Project Portfolio

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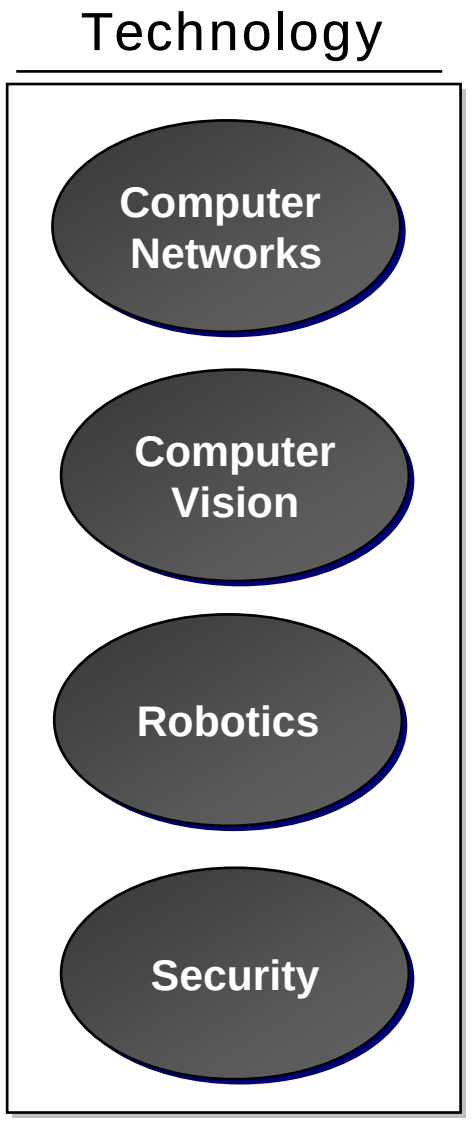
Table of Contents

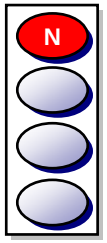
My Research Interests

- Major Research Interests
  - Wired/Wireless Computer Networks
  - Image Processing, Machine Vision
- Minor Research Interests
  - AI, Game Theory
  - Robotics, HCI
  - Computer Security



Project Profile : 1. A Prototype of the scalable Web 3.0

Project Name	Scalable Web 3.0	Dept.	CS at Cornell	Role	Research Assistant	Period	Mar/2007–May/2007
Main Theme	Our goal is to implement a type of online multi-user role playing game of the sort that may be typical of what some are calling “scalable Web 3.0.						
Knowledge	• Computer Networks • Distributed Systems • Web Systems	Members	Three M.Eng students (Cornell Univ.)				



Methodology & Tool

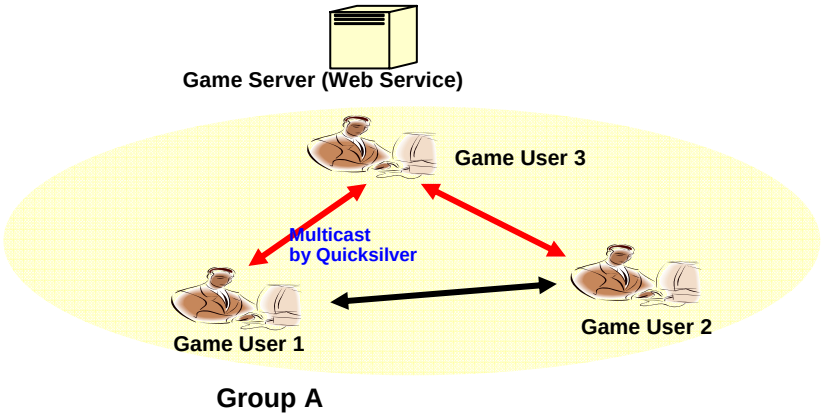
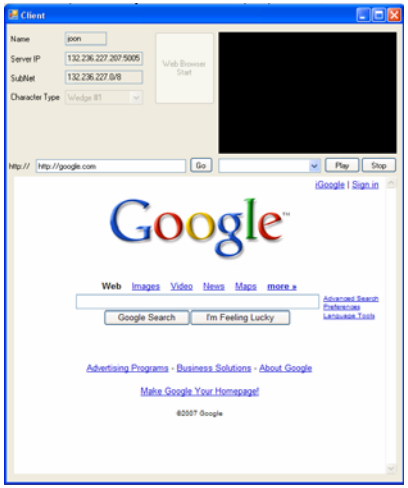
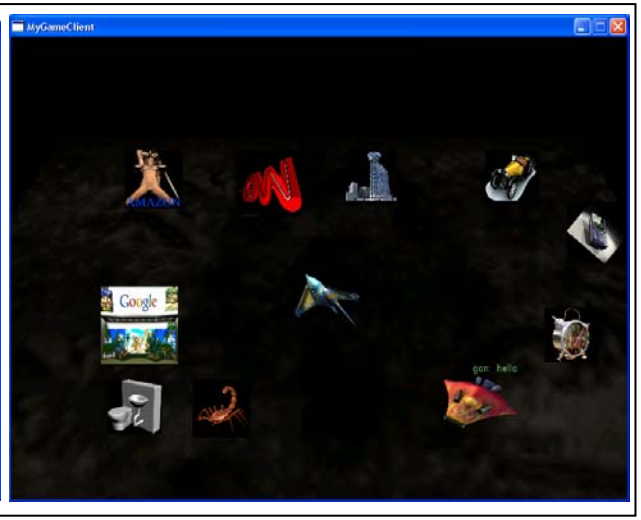
Methodology & Tools	Reference
In this project, our achievement is to design and implement Web 3.0 which will be a world of highly dynamic content, supported by highly scalable publish-subscribe event notification. Hence we design our system to support the high dynamic group membership by using the Quicksilver, the dynamic web browsing with user-interaction, and the audio/video streaming services (dynamic content transfer). It also provides advanced 3D avatar, 3D game graphics for each user, and chatting services. To improve the security, our system can encrypt and decrypt multicasting packets without loss of performance.	Quicksilver

Learning Source

Research	Internet Site	Sponsor	Document
• Computer Networks • Distributed Syetems • C#	www.cs.cornell.edu/projects/quicksilver/	Prof. Ken Birman (Cornell Univ.)	

