Analysis of Quality of Service Routing Algorithms

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ABSTRACT

The routing problems can be divided into two major classes. They are 1) Unicast routing and 2) Multicast routing. The Unicast routing problem is as follows. Given a source node sr, a destination node dn, a set of QoS constraints qc and an optimization goal (optional), find the best feasible path from sr to dn, which satisfies qc. The Multicast routing problem is as follows. Given a source node sr, a set of destination nodes, a set of constraints cts and an optimization goal (optional), find the best feasible path covering sr and all nodes in st, which satisfies cts. This article presents two such Unicast QoS based algorithms called as Source Routing and the proposed Heuristic Routing. A Client Server based model has been generated to study the performance of the two algorithms with respect to the message overhead, response time and path delay. The Experiments and the results are analyzed. [Article copies are available for purchase from InfoSci-on-Demand.com]

Keywords: Bandwidth; Path; Routing; QoS

INTRODUCTION AND RELATED WORK

The Internet Community today needs multimedia communication than the traditional, well known Internet Protocol (IP) infrastructure. IP has proven to be very effective since no privileged service classes are considered, but it is not adequate for the introduction of “Quality of Service” (QoS). QoS communications on the internet are high speed connections and the goal of QoS routing is to find routes that satisfy the requirements of individual flows and to provide quality multimedia communications.

In Computer communication networks, data packets are forwarded between different nodes. Multiple paths may exist from the start node to the destination node. Due to the different qualities of links and traffic load variations, different paths may have different performance related Quality of Service properties, such as delay, response time, overhead, etc. Finding a path that satisfies some given QoS constraints is the base of QoS routing (Chen & Nahrstedt,
The routing problems can be divided into two major classes. They are 1. unicast routing and 2. multicast routing. The unicast routing problem is as follows. Given a source node sr, a destination node dn, a set of QoS constraints qc and an optimization goal (optional), find the best feasible path from sr to dn, which satisfies qc (Zheng, Tian, Liu, & Dou, 2004. (Koundinya, Negi, & Sastry, 2004). The multicast routing problem is as follows (Yuan & Liu, 2001; Moen, & Pullen, 2005; Moen, Pullen, & Zhao, 2004; Simon, & Pullen, 2003; Moen & Pullen, 2003). Given a source node sr, a set st of destination nodes, a set of constraints cts and an optimization goal (optional), find the best feasible path covering sr and all nodes in st, which satisfies cts.

This article presents two such unicast QoS based algorithms called as Source Routing and the proposed Heuristic Routing. A Client Server based model has been generated to study the performance of the two algorithms with respect to the message overhead, response time and path delay. The Experiments and the results are analyzed.

**SOURCE ROUTING**

Source routing is a method of transferring a packet through a network in which the path is already determined by the source. The information about the packet is stored in the packet itself in source routing. Whenever a packet arrives at a switching device, the decision to forward it to the next node is not needed since they are all stored in the packet itself. The device simply looks at the packet header in the packet in order to determine the port on which it should forward the packet. Source routing denotes that the source knows about the topology of the network, and hence can specify a path (Ye Tian, 2002).

**HEURISTIC ROUTING**

Heuristic routing is a Routing method in which the data, such as path delay, response time and message overhead, extracted from incoming packets during specific time intervals and with different loads are used to determine the optimum routing for transmitting data back to the source. A heuristic routing scheme called as the Label Based Probing is proposed in this work (Yuan & Liu, 2001; Kweon & Shin, 1999; Chen & Nahrstedt, 1998).

In this routing, the source is not expected to have all the information about how to get from the source to the destination. It is sufficient for the source to know only about how to get to the next node, and so on until the destination is reached. The processing in the nodes in between the source and the destination in this case is more complicated. It has only the address of the destination rather than a complete specification of the route by the source node.

The working of the Label based distributed routing algorithm is as follows. When a connection request arrives at the source node, a certain number of “l” labels are generated and a probe packet with the “l” labels is sent to the destination in search of paths that satisfy the QoS constraints. Each probe packet carries one or more labels. Whenever an intermediate node receives a probe packet, it does the following. It searches the routing table and finds the next node that can establish connections for the request. Then it calculates the number of labels to be distributed for each of the next nodes, and finally sends a probe packet with the labels to each of the next nodes. A probe fails if there is no outgoing link that can satisfy the QoS requirement. When a probe packet reaches the destination, a path that can satisfy the QoS requirement is found. The algorithm controls the messaging overhead by manipulating the number of labels. Since intermediate nodes only distribute the labels but not generate any new labels, the maximum number of probe packets at any time is bounded by number of labels. Since each probe packet probes a path,
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