A traffic-driven IP router update process using machine learning techniques

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The task of a communication network is to transport packets from source nodes towards destination nodes. At a given point in time many nodes (or routers) receive and forward an almost continuous stream of packets. The behavior of such a router is determined by its forwarding table. This table marks for every destination in the network which outgoing link to take to reach its destination. Because communication networks are not infallable, node or link failure occur. Upon such an event, the router node adjacent to the failure cannot any longer use the failed link for reaching the next hop. When a router detects such a failure, a reconfiguration process of the forwarding table is initiated. This affects all packets towards destinations which would be using the failed link. In a typical backbone router of an Internet Service Provider (ISP), the reconfiguration can take hundreds of milliseconds or even more than 1 second. As long as an entry in the forwarding table is configured to use a failed link, all network packets sent towards that link are lost.

Because the reconfiguration happens in sets of entries corresponding to specific destinations, cleverly re-ordering these batches could significantly reduce the resulting packet loss. Indeed, ensuring that high traffic volume traffic volume would be reconfigured earlier than lower volume traffic, is the goal of the performed research.

The reordering of forwarding entries is more difficult than it appears at first sight. While over sufficiently long periods in time (tens of minutes) the relative proportions of network traffic towards different destinations might be quite stable, this is not the case for periods less than a second. Therefore, we evaluate prediction methods to make predictions of network traffic in the very near future. In the performed research, both machine learning techniques such as Neural Networks, Support Vector Machines, as well as time series prediction techniques such (F)AR(I)MA(-GARCH) were evaluated.

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