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SPACEWIRE AND ITS COMPARISON WITH ETHERNET AND AFDX

Abstract

With the development of space information technologies, payloads increases rapidly. High speed and unified interconnection for data, voice and video are highly recommended. In order to satisfy the requirement of aerocraft's multi-transmission for further development, many high speed bus standards have been putforward. SpaceWire, Ethenet and AFDX are the promising standards among them. SpaceWire is a full-duplex, bidirectional, serial, point-to-point data link, It is based on IEEE 1355-1995 and LVDS standard (ANSI/TIA/EIA-644), especially used for space applications. It was put forward by ESA in 2003. SpaceWire takes an indispensable role in confront with the shortage of bandwidth of bus among data processing systems, by offering a kind of universal interface standard, it gives rise to the simplification and regulation of the interconnection of heterogeneous systems. SpaceWire has been applied on the space missions such as Mars Express (ESA), International Space Station European Drawer Rack (ISS EDR) (ESA), James Webb Space Telescope (NASA)etc. Ethernet is a local-area network (LAN) architecture. The Ethernet specification served as the basis for the IEEE 802.3 standard, which specifies the physical and lower software layers. The newest version, called Gigabit Ethernet, supports data rates of 1 gigabit (1,000 megabits) per second. Ethernet is a very mature bus standard. Fiber Ethernet can satisfy the requirements of complicated spacecrafts such as the space station. In spite of its realtime ability, Ethernet is a good choice for high speed interconnection. Ethernet can support TCP/IP very well. And nowadays, IP has become very important in space tasks. Numerous IP/Ethernet-based network components have been moved to aerospace, for example, Cisco Router used in Low Earth Orbit (CLEO) HP ProCurve(TM)Switch aboard the ISS Columbus moduleGSFC'sProposed IP-centric n lunar communication networkTransformational Satellite Communications System (TSAT) and European Satellite Communication Network (SatNEx). AFDX(Avionics Full Duplex switched ethernet) is based on IEEE 802.3 ethernet rooted from the commercial Ethernet network technology. It has the advantages of low-cost, high-bandwidth, low-latency, strong-realtime, high-reliability and etc. AFDX networks have been used in avionics. And it can support IP and UDP well. SpaceWire, Ethernet and AFDX have different advantages. This paper present a comparison between SpaceWire, Ethernet and AFDX, in respect to topology, bandwidth, PNP , TCP/IP supporting, available for space environment. Finally, by comparing their protocols, the compatibility of the higher layer protocol and application software between SpaceWire and Ethernet is discussed.