Chapter 3.28
Bluetooth Scatternet Using an Ad Hoc Bridge Node Routing Protocol for Outdoor Distance Education

Yao-Chung Chang
National Dong Hwa University, Taiwan, ROC

Han-Chieh Chao
National Dong Hwa University, Taiwan, ROC

Jiann-Liang Chen
National Dong Hwa University, Taiwan, ROC

ABSTRACT

In recent years, the prevalence of Internet and wireless technology has promoted mobile communications as a major research area. For future distance education purposes (Instructional Technology Council), to be able to access course materials anytime/anywhere will become a key issue, especially when students are not in the classroom, but are within a museum or a field investigation process; using an Ad hoc mechanism to access the real-time brief or introduction can definitely improve their learning interests greatly. One of the topics is IEEE802.11, which includes the Wireless LAN and Mobile Ad hoc Network (MANET) infrastructure (Perkins, 2000). MANET has no fixed infrastructure, but is capable of dynamic changing network architectures, such as PDAs, cellular phones, and mobile computers. Bluetooth (The Official Bluetooth SIG) possesses a smaller radio range, low power, and low costs. The Bluetooth Scatternet is a specific case of MANET (IETF MANET Working Group). In this paper we propose a Bridge Node Routing Protocol (BNRP) based on a revised Distributed Topology Construction Protocol (DTCP), into which a shortcut mechanism is added for better performance. The BNRP uses bridge nodes to preserve effective transmissions and achieve better Bluetooth Scatternet performance, and it can apply for outdoor distance education environment anytime and anywhere.

BLUETOOTH SCATTERNET AND MANET

Distance Education

The process of extending learning, or delivering instructional resource-sharing opportunities, to locations away from a classroom, building, or site, to another classroom, building, or site by using video, audio, computer, multimedia communications, or some combination of these with other traditional delivery methods. - Defined by ICT (Instructional Telecommunications Council)

Hence, distance education is growing, and more and more schools are using distance learning to assist teachers and students in study. Distance education can be divided into synchronous and asynchronous by time; video, radio, and data by teaching mediums. Several kinds of distance education are shown in Table 1.

For future distance education purposes, to be able to access course materials anytime and anywhere will become a key issue. One scenario is that when the teacher is outdoors teaching with his notebook, all other students are using PDAs or mobile devices to access the materials from teacher's notebook. This kind of scenario extends the usage of distance education, especially when students are out of the classroom and within a museum or a field investigation process. Using the Ad hoc mechanism of MANET to access the real-time brief or introduction can definitely improve their learning interests greatly.

Table 1. Classifications of Distance Education

	Synchronous	Asynchronous
Video	Videoconferencing	Videotape, Broadcast video
Radio	Audio-conferencing	Audiotape, Radio
Data	Internet chat, Desktop videoconferencing, Web	E-mail, CD-ROM, Web

Bluetooth Scatternet and MANET

Bluetooth Scatternet is the specific case of MANET. Bluetooth Scatternet is associated with several Piconets; each Master Node of Piconets coordinates all communication in its Piconet. Two Bluetooth devices must be formed, a Master-Slave pair to connect each other; this is quite different from the MANET connection operations.

Figure 1 shows the difference between three network architectures: Infrastructure Mobile Network, Ad hoc Mobile Network, and Bluetooth Scatternet.

The main property of Bluetooth is its low-cost and low-power radio transceiver. The goal of Bluetooth is to replace cable connection between electrical equipments and provide short-range communication in the Personal Area Network (IEEE 802.15 Working Group for WPANsTM). Therefore, the conventional routing protocols designed on MANET are not suitable for Bluetooth Scatternet environment. Because of the variable characteristics of the Scatternet architecture, the ability of routing information maintenance and repair are the main concerns to design the routing protocol. How to choose the role of a node and the bridge node in Bluetooth Scattetnet is the key point for developing routing protocol. The next section will introduce three relative research papers about routing in Bluetooth Scatternet. Presentation of a routing protocol (BNRP) based on the DTCP follows, along with discussion about the simulation and analysis of BRNP and MANET style routing protocols. The final section concludes this chapter and points out future work.

RELATIVE RESEARCH

We will introduce three papers about Bluetooth Scatternet in this chapter.