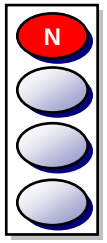
Project 1 Output :

- **A Prototype of the scalable Web 3.0**

	Main Output	Explanation
1		•An example of 3 nodes in the multicast network using quicksilver
2	 	• Left : After joining the Google web site, it is shown in the client window • Right : Red spaceship is about to create the building

Project Profile : 2.Overlay Network Project

Project Name	Overlay Network Project	Dept.	ECE at Cornell	Role	Research Assistant	Period	Jan/2007–May/2007
Main Theme	The goal is to create an overlay network for a set of nodes that will overcome a certain type of Internet failure called a transient partitioning event.						
Knowledge	• Computer Networks • Distributed Systems	**Members**	M.Eng student (Cornell Univ.)				



Methodology & Tool

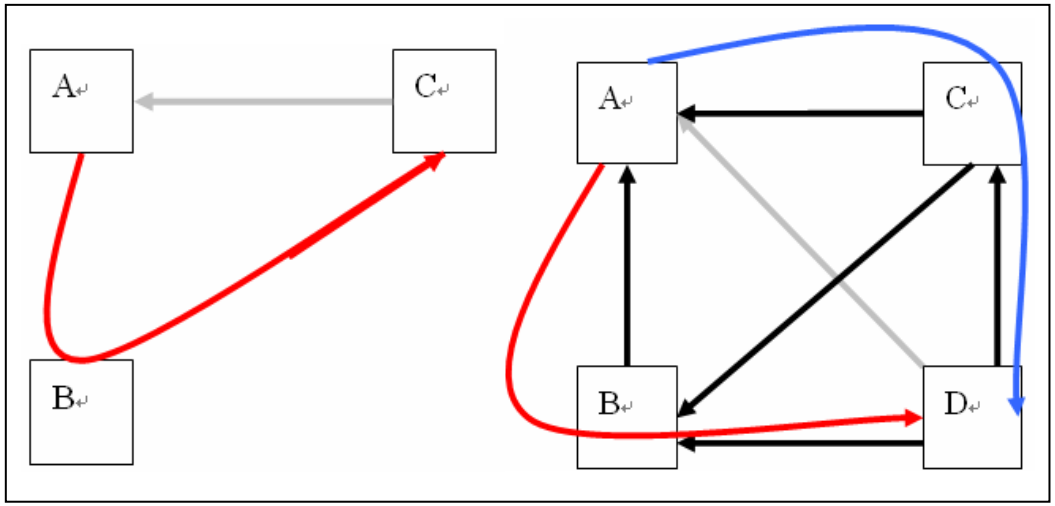
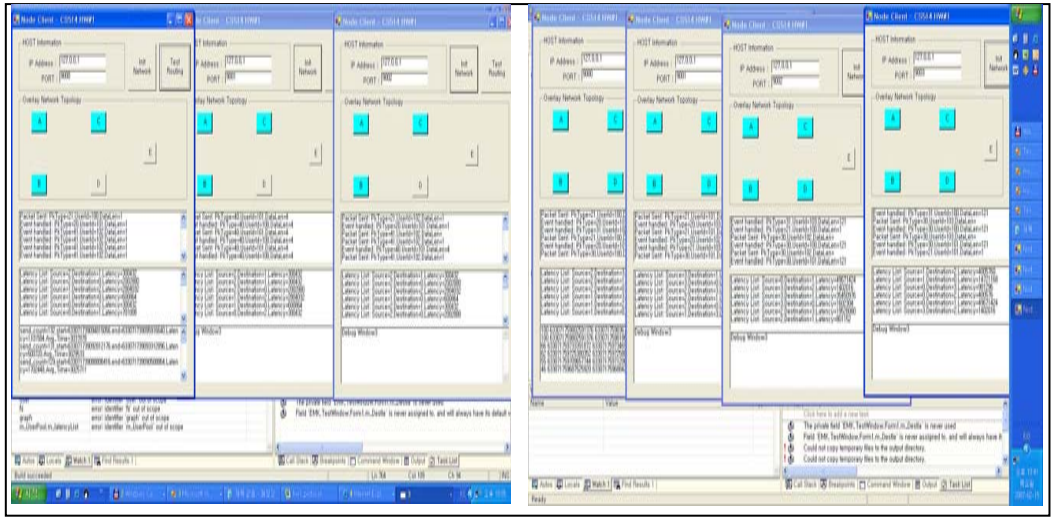
Methodology & Tools	Reference
An “overlay network” is a software layer that implements the same style of send/receive functionality as does the Internet, but that does so on behalf of some set of *endpoint nodes*. The overlay is implemented by a software layer that itself uses standard Internet functionality (TCP/IP, UDP, etc). However, applications running “over” the overlay have access to special advantages that normal Internet communication might lack, such as security, better quality of service, or other properties. The goal is to create an overlay network for a set of nodes that will overcome a certain type of Internet failure called a *transient partitioning event.* When a network partitioning event occurs, certain network paths stop working, even though there may be other “indirect” paths that could carry data between the same nodes. For example, suppose that our endpoint nodes are machines A, B and C. A situation could arise in which A can’t make direct connections to B, and yet A can talk to C and C can talk to B, hence A could have relayed information through C and continued to communicate.	Resilient Overlay Networks at MIT

Learning Source

Research	Internet Site	Sponsor	Document
• Computer Networks • Distributed Syetems • C#	A. nms.csail.mit.edu/ron/	Prof. Ken Birman (Cornell Univ.)	

