ELE437 Computer Communication Mini Conference CCMC'99

Department of Electrical and Computer Engineering, University of Rhode Island, Kingston, Rhode Island 02881

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Session II. 10:00-11:45, Wednesday, May 3, Wales 224

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1 A study of Jini Technology
Hua Wei. Graduate School of Oceanography, University of Rhode Island, Narragansett, RI

A Jini system is a distributed system based on the idea of federating groups of users and the resources required by those users. It makes access to and delivery of new network services as simple as plugging in a telephone. This project describes the high level architecture of a Jini software system, defines the different components that make up the system: a runtime infrastructure and a programming model. Jini infrastructure provides resources for executing Java language objects, communication facilities between those objects, and the ability to find and exploit services on the network. It consists of a distributed security system, the lookup service and the discovery/join protocol, which are all characterized in this article. The programming model helps building a distributed system which is organized as a federation of services and client programs. The three parts of the programming model: the leasing, transactions, and distributed events, are also discussed.

2 Medium Access Controller of the ICED Network
Tim Giguere and Shaun McCarthy. Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI

This project is to implement the medium access controller (MAC) of the ICED network. The medium access controller sends signals to and receives signals from the physical layer (8391 and 8392 chips) and sends signals to and receives signals from the logic link controller (LLC). The signals sent by the MAC layer tell both the physical and LLC layers when it is appropriate to send data along the network. More specifically, the physical layer sends a collision signal (which signifies a collision along the network bus) and a carrier sense signal (which signifies data on the network bus) to the MAC. The MAC in turn tells the LLC when it is appropriate to send data based on the signals from the physical layer. The MAC also tells the physical layer the actual destination address via a lookup table (the MAC receives a three bit address, and the address is decoded to indicate one of eight computers). The MAC transfers the data from the LLC to the physical layer by means of serial loading. The data is sent to a shift register, which sends the data to the physical layer, one bit at a time.

4 Erbium Doped Fiber Optic Amplifiers
James (Jay) M. Boyer. Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI

Computer users are calling for more and more bandwidth to increase speed. With optical fiber systems being able to routinely operate in the 10-100 GHz bandwidth range, and with operation in the Tera hertz range in the very near future, fiber optics may well be the transportation medium used by all computers in the future. With the use of fiber optic systems the attenuation of signal strength over the length of the fiber will have to be considered. One way to amplify the signal is to use a detector to detect the signal and then a source to regenerate the signal. This method is cumbersome and exceedingly cost prohibitive. The other option is the use of an optical amplifier. Fiber based optical amplifiers offer significant potential within fiber communications. Optical amplifiers operate solely in the optical domain. Therefore, instead of using regenerative repeaters, that require optoelectronic devices for source and detector, together with substantial electronic circuitry, and substantial cost, optical amplifiers can be placed at intervals along a fiber link to provide linear amplification of the transmitted optical signal. The optical amplifier provides a simpler solution since it is a single in-line component which can be used for any kind of modulation at
virtually any transmission rate. There are various types of in-line amplifiers. I will discuss one specific rare earth fiber amplifier that is erbium doped. These amplifiers have the ability to provide high gain over wide spectral bandwidths, making them exceedingly suitable for future optical fiber system applications.

5 Introduction to Data Communication in Nanoelectronics
Dansiter Rajaratnam. Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI

Nanoelectronics is the electronics technology for a future generation of much smaller and more densely integrated computers. At the current rate of miniaturization, it has been predicted that the conventional transistor technology will reach a minimum size limit at the turn of the century. At that point, small-scale quantum mechanical effects, such as tunneling of electrons, will begin to dominate the essential effects that permit a mass-action semiconductor device to operate. To transfer data in nanoelectronics, many of the new nanoelectronic two-state devices that are the most widely investigated and discussed as nanoscale replacements for the transistors are Quantum dots and Single-Electron Transistors. Quantum dots (or "artificial atoms") and single-electron transistors (SET) govern tunneling of a small number of electrons through the influence of an electric field from a nearby gate electrode. Through this, scientists have shown switching and amplification properties of nanoelectronic two-state devices are similar to microelectronic transistors. In the future, quantum dots are likely to be made even smaller, further increasing the speed of communication. Also, the quantum dot devices are sensitive to and can take advantage of the presence or absence of the charges of single electrons. Other electronic nanodevices that take advantage of quantum mechanical effects, such as quantum dots arranged to form "quantum-dot cells" and "wireless" cellular automation also are among the more innovative of the recent proposals. Despite several obstacles to overcome in nanoelectronics, nanotechnology could introduce many new applications and possibilities.

