A Validation Model for Non-Lexical Routing Protocols

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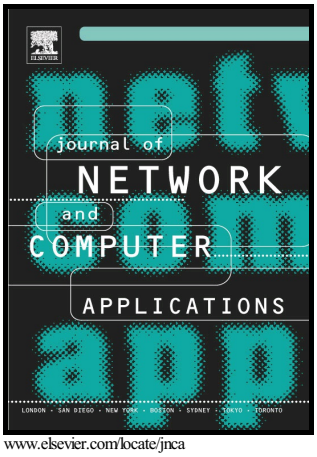

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Abstract Routing protocols properties form an essential topic of research. Ensuring that a routing protocol is stable, loop free and reaches the global optimal topology solution is needed for both evaluating it and doing the required enhancements for it. There exist several trials in previous researches to enhance routing protocols. Those works depend on either theoretical models or simulation to validate their results. Existing validation models target lexical based routing metrics only.

In this work, we propose a validation model for non-lexical routing metrics (such as Enhanced Interior Gateway Routing Protocol - EIGRP). Our validation model is based on abstract algebra. It helps in validating necessary routing properties and enhancing existing routing protocols in such a way that makes them meet those properties.

1 Introduction

IGRP [24] (Interior Gateway Routing Protocol) is a distance vector routing protocol proposed by Cisco. It employs the Distributed Bellman-Ford (DBF) routing algorithm. The distance information in IGRP is represented as a composite of available bandwidth, delay, load utilization, and link reliability [24]. EIGRP [5] has appeared as an enhancement version of IGRP. The same distance vector technology found in IGRP is also used in EIGRP, and the underlying distance information remains unchanged. The convergence properties and the operating efficiency of this protocol have improved significantly due to the use of DUAL [16, 11] (Diffusing Update Algorithm). This allows for an improved architecture while retaining existing investment in IGRP [1]. The convergence time with DUAL rivals that of any other existing routing protocol [13].

EIGRP employs one of DUAL's loop freedom sufficient conditions [11]; that is the SNC (Source Node Condition) as its feasibility condition. This condition is met when neighbor's advertised distance to a destination is less than the feasible distance for that destination, and it is used to select one of its neighbors as feasible successor. The feasible successor is one of the neighbors that can become a successor upon loosing the successor. While DUAL ensures the loop freedom, however, it lacks the routing stability. We employ our model to show how this is shown, and what are the guidelines to routing algorithms to ensures the routing stability property.

We propose a new algebraic construction, which we call *functional product* for modeling non-lexical routing protocols metrics (such as EIGRP). The properties derived from this algebraic construction will help in verifying essential routing characteristics like global/local optimality, monotonicity [22] , inflationary [26] , stability, and loop freedom.

This paper is organized as follows: next section scans the literature of this field, section 3 gives a quick overview of routing algebra, our proposed validation model is presented in section 4, we inspect in section 5 the EIGRP metric using functional product, and section 6 concludes the paper.

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