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Letter of Intent
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Advanced Network Modelling Facility

Researchers

Project Leader:

Joseph Peters, Professor, School of Computing Science

Principal Co-Investigators:

Luis Goddyn, Associate Professor, Department of Mathematics
Qianping Gu, Associate Professor, School of Computing Science
Steve Hardy, Professor, School of Engineering Science
Tiko Kameda, Professor, School of Computing Science
Arthur Liestman, Professor, School of Computing Science
Ljiljana Trajkovic, Associate Professor, School of Engineering Science

Affiliated Faculty:

Lou Hafer, Associate Professor, School of Computing Science
Russell Tront, Senior Lecturer, School of Computing Science
Edward Lo, Lecturer, University College of the Fraser Valley

Description of Proposed Infrastructure

The proposed infrastructure is a facility for the design, modelling, development, and testing of network protocols. The central facility will consist of eight Linux workstations and a Linux file server interconnected by a high-speed optical network with optical switching. Wireless technology will be used to communicate between the central facility and an ad hoc network of 16 wireless Linux workstations equipped with Bluetooth chipsets. This hybrid optical-wireless network will use a high-speed optical link to connect to the ACS backbone. An Adtech AX4000 will be used for traffic generation and measurement. The facility will be located in a new building. (Need to estimate space requirements.)

Funding:

A very rough guess at the cost is $1M to $1.5M. Applications will be made to both CFI and BC KDF for 40% each. The remaining 20% of the funding will be cash or in kind contributions from industrial partners. Potential partners include Telus, PMC Sierra, Motorola, Agilent, Shaw Cablesystems, HP, Nortel Networks, and BNR. None of these potential partners has been contacted at this point but several of them have supported other recent SFU initiatives with cash or equipment donations. (Need to get quotes for equipment.)

Summary of Research Projects

Ad Hoc Networks

Recent advances in computing, wireless technology and self organizing systems has sparked a surge of interest in the development of practical multi hop ad hoc networks. Efficient and scalable routing protocols remain an open issue, particularly to achieve reliable multicast and quality of service. An important and expanding area of current research is on the exploitation of the natural clustering that tends to occur in many real world networks, as this clustering can be used to provide hierarchy and thus simplify network connectivity and structure. Wireless devices using Bluetooth chipsets are just now reaching the market in volume production, and costs are in decline. Although these devices are single hop ad hoc network capable and have protocol hooks to support extension to multi hop networks, Bluetooth multi hop networks are not currently available (for lack of practical routing protocols). This presents an opportunity to establish a reasonably large scale ad hoc network test bed relatively economically. Test beds are extremely valuable to support and validate simulation work. To date there have been very few ad hoc network test beds, and we are not aware of any large scale test beds within the university research groups. The multi hop ad hoc network test bed at Carnegie Mellon University had only 7 nodes. (Need to make this paragraph shorter and then expand it again later in the application process.)

MPLS for IPV6

The current version of the Internet Protocol IPv4 has been in use for nearly two decades and has nearly reached its limits because of the explosive growth in demand for IP addresses. The world has started to migrate to the next generation protocol, IPv6, even as development continues. The migration to IPv6 complicates an already complicated internet environment which includes IPv4, IPX, Appletalk, and other layer 3 protocols which can be running on top of any type of layer 2 carrier network technology including ATM, Ethernet, Frame Relay, and PPP. Multiprotocol Label Switching (MPLS) uses label switching instead of network address lookup in backbone networks to allow all combinations of layer 2 technologies and layer 3 protocols. The proposed hybrid optical/wireless facility would be an excellent test bed for the development and testing of MPLS with new protocols including IPv6. (Need to modify this paragraph to explain why we want Linux workstations to study MPLS.)

Modelling of Networks and Protocols

Members of this research team specialize in the modelling and analysis of network communications. The base of expertise is broad and includes experimental methodology (Trajkovic, Hardy), simulation (Trajkovic, Peters), discete modelling (Liestman, Gu, Goddyn, Kameda, Peters), and analytic modelling (Trajkovic, Kameda, Peters). Graduate student members of the Network Modelling Group (current more than 20 students) have even broader interests.

Optical Switching

We need a paragraph about optical networks to justify our request for optical switches and interconnectivity.

Capacity for Innovation

There are three main approaches to the modelling and performance evaluation of networks: measurement, simulation, and mathematical modelling. A good performance evaluation expert is well-versed in at least two approaches and preferably three, but few know more than one approach well. At SFU, there is existing expertise in all three areas, but there is little infrastructure to support the experimental and simulation studies. The proposed facility, combined with existing strengths would create a centre of expertise which would be unique in B.C. (Need to check what is available elsewhere in the Canada and the world.)

The proposed facility would be used to train researchers at the graduate level in the area of network modelling and performance evaluation. SFU already has a highly successful facility for training network managers at the undergraduate level. Students who complete CMPT 471 are immediately employable as network managers. This facility is unique in B.C. There is no facility for training highly qualified personnel at the graduate level. The proposed facility would enhance the existing expertise with a state-of-the-art training facility.

The Communication Networks Laboratory, headed by Ljiljana Trajkovic, specializes in the analysis of traffic traces using a combination of experiments and simulations to determine loss rates, buffer utilization, and other properties. The hardware in the lab includes three ATM switches, 13 workstations, and network interconnectivity. This hardware would complement the proposed facility by adding a third technology - ATM - to the proposed optical and wireless technologies.

The main purpose of the facility will be to study networks and communication. The facility will also provide high performance computing to other groups at SFU and throughout Canada (via the high-speed optical link). The presence of a user community for the facility has the added advantage of providing a source of traffic for study.