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A distributed multicast tree using share link migration scheme for wireless asynchronous transfer mode network

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Abstract

In recent years, wireless asynchronous transfer mode networks have become popular and are in widespread use for supporting various types of data transmission. To minimize the cost in setting up routes and to meet the QoS constraint in time-sensitive traffic, in addition to bandwidth capacity, this paper focuses on the optimization of the number of shared links to reduce the call-blocking rate and the handoff failure rate for intercell roaming. The average longest path length and the average of the average path length of the constructed multicast trees are shown to be stable when the network load becomes heavy.

Keywords: Asynchronous transfer mode; Multicast; Migration; Wireless; Handoff

1. Introduction

Integrating multicasting and mobility into internet architectures has become more and more popular [1,2]. Paired with the rapid developments in asynchronous transfer mode (ATM) networking technology, the rise of wireless communications signals the start of a new era in telecommunications. In this era, not only will users need higher bandwidth; they will also demand mobility. A typical future wireless user may be carrying a hand-held computer (PDA) with audio

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and video conferencing capabilities and may demand high-speed data communication on the order of 10 megabits per second or higher. A wireless ATM network, which is designed to provide isochronous and asynchronous high speed communications for wireless users, is a good match for these demands.

The wireless ATM network consists of base stations (BS), mobiles, and network interface equipments. A BS may contain several radio ports to support mobile users. A group of mobile users is connected to the same wireless ATM network interface equipment. This collection of mobiles is called a cell. The cell architecture is shown in Fig. 1. A mobile user might have a few simultaneous connections in the wireless ATM network. When a handoff occurs, these connections may need to be re-routed.

Handoff is an important function of the network where users are mobile and is implemented by the network to give the users freedom of motion beyond a limited wireless coverage area while they are communicating. The handoff is the procedure by which a user's radio link is transferred from one radio port to another through the network without an interruption to the user connection. We can divide the handoff event into two levels. One is the network level and the other is the radio level. The radio level handoff is the actual transfer of the radio link between two ports. The network level handoff supports the radio level handoff by performing re-routing and buffering. Some of the procedures used in the network level handoff are determined by the radio level handoff. There is a cell manager for control and management within each cell. We assume that the cell managers have some knowledge about the neighboring cells and the network addresses of neighboring cells are stored in a local lookup table and it is updated periodically by means of an update protocol. We also assume that these cells are interconnected by wireless ATM network switching nodes. According to these concepts, we investigated the handoff using two different situations: intracell handoff (Fig. 2) and intercell handoff (Fig. 3). In the intracell handoff, the user

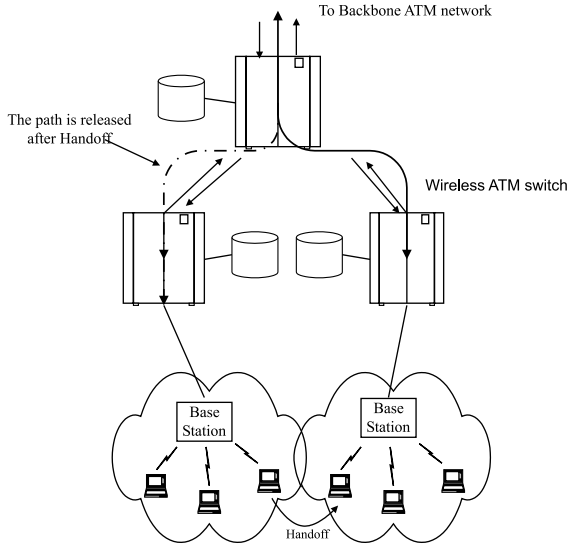

Fig. 1. A cell architecture in wireless ATM network.

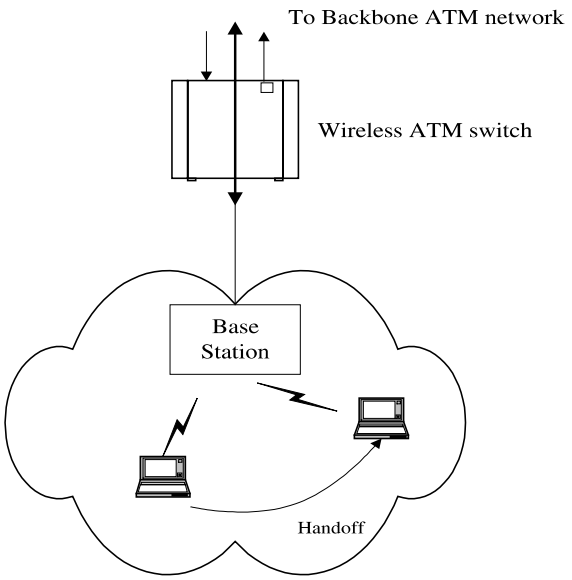

Fig. 2. Intracell handoff.

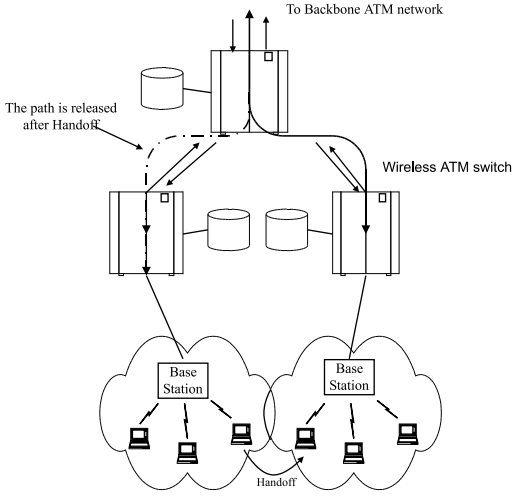

Fig. 3. Intercell handoff.

is roaming within the cell. The only routing/re-routing performed is in the wireless ATM network interface equipment within the cell. The cell manager in the BS is responsible for the correct update of ATM virtual circuit translation tables within the cell. This type of routing/re-routing does not require wide area ATM network switching. The intercell handoff takes place when the mobiles roam into a different cell. In this case, the routing/re-routing involves the wireless ATM network. An intercell handoff might require one or more wireless ATM switches, depending on the handoff location and topology of the network.