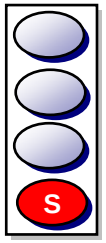
Project 2 Output :

- **Overlay Network**

	Main Output	Explanation
1		• Left : An example of 3 nodes in the overlay networks • Right : An example of 4 nodes in the overlay networks
2		• Left : programs screen shot showing an example of 3 nodes in the overlay networks • Right : programs screen shot showing an example of 4 nodes in the overlay networks

Project Profile : 3.Secure Electronic Voting System

Project Name	Secure Electronic Voting…	Dept.	ECE at Cornell	Role	Research Assistant	Period	Sep/2006–Dec/2006
Main Theme	Main goal is to design a secure and reliable system relies on an analysis of attacks, accidental failures and intentionally malicious code.						
Knowledge	• Voting Systems • Computer Security • Computer Networks	Members	Five M.Eng students (Cornell Univ.)				



Methodology & Tool

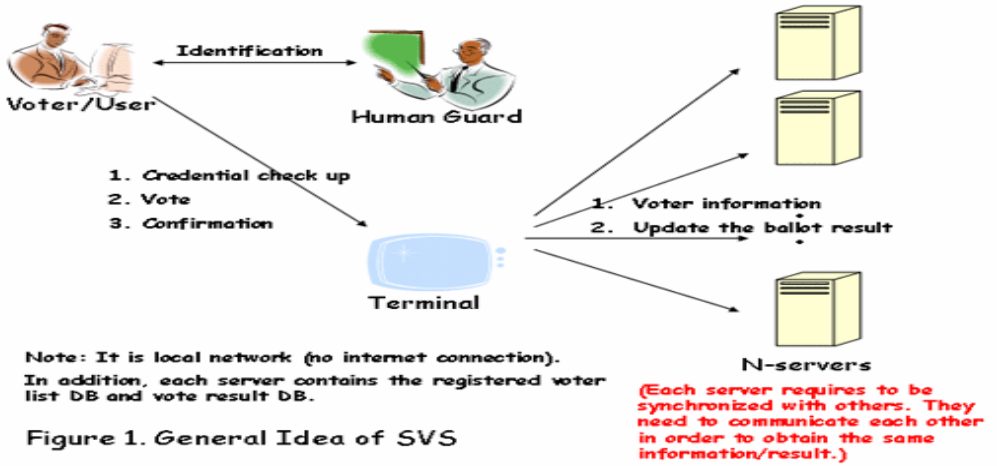
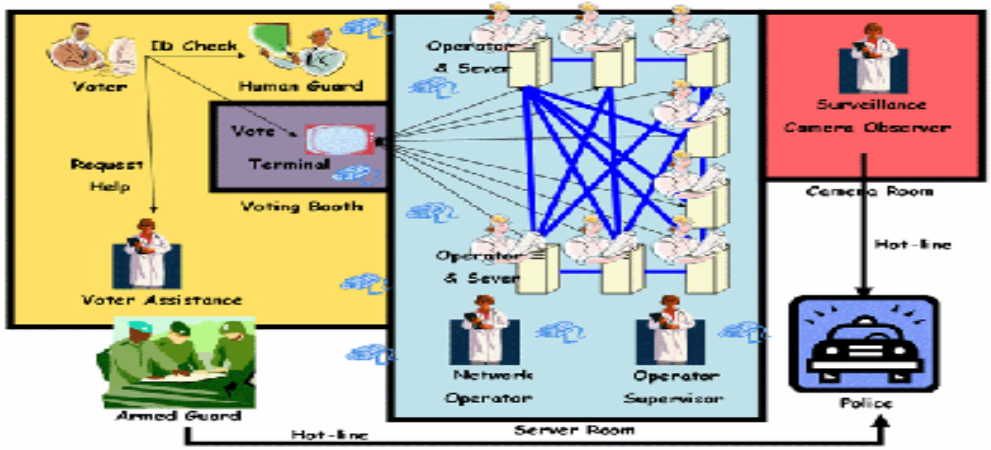
Methodology & Tools	Reference
The main purpose of Secure Electronic Voting System, SVS, is to replace the current paper voting system, which requires significant number of labor and time to count the ballots correctly, with computerized and automated electronic voting system. Specifically, we build electronic voting system within closed network which is not in the public network domain. We also embed verifiability into SVS so that SVS can solve coercion problem of currently existing electronic voting systems with receipts and ensure both voter and system level verifiability. The voter level verifiability enables the voter to verify his/her vote after voting period ends and system level verifiability ascertains the correctness and accountability of SVS so that voters fully trust SVS and SVS convinces itself with its fair operation. We design SVS only within closed network connection but it can later be adopted to nation-wide elections by resolving the problems with public network vulnerability.	A. Security Protocols: 11th International Workshop April 2-4 2003 Revised B. Chaum, Pret'a Voter, Sivs or Siva's Voting System – On going project C. Computer Networks 4th (Network) by Andrew S. tanenbaum D. TCP/IP Protocol Suite by Behrouz a Forouzan E. Modeling Analysis of Security Protocol by S.A. Schneider

Learning Source

Research	Internet Site	Sponsor	Document
• Computer Security • Voting Systems • Computer Networks	A. theory.lcs.mit.edu B. crypto.csail.mit.edu C. www.igs.berkeley.edu D.ww.verifiedvotingfoundation.org	Prof. Andrew Myers (Cornell Univ.)	

