Spanning tree protection in Ethernet microwave radio networks using adaptive modulation

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Abstract:
Ethernet technology is becoming popular in wireline as well as wireless transport networks. The Ethernet data plane itself has no protection against loops. Therefore, bridges implement the spanning tree protocol (STP) which dynamically detects loops in the physical topology. STP can be used for network protection purposes as well. However, its convergence time is in the order of tens of seconds to minutes which is far too low for carrier grade applications. Consequently, the rapid spanning tree protocol (RSTP) has been designed. The convergence times reported in the literature vary from several milliseconds to several seconds.

This work investigates the convergence time of RSTP by use of discrete event simulation for various network topologies. The simulation approach allows to discriminate between the effects inherent to the RSTP protocol and implementation specific issues. A side effect of RSTP protection is the necessity to flush the databases of learned MAC addresses in parts of the network after a topology change (link failure, link repair) leading effectively to a temporary capacity decrease.

The backhaul of mobile access networks is often implemented using microwave radio technology. Microwave radio links work at frequencies which are subject to rain fading which may cause links to fail during heavy rain. Adaptive modulation allows to dynamically change the modulation scheme depending on weather conditions. During good weather conditions an efficient modulation scheme is used providing a high data rate. During heavy rain, adaptive modulation uses a more robust modulation scheme to guarantee the high availability of the link at the cost of a reduced data rate.

If the backhaul network provides topological redundancy, it is possible to reroute traffic instead of dropping it. We will show the benefit of this approach. The rerouting can be achieved using the multiple spanning tree protocol (MSTP) by dynamically adjusting the path cost of a link. Even in this case, MSTP can achieve a fast recovery of service.