernet Type Link
Vinny Vallarine, Keith Marshall. Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI

We constructed the physical level of an Ethernet link following the type of 10 base 2. The design was created using the Renoir design tool and the VHDL hardware design language. Our design reads data of the network in a serial fashion (1 bit at a time). The data is read from the network and temporarily stored into our network buffer until 32 bits are present. Once the buffer contains 32 bits, the contents are thrown into a second buffer where the MAC layer can take the data from us. This dual buffer system allows us to be reading in from the network while the MAC layer is reading from us. This creates almost a dual-ported system bus which proved to be much faster than a one-way bus. There are many control signals necessary to keep the communication smooth. We also conduct a CRC for errors in each packet that we receive. This was done by implementing the basic method of CRC error control. A binary word is chosen for the CRC word ‘B’. Let ‘r’ + 1 be the number of bits in ‘B’ and the packet size be ‘P’. We then append 0’s to the right of the packet (called ‘BZ’ after adding 0’s). The division is done bit by bit and without carry. Our remainder has ‘r’ bits and as our book (Walrand, 66) states, it follows ‘BZ = A.B + R. Thus, any transmitted packet must be a multiple of ‘B’. We check this and know if an error is present. The last aspect of our design is that of a Manchester encoder/decoder. We ensure the data is replicated by a rising/falling edge of the clock.

28
Developing a Web-Page
Eswin Anzueto. Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI

In today's world the Internet has become one of the most important methods of communication. The reasons for this are the immense number of people that you can reach around the world, and its extremely low cost. For my ELE 437 project I developed a web page. The two main objectives of this project were: the development of a web page and the opportunity to learn HTML and some Java programming. On this home page I included some personal information, a copy of my resume, some information about my country, and some links that I considered to be helpful. To accomplish this task I did some research through the Web, and searched through some available literature on the subject. After completing this project, I now feel confident that I will be able to successfully work in a web-designing position in the future.

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Interactive Home Automation using the WWW
Kevin M. Keast. Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI

All areas of technology have expanded due to the capabilities associated with the Internet and computer communications. Automation and specifically home automation is no exception. I have developed an Internet web site utilizing HTML (HyperText Markup Language) and a CGI (Common Gateway Interface) written in PERL (a powerful scripting language) that allows a user to interact with a remote PC that is running automation applications. Using HTML FORMS a user on the Internet can make "requests" or "changes" that are processed by the CGI and forwarded to the remote PC to direct the automation application. The system is also designed so the remote PC provides application "state" information to the user. Updated "state" information provided by the automation application is developed into the form of a web page. This is accomplished using a PERL script running on the remote PC. Automatic TCP/IP connections are established periodically by the PC to post the updated web pages to the server. The development of this system involved the study of HTML, PERL, and CGI. The posting of information to the remote PC is complete and operational, however, the creation and updating of the HTML pages is still in its developmental stages.

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Satellite Modems
Edgar Rodriguez. Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI

In this era of the World Wide Web, the demand for high speed has become a high priority. Satellite Modems, already in use, reach transmission rates of 400Kbps to 9Mbps or higher. You’ll never get a busy signal, and connections is instantaneous. The big question for providers is whether cost for satellite connections can be brought to a competitive range. Satellite Modems use technology proven by the mini-dishes that deliver video signals to a fast-growing number of homes. In particular, I will discuss DirectPC and the Hybrid-net. Maker Hughes Networks system is rolling out a single dish that delivers NET service as well as video. NET by satellite is hybrid system, it requires a phone line to carry data and commands back from the user to the internet. Even so, the dishes may do well in the next few years, especially in rural areas where other services may not reach.

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The Future of Satellite Communications
Amy Grable. Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI

The recent “Internet explosion” has placed a tremendous burden on our terrestrial communications system. The Public Switch Telephone Network (PSTN) is becoming increasingly bogged down as more and more users get "on-line". Ultimately, fiber-to-the-curb will be necessary to keep up with the expanding needs of the customer, but this may take a decade or more to accomplish. In the meantime, advanced low-earth orbit (LEO) satellite systems such as Iridium, Globalstar, and Teledesic will play an integral role in relaxing the burden on the terrestrial network. These systems are designed with the mobile user in mind, and have the capability to provide fiber-like quality of service for voice, facsimile, video and multimedia applications such as the Internet. Although LEO satellite constellations require many more satellites than their geostationary (GEO) counterparts, significant advances in spacecraft production now allow for a new satellite to roll off the assembly line about every five days. LEO systems are well-suited to the needs of today's mobile user since they accommodate low-power hand-held and vehicle-mounted telephone devices with omnidirectional antennas that are easily portable and can provide instant access to a global communication system.