Project 3 Output :

Secure Electronic Voting System

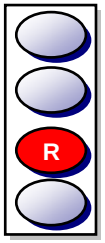
	Main Output	Explanation
1	 Figure 1. General Idea of SVS	This picture demonstrates top level view of Secure Electronic Voting System (SVS). It shows the setup of voting place. Voting place has several major rooms and one voting booth. Observers stay in the room called Observer Room (Camera Room) watching over Server Room and Voting Booth, Server Room has n number of servers, n number of operators, One network operator and One operator supervisor. Only one voter can enter the Voting Booth at a time and after screening process by a human guard.
2	 Figure 1. Top view of the system	**[Possible Attacks vs. Defence]** • Buffer overflow – Java protects the attack • Man in the middle attack – SSL Connection prevent any eavesdrop • Denial of service – SSL Connection • Dictionary Attack – Limit the number of trials • SQL Injection Attack – Limit the input • Oversized payload – protocol policy • Unwanted Revelation – masking • Back Door / Trojan Horse Attack – Open source • Tamper with DB / Create, delete, and modify votes – human factor, SSL • Multiple Casting – voter log in policy • Stay in the voting booth for indefinite time – 5 minute session timer. • Server Failure – N-server System or mix-net.

Project Profile : 4. NASA Robotics Alliance Cadets Project

Project Name	NASA Robotics …	Dept.	ECE at Cornell	Role	Research Assistant	Period	Sep/2006–July/2007

Main Theme	Main goal is to design and implement the protocols for Wireless Communications between Robots.

Knowledge	• Wireless Networks, Electronic Circuits • Mechanics, Robotics • Computer Vision, Machine Learning, AI, HCI	Members	• Four M.Eng/Ph.D studetns in Mechanics **at** Cornell • Three M.Eng/Ph.D students in ECE at Cornell • Five M.Eng/Ph.D students in CS at Cornell



Methodology & Tool

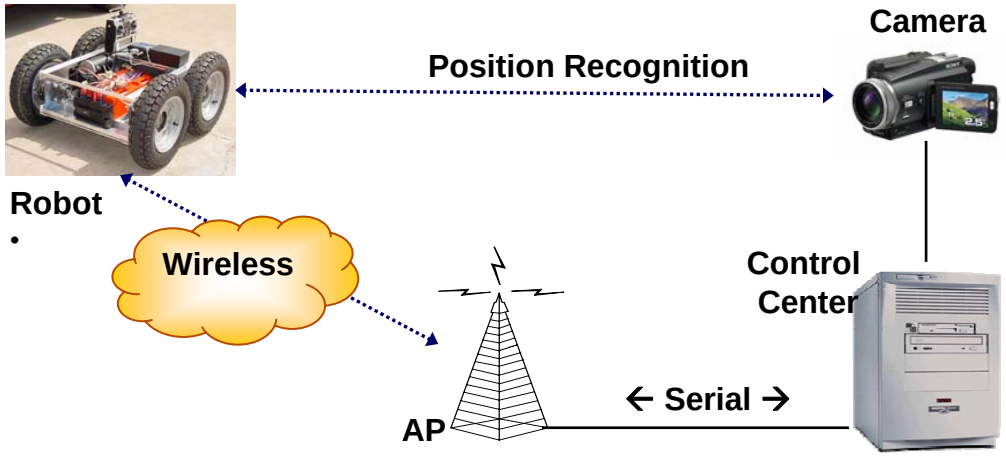
Methodology & Tools	Reference
The NASA Robotics Alliance Cadets Program is an innovative project aimed at creating a new highly integrated and interactive college master's level curriculum centered mainly around robotics. This program is being developed to enhance the curriculum for master's degree programs and ultimately broaden the American technology base. The program is being designed to be implemented at a very low start-up cost, and to make this goal obtainable, the program is being developed using low to no cost components from already developed, well-tested and robust engineering testbeds. This project outlines the strategy adopted for establishing wireless communication between a mobile robot, TekBot and a remote base station. TekBot is a low to no cost mobile robot built by Oregon State University which in its current version requires wired communication. Our aim is to be able to command and control the robot wirelessly. This will be a useful addition for NASA's curriculum development for mater's degree programs. My role in the project is to build up reliable wireless network between Robots and a base station.	Embedded ***C*** programming and the ***Atmel*** AVR By Richard Barnett, Larry O'Cull, Sarah Cox.

Learning Source

Research	Internet Site	Sponsor	Document
• Robotics • Wireless Networks • Machine Learning • Electronic Circuits	A. robots.nasa.gov B. eecs.oregonstate.edu/tekbots C. www.radiometrix.co.uk	• National Aeronautics and Space Administration • Cornell University	

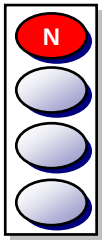
Project 4 Output :

- **NASA Robotics Alliance Cadets Project**

	Main Output	Explanation
1		• Control Center to Access Point : An access communicates with a control center via. Serial cable. • Robot to Access Point : An access point communicates with robots using Wireless Communication. • Camera : A camera records robots' position and transmit positioning data to a control center.
2		Robot-Cup Competition

Project Profile : 5. The Zone Routing Protocol Simulation

Project Name	The Zone Routing Protocol	Dept.	ECE at Cornell	Role	Research Assistant	Period	Sep/2006–July/2007
Main Theme	Main goal is to simulate and implement the Zone Routing Protocol (ZRP) using JiST(Java in Simulation Time).						
Knowledge	• Wireless Networks • JiST	Members	One M.Eng student (Cornell Univ.)				