6 Invisibility in digital data Communication
Carlo Tognina. Dep. of Electrical & Computer Engineering, University of Rhode Island, Kingston RI

There has always been a need to protect information from unauthorized access. Since confidential computer data is never more vulnerable to theft or distortion than during transmission, the broadening use of computer networks and the sharply increased use of wireless communication to transmit such data has increased the demand for technologies to secure data communication. In addition to traditional cryptography, steganography, the art of hiding information, is a more and more used technology to make digital data communication more secure. In contrast to cryptography, which scrambles information so it cannot be understood, steganography hides information inside other data so that it cannot easily be detected. This report gives a brief overview of the implementations and applications of steganography in digital data communication. The basic principle of stenographic systems, i.e. the replacement of a noise component of the 'cover' data with the secret information is demonstrated in detail using still images as 'cover' data. In order to show the flexibility and limitations of available steganographic software tools, results obtained using the public domain software s-tools are presented and discussed.

7 Introduction to Audio Compression
Li Li. Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI

One trend of new web design is to apply more and more multimedia technology. Fast Internet access and compression methods make it possible that we can not only read the tedious text from the web site but also get audio and video information such as picture, speech, music, and even the real time broadcasting program. Digital audio compression allows the efficient storage and transmission of audio data. Codec is a term from the process of the COMpression and DEcompression of digital audio. Both hardware and software codecs are in use today. In this project, just software methods are evaluated. The various audio compression techniques offer different levels of complexity, compressed audio quality, and the ratio of data compression. Today's most popular audio compression method is MP3 (MPEG level 3). It can provide high quality music

8 Searchable Online Database
Adam Greenbaum and Marlon De Paz. Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI

This project entails the creation of a searchable online database using mSQL (mini-SQL) for both the database engine and the CGI. A client-server model is used over TCP/IP, although both the client and server are run on the same machine. The database is accessible to the user through a web interface, and can be used over the internet with any standard HTML browser (ie Netscape, Internet Explorer). Items, address book entries in this case, can be added and deleted from the database through this interface. Modifications to the database can be made indirectly by searching for a record in the database, deleting it, and then re-adding the record. The mSQL backend will be running on a Sun-based system running Solaris and the Apache web server program.

11 Behavioral Simulation of Coaxial Transceiver Interface (DP8392) and Serial Network Interface (DP8391) Chip Set
Peter J. Cioe. Department of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI

The purpose of this project was to design a behavioral simulation of the Coaxial Transceiver Interface (CTI and Serial Network Interface (SNI) chip set in VHDL. The idea behind creating a behavioral simulation version of these chips was so groups designing the MAC layer can use it to help simulate a working physical layer. The MAC layer will interface with the simulation model of the SNI using the same signals as if connecting to the actual chip. The six main signals being, Receive Data (RXD), Receive Clock (RXC), Carrier Sense (CRS), Transmit Data...
(TXD), Transmit Clock (TXC), and Transmit Enable (TXE). RXD and RXC simply output the Data bits and Clock respectively to the MAC layer. CRS goes active high when there is valid data on the RXD pin. TXD and TXC is where the SNI receives the Data and Clock from the MAC layer, which uses the TXE to signify there is valid data on the TXD pin, by driving it high. The data being sent from the MAC layer to the SNI and CTI chips will be encoded first using the Manchester encoding. The same is true for the data being received, except that it will already be encoded and the will have to be decoded. This model will also be able to perform the loopback function described in the documentation. When the Loopback (LBK) signal is driven high the data being transmitted on the TXD line will be routed through the encoder and return through the decoder to RXD. The Collision (COL) signal will be driven high when the chip set is trying to transmit data at the same time it is trying to receive data. Though when the loopback function is active the collision detection and transmit drivers are disabled. Groups wanting to simulate their projects will be able to connect two of these models together and be able to simulate a working network.

