Connectionless ATM Using an ATM Switch Router

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Abstract. Short message exchange capability is required for control plane operations of several applications in ATM networks, such as multimedia networking, Intelligent Network-based services, and to support mobility in wireless ATM networks. Existing methods to transport such messages between ATM nodes typically suffer from the disadvantages of excessive management complexity (for provisioned virtual circuits), and/or of incurring large latencies (for switched virtual circuits). In this paper, we propose a new method for connectionless transport in ATM networks using the routing data that is present in all ATM switches. The “connectionless-ATM (CL-ATM)” transport technique encapsulates messages into CL-ATM packets containing the source and destination ATM end system addresses in their header. By adding a CL-ATM packet forwarding module, ATM switches can be upgraded to “ATM switch routers” enabling them to support both connection-oriented and connectionless transport modes. Routing data collected by the PNNI (Private Network-Network Interface) routing protocol is used to route datagram packets from one ATM switch router to the next. Since the proposed solution defines a generic network-layer connectionless protocol that can be used to transport datagrams generated by any application, it can also be used for IP-over-ATM transport.

1 Introduction

We have identified several applications that have a strong need to route datagram messages between entities in ATM networks. These include control-plane operations to support multimedia networking, such as communication between endpoints to check application-layer compatibility before a call is setup, queries from endpoints to name or directory servers, third-party connection setup requests, as well as other applications, such as Intelligent Network (IN)-based services, and the support of mobile users in wireless ATM networks. The current methods that exist for transporting datagrams in ATM networks suffer from the disadvantages that they either involve significant latencies caused by the setup of Switched Virtual Circuits (SVCs), or they increase management complexity by requiring Provisioned Virtual Circuits (PVCs). This leads us to the observation that a simple mechanism that does not suffer from these disadvantages will be required for connectionless transport in ATM networks. To achieve the desired low latencies for messages, an efficient mechanism for connectionless transport in ATM networks, called Connectionless ATM (CL-ATM), is proposed. The information collected by the Private Network-Network Interface (PNNI) routing protocol [1], currently used for connection setups, will also be used to route CL-ATM datagram packets. The CL-ATM network-layer protocol itself can be based on the IP protocol with the exception that ATM end system addresses are used in packet headers instead of IP addresses, or it can be based on ISO CLNP (ConnectionLess Network Protocol) [2], which is a data-
gram protocol that uses NSAP (Network Service Access Point) addresses whose address format is the basis for ATM end system addresses. CL-ATM is proposed as a complementary solution to the current connection-oriented transport mode defined for ATM networks. ATM switches can be upgraded to ATM switch routers by adding a CL-ATM packet forwarding module. Thus, ATM switch routers support both connection-oriented and connectionless transport modes.

We first describe applications motivating the need for supporting connectionless transport in ATM networks (Section 2). In Section 3, we describe existing "potential" solutions for handling datagrams in an ATM network. Before presenting our proposed solution, i.e., the CL-ATM (Connectionless ATM) network-layer protocol and its use in ATM switch routers, we provide the reader relevant background information in Section 4. Our proposal is described in Section 5. Finally, Section 6 summarizes this paper.

2 Motivating Applications

The need for efficient transport of connectionless traffic is evident in several native-mode applications in ATM networks where short message exchanges are required between network entities. Examples of such applications, which we describe below, include:

- Multimedia networking
- Intelligent Network (IN)-based services, and
- Mobile location in wireless ATM networks.

2.1 Multimedia networking

Multimedia networking creates a need to interconnect endpoints with vastly differing capabilities. A variety of multimedia end equipment has emerged in order to meet the growing demand for multimedia services. Consider, for example, video services. Video data may be stored in the MPEG-2 format but played out on an end device that only supports the NTSC format. Such examples indicate the need for application-aware routing of connections. The network needs to know the types of application-layer interfaces at the two ends of the communication in order to select an appropriate converter through which such communication can be accomplished.

A second need for application-aware routing occurs in conferencing applications, where multiple endpoints participate in a communication session. Such a session can be realized using multiparty-to-multiparty network-layer connections without requiring the use of an application-aware network node, such as a bridge [3]. However, there are trade-offs in such a realization when compared to a communication configuration in which multiple network-layer connections are routed through an application-layer resource, such as a bridge. We expect that conferencing sessions will be realized using both these approaches.

In [3], we described the detailed steps for setting up communication involving one or more application-layer resources, such as converters or bridges, as shown in Fig. 1. We refer to communication configurations that involve application-layer resources as