Methodology & Tool

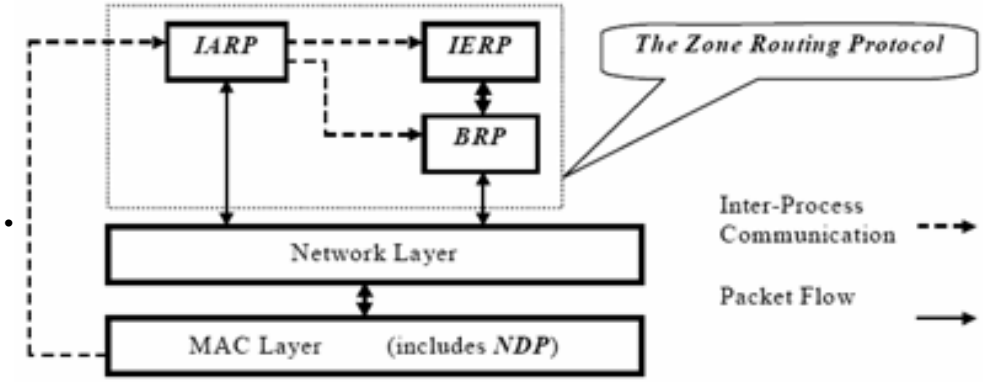
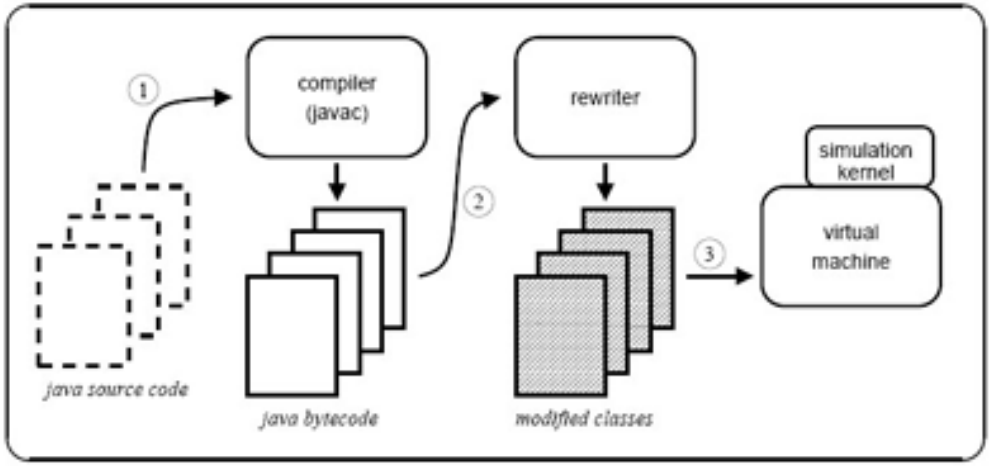
Methodology & Tools	Reference
The goal of this design project was to provide an implementation of the Zone Routing Protocol (ZRP) as a module to JiST a freely available network simulation software suite. The JiST system, which stands for Java in Simulation Time, follows a long line of simulation frameworks, languages and systems. JiST is a new Java-based discrete-event simulation engine with a number of novel and unique design features. ZRP is a hybrid protocol. This protocol divides the network into non-overlapping routing zones and runs independent protocols that study within and between the zones. Intra-zone protocol (IARP) operates within a zone and learns all the possible routes, proactively. So, all nodes within a zone knows about its zone topology very well. Inter-zone protocol (IERP) is reactive and a source node finds a destination node which is not located within the same zone, by sending RREQ messages to all border nodes. This continues until destination is found. Routing zone diameter is variable and this should be chosen optimal for a scaled topology. By zoning, control message overhead is attempted to be lowered. Current zone size estimation techniques allow ZRP to operate within two percent of the control traffic from optimal value.	Z.J. Haas and M.R. Pearlman, "The Zone Routing Protocol"

Learning Source

Research	Internet Site	Sponsor	Document
• Wireless Networks • JiST • Java	A. jist.ece.cornell.edu B. people.ece.cornell.edu/~haas C. www.eclipse.org	Prof. Zygmunt J. Haas (Cornell Univeristy)	

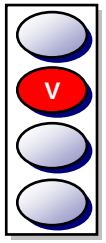
Project 5 Output :

The Zone Routing Protocol Simulation

	Main Output	Explanation
1	 Figure 3: ZRP's Architecture	The inter-relationship of the ZRP component protocols is illustrated in the picture. The proactive maintenance of the routing zone topology is performed by the IARP, through exchange of route update packets. Route updates are triggered by the MAC level NDP, which notifies the IARP when a link to a neighbor is established or broken. The IERP reactively acquires routes to nodes beyond the routing zone using a query-reply mechanism. The IERP forwards queries to its peripheral nodes through a bordercast delivery service provided by the BRP. The BRP keeps track of the peripheral nodes through up-to-date routing zone topology information provided by the IARP. The IERP also makes use of the IARP routing zone information to determine whether a queried for destination belongs to its routing zone.
2		This picture shows the JiST system architecture – simulations are compiled (1) then dynamically instrumented by the rewriter (2) and finally executed (3) The compiler and virtual machine are standard Java language components. Simulation time semantics are introduced by the rewriting classloader and supported at runtime by the Java-based simulation kernel.

