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Configuring Methods for Deadlock-Free Routing

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ABSTRACT

This paper discusses the problem of tracking of deadlock-free routes. A brief overview of existing software tools providing this functionality is given. A complete overview of the proposed software for building routes for given SpaceWire onboard networks is presented. The paper discusses the application of different existing methods for the choosing of the best route from the list of the deadlock-free routes. A brief overview of the methods for of choosing the best route according to the provided criteria is given. A new method for choosing of the best route and its modification is proposed. Authors provide the result of the methods application and the detailed comparison.

KEYWORDS

Delays, Methods, On-Board Network, Route Selection, Space Wire

INTRODUCTION

Nowadays there is a wide range of software that allows tracking routes in communication networks. Programs such as AFDX Network Design Tool System, Application Programming Interface, and Microsoft Server Software - RRAS, etc. allow tracking of the routes for different networks. However, specialized networks need a field-specific software for routing assistance. Only such software will give ability to achieve reliability and accuracy in network design.

The design of aircraft and spacecraft on-board networks deserves special attention. The equipment responsible for people lives depends on reliable and accurate design. It is necessary to track routes in such networks taking into account data transmission protocols, equipment features and other. The product with such abilities is presented in current article.

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SANDS software complex is required when designing SpaceWire on-board networks (Olenev, 2020). By means of this product, it is possible to track deadlock-free routes for the implemented structure of the on-board network. However, let us first consider the existing program analogues.

OVERVIEW OF EXISTING SOLUTIONS

Routing and Remote Access Service RRAS

Routing and Remote Access Service (RRAS) is the application programming interface and Microsoft server software (Kabir, 2014). RRAS allows creating applications that provide routing in IPv4 and IPv6 networks. In addition, communication between remote users and sites occurs through virtual private network (VPN) connections or remote access. Developers can also use RRAS to implement routing protocols.

Routers and Windows computers configured as routers typically use static or dynamic routing algorithms. Demand-dial routing is also supported. All of these routing algorithms are basically the same purpose, although they have different mechanisms for sending information from transmitter to receiver (Kabir, 2014).

This interface is not appropriate for our tasks because it can only be used for LANs and could not be used for SpaceWire.

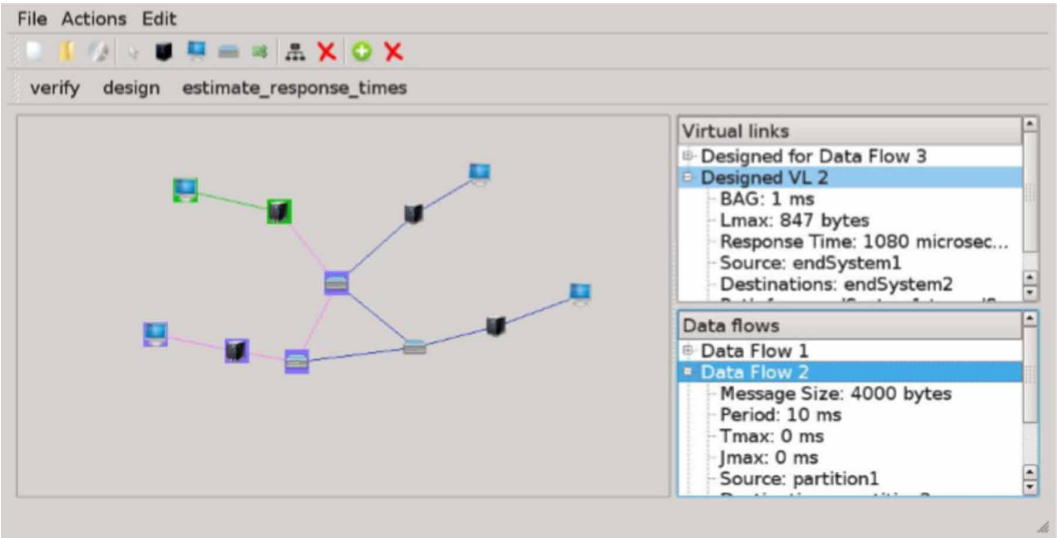
AFDX Network Design Tool

Another software tool is presented another articles (Makin, 2003). It allows tracking of virtual channels in AFDX (Avionics Full-Duplex Switched Ethernet) network and designing of network according to a given description of periodically transmitted messages and their limitations (see Figure 1, Figure 2).

This tool defines limits on message latency, size and transmission periods. In addition, it takes into account the features of AFDX networks. Features such as the ability to use different buffer strategies on switch output ports or the ability to send multiple messages over a single virtual channel.

AFDX describes the control of message transmission in on-board networks based on the traditional Ethernet 802.3 standard.

Figure 1. AFDX network engineering tool system interface left part



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