Advanced Science and Technology Letters
Vol.28 (CIA 2013), pp.121-125
http://dx.doi.org/10.14257/astl.2013.28.23

Multi-helper Relay Based WUSB/DRD/WLP Protocol in WiMedia Distributed MAC Systems

Seong Ro Lee[1], Seung Beom Lee[2], Seongmin Jeon[3], Rajeev Piyare[4], Kyeong Ho Kim[5]

[1,2,3,4,5]Mokpo Univ., Korea
[1]srlee@mokpo.ac.kr, [2]rikioh75@gmail.com, [4]rajeev.piyare@hotmail.com, [5]kch@mokpo.ac.kr

Abstract. In this paper, we propose a cooperative protocol of relay-based WUSB/DRD and WLP device in the WSS of WiMedia environment. For this, we investigate a RNT table configuration and algorithm of RNS relay node to be used in relay-based cooperative communication. Then, we describe the feature of the device to configure the WLP network and propose a cooperative protocol for WUSB/DRD/WLP device communication. The proposed cooperative protocol can communicate with WUSB/DRD/WLP devices by using the standard DRP reservation and WUSB DRP reservation.

Keywords: WiMedia, WUSB(Wireless USB), WLP(WiMedia logical link control protocol), relay-based cooperative communication

1 Introduction

In recent years, the demand for multimedia services of high quality in a wireless home network environment is growing gradually. WiMedia Alliance [1], more than 170 companies gathered, announced the standard of WiMedia D-MAC(Distributed-MAC) to allow a physical layer based on UWB(Ultra Wide Band) and a variety of applications such as wireless USB, wireless 1394, wireless IP, and Bluetooth. WiMedia D-MAC support the distributed media access method [2].

Relay transmission can improve the throughput and reduce energy consumption in the multi-rate wireless network. This is because it can be reduced the transmission time to execute relay transmission via high speed link compared with the case of transmitting directly through slow links.

UWB WiMedia devices can coexist with the wireless USB network in the same radio environment depending on the application. And communication between these networks is required in some cases. For this reason, WiMedia alliance defined a standard of WLP(WiMedia logical link control protocol) that specifies the requirements and frame format for transferring packets of network layer to the WiMedia radio platform [3].

In this paper, we propose a cooperative protocol of relay-based WUSB/DRD [4] and WLP device in the WSS of WiMedia environment. For this, we investigate a RNT table configuration and algorithm of RNS relay node to be used in relay-based

ISSN: 2287-1233 ASTL

cooperative communication. Then, we describe the feature of the device to configure the WLP network and propose a cooperative protocol for WUSB/DRD/WLP device communication.

2 Design of DRP resource reservation cooperative protocol of WUSB/DRD/WLP

The process of standard DRP reservation negotiation [2] and WUSB DRP reservation negotiation [4] are explained on each protocol, but a cooperative protocol such as WUSB/DRD/WLP has never been defined.

In the WLP protocol, client devices in the same WSS and other protocol device by using client bridge can exchange the frames. That is, if WUSB/DRD and WLP device are the same in WSS, they can communicate by using the client bridge and client device. When they are in different networks, use of the remote bridge solves the problem to communicate. The process of DRP reservation negotiation can be described in the course of the DRP reservation negotiation for WUSB/DRD/WLP using WLP protocol shown in Fig. 1.

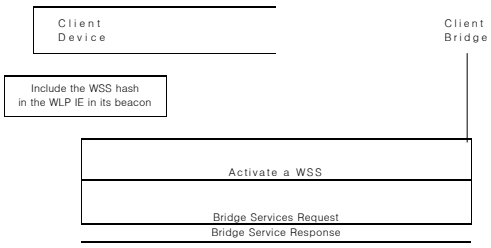
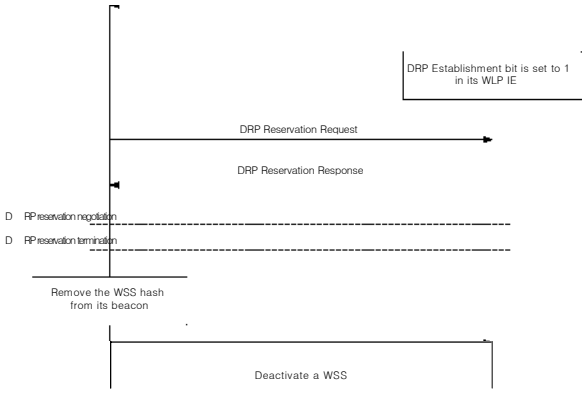