Project Profile : 6. TFT LCD Monitor Solutions for G.E and Siemens Medical Equipments

Project Name	TFT LCD Monitor Solutions	Dept.	Research Dept.	Role	Researcher	Period	Jan/2005 – June/2006
Main Theme	Main goal is to develop a software for the TFT LCD monitors.						
Knowledge	•Wired Networks, Electronic Circuits, Image Processing / DICOM GSDF •C, C++, Visual Basic 6	**Members**	• Three researchers for circuit designs • Three researchers for software implementation				



Methodology & Tool

Methodology & Tools	Reference
Any monitors are Medical Grade Color LCD monitors. The Monitors meet the medical safety and EMC standards and requirements. It is optimized to meet the challenging video endoscopy applications. The Any monitors incorporate a LCD panel that provides an extremely high level of brightness, contrast, and color depth. The use of Any's original technology allows natural reproduction of video images, which is often difficult to achieve on typical LCD monitors. In addition, this monitor provides superior versatility with a variety of signal input capabilities for analog or digital, SD or HD, and DVI-D, as well as user-friendly operational conveniences such as its User Memory functionality. The above mentioned features and a compact and light design, make the Any's products the monitor of choice in video endoscopy cart installations. The monitors provide sophisticated I/P conversion using Any's original Algorithm technology. This combines the pixels above, below, and in the diagonal direction of the moving picture part, and then inserts a natural pixel to create the absent lines. The result is much smoother image reproduction for both moving and static picture areas.	

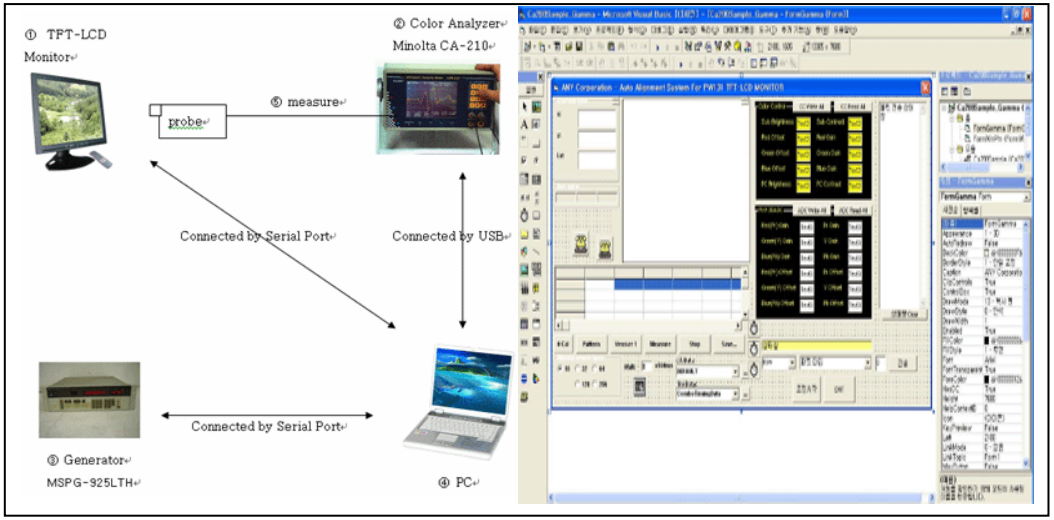
Learning Source

Research	Internet Site	Sponsor	Document
• Electronic Circuits • Image Processing • Wired Networks	A. www.any21.co.kr	Any Corporation (S.Korea)	

ANY CORPORATION
Digital Imaging & Display
ISO9002

Project 6 Output :

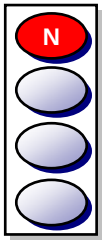
TFT LCD Monitor Solutions for G.E and Siemens Medical Equipments

	Main Output	Explanation
1	 	• **M170TL** is a 17-inch analog and digital TFT/PVA-LCD offering a fast response time of 6 ms (G to G), 1500:1 contrast ratio, 300 cd/m2 brightness, 1024 x 768 resolution, 178 ° /178 ° viewing angle. • **M190TL** is a 19-inch analog and digital TFT/PVA-LCD offering a fast response time of 6 ms (G to G), 1000:1 contrast ratio, 350 cd/m2 brightness, 1280 x 1024 resolution, 178 ° /178 ° viewing angle.
2		This is the program for Color-Adjustment of Medical TFT-LCD monitors. There are four entities to communicate with each other to achieve the goal. A program on a PC is linked to TFT-LCD monitor, Color Analyzer, and Signal Generator to communicate. Once communication lines are established, first, the program on PC commands the signal generator to generator desired signals. Secondly, the program sends a request to the color analyzer to measure values of the monitor through a probe. If measured values are valid, the program calculates and evaluates the values to achieve a goal which is fits to desired color specifications such as DICOM GSDF.

Project Profile : 7. Online Bomberman Game Design

Project Name	Online Bomberman	Dept.	Research Dept.	Role	Software Engineer	Period	Apr/2003 – Dec/2004

Main Theme	Main goal is to develop a login server, a game server using TCP/UDP, a monitoring tool for the server, and a script engine for the server, to design network security for protocols, to design/optimize DB schema.		
Knowledge	• AI, Game Theory, Computer Graphics, Image Processing • Wired Networks, Computer Security, Cryptography • Windows 2003 Server, Suse Linux, C, C++, MFC , MS-SQL	**Members**	• Three developers for game servers, game clients • Four graphic designers for game images