12 Java-Based Virtual Community
Jose Barbosa. Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI

Java has become one of the most popular Internet programming languages. Web based Java applications make a web site more attractive and can allow browsers to interact with the web site. Java programs can do just about anything on the web. Java has multimedia, three dimensional viewing, animations, and drawing options. The most popular web application on the Internet today is an online virtual community. In order to become more acquainted with the Java programming language I created a Java based virtual community. The virtual community I decided to build was a Chat room. The chat room application consist of two parts one is the chat room itself and the other is the chat server. The chat room has two text boxes one for the user to type in a message and another to display messages from all the other users that are logged in. The chat room also displays the names of the people that are logged into that room. The chat server logs people into the chat room by asking the user to type in a nickname. The chat server also keeps track of who is in the chat room. The chat application allows web users to talk with other web users in real time. The objective of this project was to learn more about Java programming and by building an online virtual community I have gained knowledge in the Java language.

13 A Web Based Java Bank Application
Dilip K. Pullabhotla. Dept. of Computer Science, University of Rhode Island, Kingston, RI

The purpose of this project was to design and implement a web based Bank application using Java. This project is basically a client/server application where the client is a Java applet launched in the user's web browser and the server which is the Bank Server listens to requests from the client and has methods to provide services to the client requests. The client's requests in this bank simulation are opening an account, making transactions (deposit, withdraw, funds transfer) and a balance inquiry. For providing the communication between the client and the server I used Java RMI (Remote Method Invocation), a set of classes in Java that supports remote programs written in Java to communicate with each other.

14 Implementation of IEEE 802.2 LLC Sub-layer for ICEDNET
Thomas Wenisch. Justin Keough. University of Rhode Island, Kingston, RI

The ICEDNET is a network of FPGA-based embedded CPU’s being developed by students over several semesters of their course of study in the Integrated Computer Engineering Design (ICED) curriculum the University of Rhode Island. We will create a software implementation of the IEEE 802.2 standard for the LLC sub-layer of the DLC network layer. The LLC layer will present an interface to higher level protocols and will support the minimum IEEE 802.2 requirements of supporting transmission and reception of XID, TEST, and UI (Unnumbered Information) packets. In addition, we will implement a non-standard extension which will allow the transmission of an arbitrarily large stream of data across the network by packetizing the data and transmitting it with a Go-Back-N ARQ. Our implementation of the LLC assumes that address resolution is done at a higher network layer (an Address Resolution Protocol (ARP) sublayer), and that CRC-32 checking of the packets is performed at the MAC layer.

15 MAC Implementation
Michael Curtis, Alicia Dail, and Robert Lincourt. Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI

For this project, the Medium Access Control (MAC) sublayer of the Data Link Layer (DLL) will be implemented. The packets will be passed from the Logic Link Control sublayer (LLC), where it will already be framed, and packaged, ready to be sent to the bus. The MAC sublayer controls when the packets get sent to the bus by employing the CSMA/CD method of accessing a bus. This method ensures that a packet can be sent only when there are no other packets being sent. The station with data to transmit will continue to monitor the channel, until there is no carrier signal found. If the bus is busy the station will wait until the line goes idle, otherwise the station will transmit the data immediately. When the line goes idle, the station will begin transmitting, while checking the channel for collisions. If a collision is detected during transmission, the transmitting station will cease transmission of data and will send a jamming signal. This signal ensures that the collision lasts long enough to be detected by all stations on the network. Once a collision is detected, the transmitting station waits a random amount of time before attempting to retransmit. At that time the data proceeds through the CSMA/CD method again. If two or more stations begin transmitting simultaneously on the idle bus, they will collide. In this case, all involved stations will cease transmission, wait a random time, and attempt to place the packet on the bus again, going through the same CSMA/CD method. The CSMA/CD will be implemented in hardware, though the use of a state diagram in Renoir. This implementation will allow for easy transitions between states and for elementary operations within each state.