Fig. 1. The proposed DRP reservation negotiation of WUSB/DRD/WLP



It is possible to communicate using client devices and the client bridge when WUSB/DRD and WLP device are the same WSS. In order to enable connection to other devices in a WSS, a device must activate the WSS. Prior to activating a WSS, a device must be enrolled in the WSS. To activate a WSS, a device has to include the WSS hash in the WLP IE in its beacon in each superframe. A device may deactivate a WSS by removing the WSS hash from its beacon. In order to enroll in an existing WSS, a device must first discover the existence of another device accepting enrollment for that WSS. A device may use the D1 and D2 frame exchange to discover information about a WSS advertised in a neighbor's WLP IE. During discovery and a subsequent enrollment session, a device that is already enrolled in an existing WSS is referred to as a registrar, and a device seeking to enroll in the WSS is referred to as an enrollee. These roles are temporary and last only for the duration of the enrollment session. A device shall be capable of acting as a registrar. A device shall be capable of acting as an enrollee. To check the WSS properties of a WSS activated by a neighbor, a device sends a D1 association frame to the neighbor. A device does not send a D1 frame to a neighbor unless the Discoverable bit is set to one in the latest WLP IE received from the neighbor. A device that receives a D1 association frame responds with a D2 association frame that contains device information and WSS information, or an F0 association frame that indicates why the discovery request is not accepted or WSS information is not available.

A device may request a bridge to forward frames to or from other nodes by sending a Bridge Services Request control frame to the bridge. A device may also transmit a Bridge Services Request control frame to update protocol or multicast forwarding filters, or to terminate the bridge services requested. Each time a bridge receives a Bridge Services Request control frame from a device, it discards any information retained from previous requests from that device, and use only the information contained in the received request. When a bridge receives a Bridge Services Request control frame, it responds with a Bridge Services Response control frame.

A client device may request a client bridge with which it has enabled bridge services to establish a DRP reservation for traffic addressed to the client device if the bridge indicates support for DRP establishment in its WLP IE. A bridge that supports DRP establishment and receives a DRP Reservation Request control frame establishes a reservation according to the TSPEC field included in the frame, if possible, and report the result in a DRP Reservation Response control frame. The client device establishes a DRP reservation when receiving the response. And if communication between devices is terminated or DRP reservation is completed, the client device deactivates a WSS by removing the WSS hash from its beacon.

3 Simulation Result and Discussion

For performance analysis of RNS relay DRP method, we consider the ns-2 simulation environment [5]. Assume randomly distributed devices within 10m x10m and 2048 byte size of packet forwarding. Fig. 2 shows the change of performance according to the number of nodes. The Simulation shows that the relay DRP is superior to existing DRP method. With the increase in number of nodes, it shows a better performance. In

the case that the number of nodes is increased and failure occurs in the communication between the nodes with the channel condition, it is expected that running the relay transmission through the relay DRP improves the throughput of transmission between the nodes.

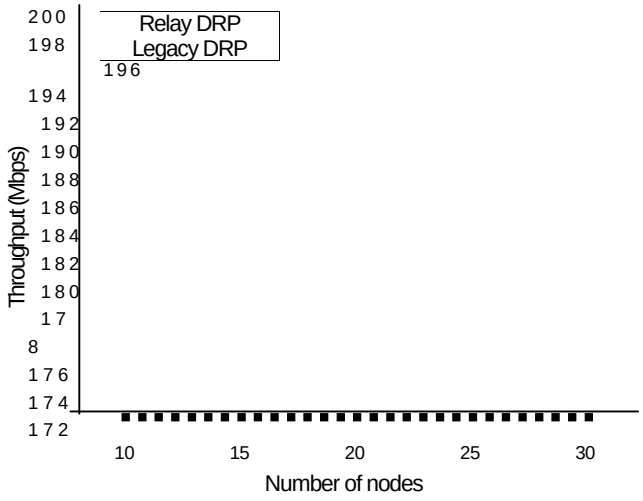


Fig. 2. RNS throughput according to the number of nodes

4 Conclusion

In this paper, We proposed a cooperative protocol of relay-based WUSB/DRD and WLP devices in a WSS of WiMedia environment. The proposed cooperative protocol can communicate with WUSB/DRD/WLP devices by using the standard DRP reservation and WUSB DRP reservation. We did relay transmission in UWB-based WiMedia using the proposed protocol. And it was confirmed through performance analysis that it is possible to improve the throughput and reduce energy consumption.

Acknowledgement. "This research was supported by the MSIP(Ministry of Science, ICT and Future Planning), Korea, under the C-ITRC(Convergence Information Technology Research Center) support program (NIPA-2013-H0401-13-2006) supervised by the NIPA(National IT Industry Promotion Agency)", "This work was supported by the National Research Foundation of Korea(NRF) funded by the Ministry of Education(No.2011-0029321).

References

1. WiMedia Alliance, http://www.wimedia.org
2. WiMedia MAC Release Spec. 1.5: Distributed Medium Access Control (MAC) for Wireless Networks (2009)
3. WiMedia:, WiMedia Logical Link Control Protocol (WLP). WiMedia WLP Specification Draft 1.0 (2007)
4. Wireless USB Key Developers technical working groups: Wireless Universal Serial Bus Specification, Revision 1.1 (2010)
5. The network simulator ns-2, http://www.isi.edu/nsnam/ns