Methodology & Tool

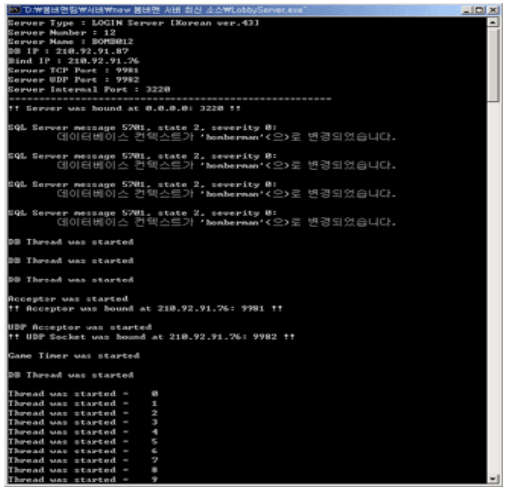
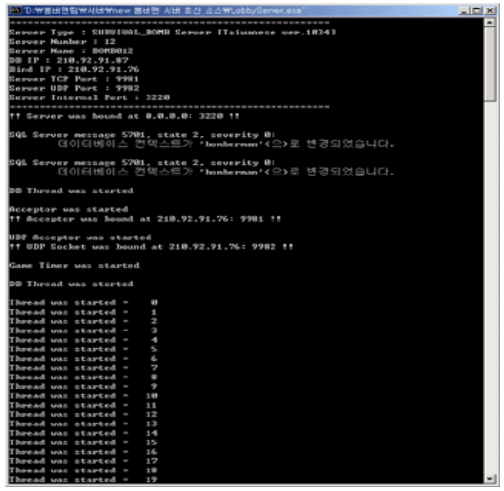
Methodology & Tools	Reference
We developed a login server, a game server using TCP/UDP, a monitoring tool for the server, and a script engine for the server. We designed network protocols for a network game and encryption for packets. We designed and optimized DB schema for a game server.	

Learning Source

Research	Internet Site	Sponsor	Document
• AI, Game Theory • Computer Graphics, Image Processing • Wired Networks	A.pub.mgame.com/game/bomber/_share/index.php B. www.mgame.com	MGAME Corporation (S.Korea)	

Project 7 Output :

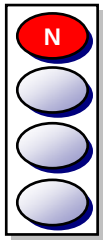
Online Bomberman Game Design

	Main Output	Explanation
1	 	• Left : Online Bomberman Client • Right : Game screen shot
2	 	• Left Online Bomberman Login Server • Right : Game Server

Project Profile : 8. Net-Game Pack Solution

Project Name	Net-Game Pack Solution	Dept.	Research Dept.	Role	Software Engineer	Period	Oct/2001 – Apr/2003

Main Theme	Main goal is to create a platform server for mobile network games and network libraries for game developers on cell phones and to make a game hybrid server for both wired and wireless clients		
Knowledge	• Wired & Wireless Networks, AI, Game Theory • Windows 2000 Server, Embedded system (BREW) / C, C++, C#, JAVA, MS-SQL	**Members**	• Two developers for a game server • Two developers for a platform server



Methodology & Tool

Methodology & Tools	Reference
Net-Game Pack Solution is Game-Net Platform for both online and mobile games. I created a platform server for mobile network games and network libraries for game developers on cell phones. I also made a hybrid game server for both wired and wireless clients.	

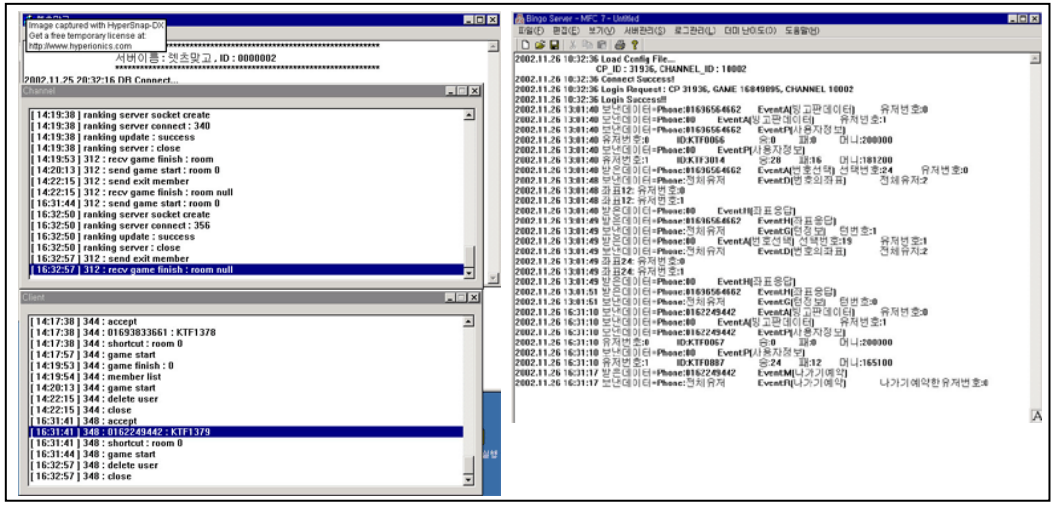
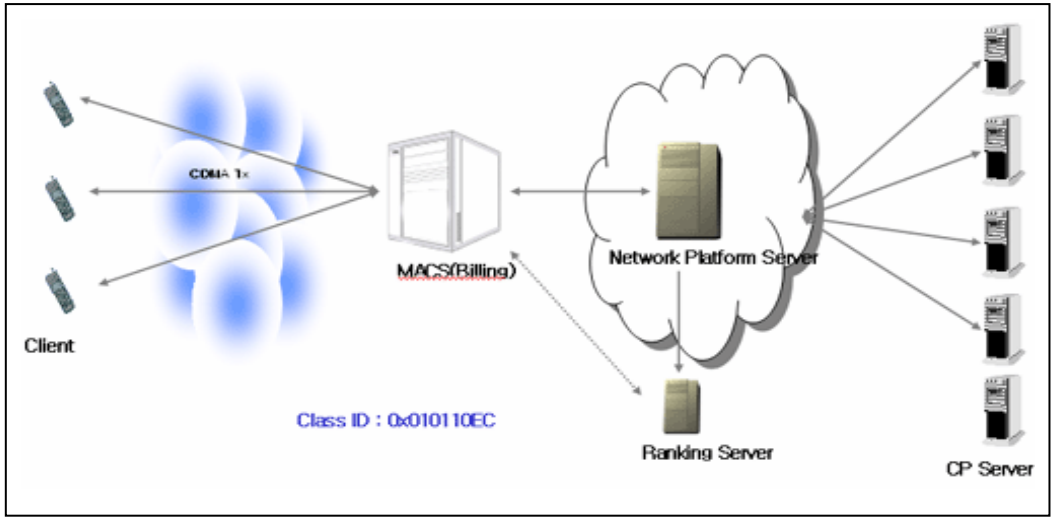
Learning Source