18 The Future of Fiber Optics in the Home
Christopher M. Abatecola. Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI

Fiber Optic cables are being deployed throughout the world to interconnect large cities for high-speed communication. They also serve as the backbone for the Internet. However, with the number of on-line users growing each day, connecting to the
Internet from home can be time consuming and frustrating. It is apparent that the "last mile" problem still remains evident. The problem occurs when the high bandwidth of the fiber optic cable is distributed to a Plain Old Telephone System (POTS) which only uses a fraction of the fibers' bandwidth, causing a bottleneck before reaching the home. There are some alternatives to the problem. CATV companies now offer a faster connection using existing cable lines. There are others, but it is inevitable that Fiber-to-the-Home (FTTH) is the best solution. Fiber optic cable has 100 times more bandwidth per home than any other system available. Once in place, it can be easily be upgraded and will last up to 30 years. There is one drawback, however, fiber optic cable is costly to install. Who should pay for it? The majority of the cost would come from telephone companies leaving the consumer to pay for the remaining expenses. The initial fee for installing fiber in the home would be somewhat expensive given the complexity of the hardware needed. But the monthly cost would only be three times that of the current cable modems. It is obvious that fiber optic cable will be the future of communication, but only a small percentage of consumers today would have the necessity and/or be able to afford such a luxury.

19 Logic Link Control Layer
Roland Zeuge and Christopher Leaver. Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI

For our project we will design the Logic Link Control (LLC) layer that will be usable for networking the ICED computer that will be created in other classes. The LLC layer will consist of these parts: it will do the framing for the computer, and it will do the ordering for any and all transmissions. We will evaluate the Automatic Repeat Request (ARQ) types and decide whether a stop-and-wait, a go-back-in, or a selective repeat ARQ will be the best to use with the computer design. We will have to be able to respond to any incoming signals, including a dummy ping package. This layer will also do the framing as stated earlier, and to do this we will establish a standard that we will use to break up the transmissions into blocks, or frames which can then be sent across the network. The frames will consist of an Unnumbered Information (UI) frame, an Exchange Information Request (XID) frame, and a Test Frame Request (TEST). The UI command sends information without any expected acknowledgment. UI is the connectionless frame format therefore the data contained in a UI frame may be lost if a transmission error occurs. It would be the responsibility of a higher protocol layer to initiate a retransmission. The XID conveys the types of LLC services supported and the receive window size. Receipt of an XID command causes the destination LLC to respond with an XID response. The XID format consists of an 8 bit Format Identifier followed by a 16 bit parameter field. The IEEE has defined a "Basic XID Format" which is indicated when the Format Identifier is 81 (hex). In this case the parameter field consists of a one-byte class identifier (Type 1 versus Type 2) and a one-byte Receive Window Size value. The receive window size specifies the maximum number of bytes that can be sent to the station without receiving an acknowledgment. When a station receives an XID command frame it is expected to return a XID response with the same type of information as described for the command. The XID response is sent at the earliest possible time after receipt of the command. If the attached system software wants to test the LLC link it can cause a Test frame to be sent. A station receiving a Test frame is expected to send the frame back to its source at the earliest possible time. If there is test data included in the frame then the data field is returned in the Test Response. When a station receives a Test command frame it returns a Test response.

20 Writing the TCP/IP Layer for an Ethernet Connection
Joseph Tedesco and Jeff Dugas. Dept. of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI

The project that we did was the TCP/IP protocol for the ICED computer. The TCP/IP layer deals with two parts, the TCP or Transmission Control Protocol, which deals with the host to host protocol, and the IP or Internet Protocol, which is used to provide the routing function across multiple networks. Each of these protocols put a header on the data being sent. Our job will be to implement these protocols and to create the correct headers for each. We programmed C code to implement this layer. The code then passes the header attached to the file that has to be transferred to the lower levels. The lower levels will split up the file and transfer it over the ethernet.

24 Log On ... To Your Answering Machine
Brett DeBeaulieu. Dept. of Electrical and Computer Engineering, University of Rhode Island, Kingston, RI