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Data Link Control Layer for the ICEDNET Network
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For the joint ELE 405 and ELE 437 design project, we will design the LLC sublayer of the DLC layer for the overall CEDNET network design. This will be done in conjunction with ther teams who are working on other layers of the network. We will be using the IEEE 802.3 Standard Ethernet packet as a odel for our own packet design. We will be using the Go-Back-7 method for the ARQ, and our start of frame delimit will consist of 8 bits as follows: 0111 1110. We will be using the stuffed 0’s method to account for the appearance of the SFD within the packet data. Our code will be written in C++, which will be easily interfaced with the MAC sublayer, which is also being written in C++.
Controller Area Networks
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The Controller Area Network (CAN) is a local area network for microcontrollers. It is an ISO defined serial data communication standard. It was developed during the late 1980's as a way to network the individual devices of control systems in automobiles. The idea for CAN originated because of the increasing complexity of systems in cars to control everything from anti-lock brakes to air conditioning. The amount of wires needed to transmit the control signals was becoming overwhelming. This is because individual wires were needed to connect a sensor with the controller that used its data. Not only was the amount of wiring overwhelming during manufacture, it also made for problems in diagnosis and repair. As a solution to this problem, the Robert Bosch company defined the CAN protocol. The CAN provides a single bus on which all of these signals can travel. The CAN standard specifies a high bit rate, a high immunity to electrical interference, and an ability to detect errors. The many advantages of CAN include cost effectiveness in design and implementation, robustness, ease of configuration, reliability of transmission, and ease of problem diagnosis. Also, CAN networks can be implemented using small, inexpensive, off-the-shelf components. Because of these advantages, other industries have begun using CAN technology. Today, it has become widely used in the automotive industry and has been expanded to such applications as medical device control and manufacturing.

Coast Guard HFDL Modem
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The United States Coast Guard uses a High Frequency Data Link (HFDL) to communicate text messages. The Harris RF-3466A modem transforms the input (ASCII) text and outputs a 39 tone audible signal. The modem employs Frequency Shift Keying to represent two binary digits with each tone. The output of the modulator is then sent to the transmitter. The HFDL is prone to high error rates, therefore the modem performs two main functions to the data before it is modulated: Reed-Solomon Forward Error Correction (FEC) and Interleaving. Also the receiving terminal employs a "Go Back-N" type of Automatic Repeat Request (ARQ). FEC involves encoding data at the sending station so the receiving station can correct errors introduced during transmission. The FEC code reflects the bit pattern of the data stream and is inserted into the data stream. At a 2400 bit-per-second rate, the data can be corrected even with a 20% error rate. A large percentage of the errors in the HFDL fall under the general category of burst errors. Interleaving assembles the coded data into a matrix as rows. Then, once the matrix is full, the data in the matrix is read off as columns. In this way the packets are broken up before they are transmitted. In this way if a burst error does occur, the bit errors will not be confined to one or tow packets but several. Of course the receiver performs the inverse of the interleaving process. It also uses the FEC to correct the data. However, if after these processes are completed, all of the errors have not been corrected, the receiver will use ARQ to ask the transmitter to retransmit the data.

Java Programming and Network Communications
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Information exchange plays an essential role in our daily life. Along with the advance of technology, the World Wide Web and the Internet make more and more excitements on information communications. The Internet ties the "information world" together and the World Wide Web makes the Internet easy to use and gives it the ability of multimedia. Since the features such as platform independent, interactive and has a number of built-in networking capabilities that make it easy to develop Internet-based and Web-based applications, Java becomes more and more popular as an Internet programming language. No programming language makes it easier to access the Internet than Java. In this project, I will explore some aspects of Java programming language, illustrate its important role in Web communications and development a Java program that demonstrates a simple token ring network. Through this project, I become familiar with Java programming.