TCP Vs UDP FOR DISTRIBUTED REAL-TIME APPLICATIONS: A PRACTICAL APPROACH

T. VIJAYANANDA, L. SAMARANAYAKE AND S. ALAHAKOON

Department of Electrical and Electronic Engineering, Faculty of Engineering, University of Peradeniya.

Vast attentions have been paid both in the industry and academia on IP based Ethernet networks for distributed real-time applications mainly due to cost, compatibility and maintainability reasons. The controller in a distributed real-time system has access to the network through the network interface card of the computer in which it is implemented. However, the object to be controlled (Brushless DC motor (BLDC) in this case) must be provided with network connectivity by external means, which interfaces the object to the network. Development of such an Ethernet Ready Sensor Actuator (ERSA) module at a locally affordable cost using local engineering skills and technology is presented in the first half of the paper.

The completed ERSA hardware module is capable of completing one analog to digital conversion of the sensor measurement and a digital to analog conversion of the received control input needed for a single actuation cycle within 1 ms. Further it supports changing sampling frequency, type of protocol, actuating mode i.e., time triggered or event triggered.

In the second half, the ERSA module is used in a 10/100 Mbps Switched Ethernet network to control the speed of a 3000rpm inverter fed BLDC motor. Connection oriented, reliable Transport Control Protocol (TCP) and connectionless best effort User Datagram Protocol (UDP) have been used in the network layer. A comparative study is carried out on TCP and UDP for artificial variable network traffic in the distributed control loop with the intention of finding the better network layer protocol for distributed real-time applications.

The experimental results show that under lower network traffic (up to about 70% network utilization), both protocols behave the same. However, when it reaches 90%, TCP starts deteriorating. But UDP remains unchanged. This is contradictory to the expected performance based on the construction of the two protocols. The possible reason is that the time consumed on flow control mechanisms in TCP becomes a burden under heavy utilization. Since UDP uses no such mechanism, its performance remains unchanged. This aspect needs further attention in the future.