Research	Internet Site	Sponsor	Document
Wired & Wireless Networks	A. www.gameboy.co.kr	MOBILEONE Communication (S.Korea)	

Mobileone communication

Project 8 Output :

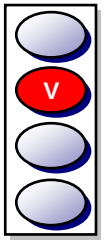
Net-Game Pack Solution

	Main Output	Explanation
1		• Left : Platform Server For Networking Game • Right : Game Server For wired / wireless clients
2		This picture shows how the platform server, game (CP) server, and clients work.

Project Profile : 9. FINDTECH Solution

Project Name	FINDTECH Solution	Dept.	Research Dept.	Role	Research Assistant	Period	Mar/1999 – Jul/2001

Main Theme	Main theme is two solution: Internet Video Indexing (i-VIBS) Solution and Home Video Editor (i-CAM) Solution		
Knowledge	• Computer Vision, Image Processing, Wired Networks • C, C++, MFC, CGI, XML, MDB, MS-SQL, Windows Media Server, DirectX	**Members**	• Three Ph.D students of Hanyang Univ. (S.Korea) • Four M.S. students of Hanyang • One Undergraduate student of Hanyang



Methodology & Tool

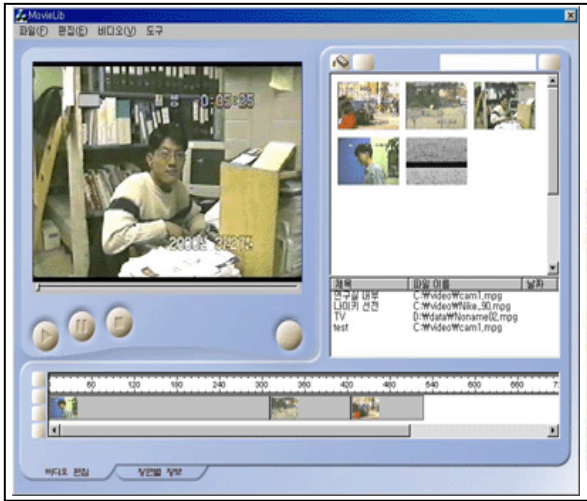
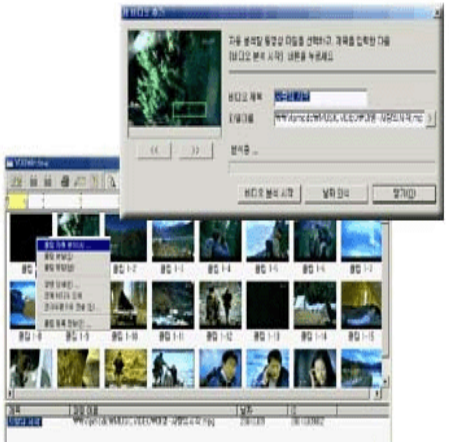
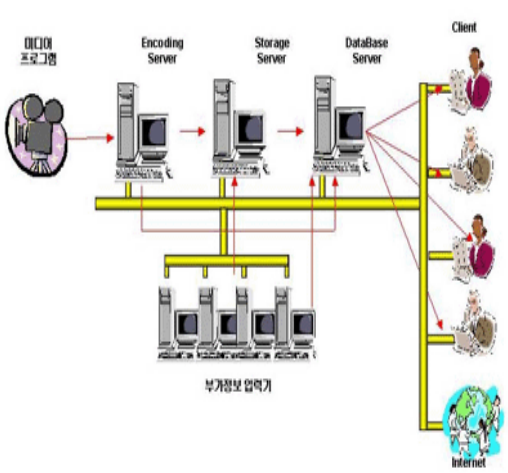
Methodology & Tools	Reference
"**Internet Video Indexing (i-VIBS) Solution**" : A solution makes mpeg-1, ASF file format and saving in DB and automatically creating web-pages including meaningful data for videos, after analyzing sources to meaningful units such as news, show, sports programs. I developed parts for Managing and Searching a video indexing through Web automatically. I implemented then Network load balancer for a storage server. "**Home Video Editor (i-CAM) Solution**" : A solution shows videos in a way of image gallery after editing videos, abstracting still-cuts (pictures) from a source, saving to mpeg-1, mpeg-2. I made parts to save video data edited as a MPEG-1,2 format and created a video CD using the video data in the project. My role in the project was to 1) make some type of edited mpeg-1, mpeg-2 save, 2) Make a video CD, 3) divide and saving a file, 4) develop a gallery type webpage using XML.	

Learning Source

Research	Internet Site	Sponsor	Document
• C, C++, MFC, DirectX • Image Processing	A. www.fintek.co.kr B. viplab.hanyang.ac.kr	FINDTECH Research (S.Korea)	

Project 9 Output :

- **FINDTECH Solution**

	Main Output	Explanation
1	 	“Home Video Editor (i-CAM) Solution” 
2	 	• Left : Architecture of the system • Right : “Internet Video Indexing (i-VIBS) Solution”