Progress Report

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1. Aim and Objectives

Generally speaking, my research mainly focuses on the design and analysis of algorithms such as network routing algorithms, approximation algorithms and scheduling algorithms.

The objective of my study and research for my PhD education is to design a set of routing protocols for a large-scale hybrid network. To be specific, I aim to build up some QoS routing algorithms for the Mobile Ad hoc Networks (MANET) and Optical Networks. I believe that Optical Networks will be the major backbone and MANET will be the leaves for the future networks. Optical networks offers the capability of building very large wide-area networks with throughputs on the order of gigabits per second for each node, while MANET can be rapidly deployed without relying on pre-existing fixed network infrastructure. If we can combine these two technologies in perfect harmony, then we can get the merits of both: High speed, flexibility and adaptability.

I have finished the first phase of my work, which is the topic of Video on Demand. Algorithms have been designed and implemented. Several papers have been published or submitted.

2. Idea and Approach

- To conduct a comprehensive study of hybrid MANET and optical networks architecture, find some intrinsic problems and basic design rules through detailed comparison.
- To set up a component model for hybrid system and try constructing a coarse framework to reveal some common concerns in a designing process, then elaborately analyse the routing model in such kind of hybrid system.
- To develop techniques that are efficient, scalable and fault-tolerant for routing issues in the hybrid system.
- To propose effective queuing and scheduling schemes for interfaces between Optical Nets and MANETS.

The following are the major techniques we will use to develop a hybrid network routing scheme which should be efficient, flexible, scalable and fault-tolerant:

- Dynamic scheduling for traffic smoothing.
- Multi-path solutions for fault-tolerant routing.
- Online queuing techniques for traffic engineering.
- Approximation algorithms design for queuing, scheduling and routing.
- The hybrid optical switching (HOS) approach that combines OCS and optical burst switching (OBS).
- Simulation models using the Objective Modular Network Testbed in C++ (OMNeT++) package.

3. The Progress In the Past Year

- The first phase of my work has been finished, which is the topic of Video on Demand. Algorithms have been designed and implemented. Several papers have been published or submitted.
- The framework of a routing protocol for the Mobile Ad hoc Networks has been designed.
- The core problems of the Routing Process and the Queuing Process in Optical Networks have been carefully reviewed.
- The simulation platforms such as NS2, OMNET++ and JSIT have been studied and constructed.

4. Future directions

- To extend the Video on Demand problem to the MANET environment.
- To build a simulation project for my routing protocol for the Mobile Ad hoc Networks. Then measure the performance of this protocol and improve on it. Several publications to be expected.
- The design and test a Routing Protocol for Optical Networks, both Unicast and Multicast.
- After that, I will try to join both protocols together to form a hybrid routing framework; the characteristics, functions and performance of the joint nodes will be exhaustively studied.
- Approximation Algorithms or Randomised Algorithms for Queuing problems will be used.

5. Papers

1. Chao Peng, Hong Shen, "Model-based estimation of 3D human motion", *The 3rd International Conference on Grid and Cooperative Computing*, LNCS 3251, Oct. 21-24, 2004 in Wuhan, PRC.
2. Chao Peng, Hong Shen, "Storage-aware Harmonic Broadcasting Protocol for Video-on-Demand", *The Fifth International Conference on Parallel and Distributed Computing, Applications and Technologies*, LNCS 3320, December 8-10, 2004, Singapore
3. Chao Peng, Hong Shen, "Discrete Broadcasting Protocol for Video-on-Demand," *Submitted to the IEEE Transactions On Broadcasting*.
4. Chao Peng, Hong Shen, "The BEE Routing Protocol for Mobile Ad Hoc Networks", *To be submitted*.