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eXtend collection tree protocol

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Abstract:

In this work, we propose eXtend Collection Tree Protocol (XCTP), a routing protocol that is an extension of the Collection Tree Protocol (CTP). CTP is the de-facto standard collection routing protocol for Wireless Sensor Network (WSN). CTP creates a routing tree to transfer data from one or more sensors to a root (sink) node. But, CTP does not create the reverse path between the root node and sensor nodes. This reverse path is important, for example, for feedback commands or acknowledgment packets. XCTP enables communication in both ways: root to node and node to root. XCTP accomplishes this task by exploring the CTP control plane packets. XCTP requires low storage states and very low additional overhead in packets. With the reverse path, it is possible to implement reliable transport layer protocols for Wireless Sensor Network (WSN). Thus, we designed Transport Automatic Piggyback Protocol (TAP2), a transport protocol with Automatic Repeat-reQuest (ARQ) error-control on top of XCTP. We implemented these protocols on TinyOS and evaluated on TOSSIM. We compared XCTP with CTP, Routing Protocol for low-power and lossy networks (RPL), and Ad hoc On Demand Distance Vector (AODV) protocols. We conducted scalability and stress tests, evaluating them with different loads and number of nodes. Our results shows that XCTP is more reliable than CTP, delivering 100% of the packets. XCTP

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sends fewer control packets than RPL. XCTP is faster to recovery from network failures and also stores fewer states than AODV, thus being efficient and agile.

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I. Introduction

Wireless Sensor Networks (WSNs) are composed of a large number of nodes with sensing, computation, and wireless communication capability. These networks have computing and communication energy constraints. Many applications in WSN need to transport large amount of data (image, audio, video monitoring). These applications are not tolerant to data loss, thus it is important to provide mechanisms to reliable collect data.

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