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Traffic Engineering for a Set of Multicast Groups with Respect to Hard Real Time QoS

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Abstract. In this paper, the problem of finding a near-optimal routing solution for a set of real time multicast applications in a meshed core network is studied. Such kind of network is typically a backbone network in automobile, airplane, or industry control network. We will introduce our routing planning methodology based on genetic algorithm, and will focus on the implementation with Earliest Deadline First (EDF) scheduler. Its properties and schedulability conditions are analyzed and integrated into our model. We will show how hard real time QoS can be guaranteed through proper routing and delay bound allocation. At last, based on the calculation result, the performance of our methodology will also be discussed. Although this work originates from the analysis of an industrial core network, the model and the algorithm introduced in this paper are also suitable for solving similar problems in other networks.
Keywords: traffic engineering, multicast routing, genetic algorithm, EDF, hard real time QoS

1 Introduction

Communication of interacting applications in complex industrial systems, such as automobiles, airplanes as well as automated working plants, is realized by intensive use of different buses such as some field buses, e.g. Controller Area Network (CAN). These buses and other networks can be looked as subnetworks.

Quite generally, subnetworks need to communicate with each other. For example, there could be communication between controllers of a sensor/actuator array on a CAN bus and a management computer, which is placed in another subnetwork using other communication technology, e.g. Ethernet. Due to different QoS requirements and realization costs, a complex system may contain a number of subnetworks with several different buses or network technologies. Typically these subnetworks are interconnected by some core network. As an example, Figure 1 shows a conceptual industrial core network.

In this figure, "gateway" indicates a gateway between the core network and subnetworks, and "end system" indicates a device that is directly connected to a switch of the core network.