

# Projects Undertaken

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## **1 The Impact of User Behaviour on the Interoperability of Wi-Fi hotspots and Packet Cellular Networks**

The rapid emergence of Wi-Fi hotspots that are aimed at providing broadband wireless access to users in and around places of commercial interest presents the unique problem of integrating the existing cellular networks with these. The traditional cellular networks have in-built mechanisms for billing, authentication, and resource allocation. However, the Wi-Fi hotspots provide the user with instant, inexpensive, and faster connectivity, and the user may prefer to connect to a locally installed Wi-Fi Access Point instead of the packet cellular network. In this project, an architecture that explores the interoperability issues between the hotspots and the traditional cellular network is studied. In the presence of multiple wireless networks with different access costs, different areas of coverage and bandwidth, the user's choice to select a particular network can significantly impact the user benefits and resource usages. Three major user profiles – cost conscious, bandwidth conscious and glitch conscious user profiles - were identified and their impact on resource utilization was studied through extensive GloMoSim simulations.

This work was done under the guidance of Professor C. Siva Ram Murthy, Department of Computer Science and Engineering, Indian Institute of Technology, Madras. A paper titled “The Interoperability of Wi-Fi Hotspots and Packet Cellular Networks and the Impact of User Behaviour” was submitted to ICC 2004, Paris on the basis of this project.

## **2 Policy Framework for Autonomic Data Management**

Extremely large amounts of data are generated and used by organizations today. Managing such vast repositories of data is no easy task and calls for a skilled Database Administrator (DBA). A big share of the operating costs of an organization goes into hiring the DBAs. In such a situation, autonomic management of the data is of great significance. In this project, an XML based framework was developed for defining data management policies in terms of real world objects. A graphical user interface implementing this framework in a user-friendly format was also developed. Thus a person with no experience in database administration can specify the database administration policies with ease.

This project was carried out during my summer internship at IBM India Research Laboratory, New Delhi under the guidance of Dr. Mukesh Mohania during May-July 2003. The

work has lead to a paper titled “Defining Data Administration and Operational Policies at the Business Object Level for E-Governance Applications” (to appear in the proceedings of the First International Conference on E-Governance, New Delhi, December 2003).

### **3 Protein Secondary Structure Prediction Using Artificial Neural Networks**

Proteins are the machinery of life. Deciphering the structure of proteins can help in the design of new drugs and medicines. The various experimental methods to determine the complex 3D structure of proteins are often very time-consuming and sometimes, even impossible. Therefore computers are used to predict the Secondary Structure of proteins. The Secondary Structure thus predicted can give insights into the 3D structure. Of the various methods used in Secondary Structure Prediction, Artificial Neural Network based predictors have proven to be the most effective. In this project, a Feed Forward Neural Network based Protein Secondary Structure predictor was implemented. A Jury of Networks is also used to improve the prediction efficacy. The various parameters affecting the network training and prediction are analyzed.

The predictor developed as part of this project participated in the CASP 5 Biannual International Protein Structure Prediction Contest. The predictor performed very well and obtained the highest accuracies for three protein sequences among all participants worldwide. An abstract of this work has been published in CASP 5 Method abstracts.

This work was carried out under the guidance of Professor Vidyasagar M., Executive Vice President, Tata Consultancy Services, as part of the Indian Academy of Science Summer Fellowships 2002.

### **4 RefKeep - A personal Bibliography Assistant**

RefKeep is An XML/JAVA based application which automates the storage and retrieval of research and reference material. It functions as an aid to researchers in organizing their research material in a efficient manner so that they are able to locate specific material with ease. Version 1 of this application is complete. Currently, the entire application is being reengineered to make it more flexible and efficient in execution.

This project is being carried out under the supervision of Dr. Deepak Khemani, Asst. Professor, Department of Computer Science and Engineering, Indian Institute of Technology, Madras.

### **5 Pascal Compiler**

- A compiler for the Pascal language was implemented as a part of the Language Translators course at IIT Madras. Lex and Yacc were used for lexical analysis and parsing. The main body of the compiler was coded in C++. Compilation errors were flagged with intelligent error messages. The output produced was a low-level C code which simulated the execution

of the compiled program. The compiler correctly compiled and executed the recursive quick sort program, which was used as a benchmark.

## **6 ConMan - A Generic Online Contest Management Framework**

Online contests have become very popular today. Developing the software to conduct an online contest is a time consuming task. In this project, we have developed a generic framework using which one can develop online contests with ease in a short span of time. Only the details specific to the contest have to be coded in compliance with the ConMan API. The framework handles the common tasks like user logins, client-server communication, scoreboards, logging and crash recovery automatically. Software to manage an online programming contest was developed to exemplify the use of the framework. The entire framework was coded in Java. This project was completed as part of the Software Engineering course at IIT Madras.

## **7 VoIP - A Comprehensive Study**

Voice over IP or VoIP is a fast emerging technology which provides cost effective telephony solutions. As against traditional PSTN networks, VoIP converts voice into suitably encoded digital packets and transmits those across existing IP based networks like the internet. Apart from simple voice-based telephone services, VoIP can provide advanced functionality like unified multimedia messaging, real-time data transfer and multi-party conferencing.

VoIP depends on many components audio/video codecs, VoIP protocols, IP servers, gateways and of course, the IP phones, to make this possible. G.711 and G.729 are popular audio codecs while H.323 and SIP are common VoIP protocols. All the various components of a VoIP system were studied in detail. The various methods to achieve Quality of Service were analysed in relation to VoIP.

This work was done as part of a term paper in the networks course at IIT Madras.

## **8 Mobile IP - Term Paper**

As part of the Mobile Computing course, I studied the various aspects of Mobile IPv6 and compared it with the mobility support of IPv4. Some problems with mobile IPv6 were also identified and solutions were attempted.

## **9 IJVM processor**

The IJVM is a Java Virtual Machine capable of processing integer instructions. The IJVM was coded in Verilog. The implementation was tested by running sample programs written

in the IJVM instruction set and converted to IJVM assembly code by a simple translator. This work was done as part of the course CAD for VLSI Design.

## **10 Superscalar processor**

In this project, we are attempting to design and implement a scaled-down version of a super scalar processor. The processor will support 4 instructions per clock cycle and will have branch prediction, out of order issue and multiple execute units. This is a group project involving 15 students of the Computer System Design Course. I share the responsibility of coordinating the activities of project along with a friend.

## **11 File Compression Schemes**

Different file compression schemes were studied as part of the Algorithms course. I implemented a compression program which used the LZW algorithm followed by a Huffman encoding of the output. This program gave good compression ratios when compared with the Linux gzip program on different types of input files.

## **12 Route Finding using A\* Algorithm**

This project, done as part of the course in Artificial Intelligence, involved building a system to find the shortest route between two places on a map using the A\* algorithm. A GUI to construct the maps as well as to animate the functioning of the algorithm was built.

## **13 File Transfer Protocol**

As part of the Computer Networks course, I implemented a multi-threaded FTP server and client.