

Characterizing Hybrid wired/wireless networks

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In this article we consider the specification of a hybrid wired/wireless networks architecture based on a standard fieldbus protocol (PROFIBUS) extended with wireless subnets based on technologies, such as IEEE 802.11 and 802.15.4. These networks are able to combine the advantages of both wired and wireless solutions. In particular, advantages and disadvantages of several interconnection techniques are characterized.

The main research objectives of this article are the specification of a hybrid wired/wireless communication architecture based on a standard fieldbus protocol (PROFIBUS) and the proposal of the appropriate mechanisms and approaches to support real-time communications with such an architecture. The interconnection of heterogeneous physical media in a broadcast network leads to traffic congestion in the communication Systems.

PROFIBUS is an international standard (IEC 61158) of world's most popular fieldbus system. However, it does not include any wireless capabilities. Fieldbus networks are becoming increasingly popular in industrial computer-controlled systems, allowing field devices like sensors, actuators and controllers to be interconnected at low cost, using less wiring and requiring less maintenance than point-to-point connections. PROFIBUS can support up to 32 devices per segment – up to a total of 126 devices, depending on total system current.

The communication infrastructure of current Distributed Computer-Controlled Systems (DCCS) is usually based on fieldbus networks, since they provide adequate levels of performance, dependability, timeliness, maintainability and cost. Nevertheless, cabling starts to be an obstacle for an increasing number of industrial automation applications, which impose or benefit from the use of mobile devices such as handheld computers or transportation equipment.

Wireless communications must cope with real-time and dependability features at least similar to the ones encountered in traditional (wired) fieldbus networks. The support of inter-cell mobility turns this task even more difficult, since mobile nodes must handoff between radio cells in a transparent way. Finally, the impact of inter-cell mobility in the timing behavior of the network is addressed and a timing analysis of the adopted mobility management mechanism is carried out. This analysis permits to compute values for the mobility-related network parameters.

Keywords: Real-time communications; fieldbus networks; wireless networks; interconnection of heterogeneous communication networks.