So you're an aspiring actor, working on a couple of small gigs away from home, when you realize, "I need to find out if my agent's called with my next job." But you don't even have the change to make the call to your little LA apartment to check the machine (you're an actor remember, not an engineer). No problem, in the future your digital answering machine will be connected to the web. Head down to the nearest cyber-cafe, log on ... and check your voice mail. The internet and its extensions are the tidal wave of the future, don't be sucked in by the undertow, grab a surfboard and some wax - we're going for a ride. In the future you will be able to "log in" to your home, or apartment. You'll be able to check for messages on the answering machine, monitor the security system, turn on the lights for when you get home, crank up the heat or AC for your arrival, and even preheat the oven. The technology is there, widespread use and applications are still limited. What an excellent home feature for the traveler who could now avoid long distance phone charges and "house sitters". A possible step for application development for answering machine message checking has been explored for this project. A web page with script application has been implemented to check a folder for voice mail message files. If files are found, the user is presented with options to play or delete the message. The server side of the application would require the uploading (or saving) of messages on the answering machine to the server, or you would need to have a PC capable of answering the phone and storing messages. This type of software for a PC does exist, the PC only needs to have a dedicated connection to the internet (possible with a cable modem) and server capability (software also available). This project will briefly discuss the application implemented and takes an imaginative look at possible extensions and additions to this idea.

25 Internet Voice Mail
Wei Guang Guan. Dept. of Electrical & Computer Engineer, University of Rhode Island, Kingston, RI

In this project I investigated into some basics on implementing security on the Internet, networking programming basics, and client server approach for communication, by attempting at write a Internet Voice Mail program. In trying to implement some security for access Internet voice mail, I used the client server approach. The server will run on a machine with a static Internet IP address on some port, waiting for a connection. After it
connected from a client, it wait for T times for the ID and PW from the client, if ID and PW fail 3 times it disconnect from the client. If the ID and PW was correct, it send a list of voice mail file to the client and set the access flag to true, then wait for a voice mail file request from the client. If the client request a voice mail file it send that file. The client has a GUI for where the user can enter ID and PW a log in button, a field for voice mail file list and a play button. If the client connect correctly to the server then the user can choose a voice mail file and then choose play. I used Java programming language first it is because it has good support for TCP/IP network programming, second it is because Java is a pretty good platform independent programming language.

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Introduction to Fiber Optic Cables and the EDFA
Nicholas Soscia. Dept. of Electrical & Computer Engineering
University of Rhode Island, Kingston, RI

Since information transfer via fiber optic cables is on its way to becoming the main and most efficient form of communication in the near future, I thought that a good topic to research upon and discuss would be fiber optic cables and the EDFA (Erbium Doped Fiber Amplifier). Fiber optic communication utilizes a beam of modulated monochromatic light that functions as a way of carrying information from a transmitter to a receiver. The process of Total Internal Reflection is the key to how the fiber actually functions. Proper functionality is directly dependent on the composition of the cable. The dimensions of the fiber and its different material makeup therefore determine the amount of attenuation in the light signal. The three main kinds of attenuation will briefly be discussed. The advantages of fiber optic communication do indeed outweigh the disadvantages and therefore seem to make it a much better means of communication, compared to copper wire. Because of its high bandwidth, low attenuation, interference immunity, low cost, and lightweight, optical fiber is becoming the medium of choice for high-speed digital communications. The fact that a single strand of cable (like the standard Bellcore OC-48 cable) can transmit 2 gigabits of binary data (all the information in a set of encyclopedia volumes) in less than a second is definitely supportive of this. When the information from the transmitter to receiver travels a long distance, a repeater is needed to boost the information. Today, the EDFA functions as the repeater, and is a means of controlling and amplifying a light signal passing through a fiber optic cable.

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Cable Modem Overview
Duytuan Le. Dept. of Electrical & Computer Engineer,
University of Rhode Island, Kingston, RI

As the internet continues its incredible growth, there is an increasing gap between the bandwidth provided by today's modems and the bandwidth required to see the new java/shockwave/cgi web pages everybody is talking about. Web pages can take a number of minutes to load, and that definitely detracts from their excitement. On-line access via cable modems will soon allow PC users to download information from on-line services at a speed - 1,000 times faster than today's fastest telephone modems. In just 1.2 seconds, a user can download data that today takes 20 minutes to receive with the standard telephone modem. These great speeds are easily reached because Cable Modems use coaxial cable, which has an existing data rate of 500Mbps and a bandwidth of 350Mhz. In the near future Cable Modems will offer subscribers access to streaming audio and video servers and CD-ROM servers. Each time your P.C. is turned on the cable modem automatically establishes a connection to the Internet that can be utilized to create a VPN for work-at-home users. All these services can be brought to your house for a small installation fee of about one hundred dollars and a monthly fee of about 40 dollars, provided cable is already installed.