Flat Routing in Internet-like Topologies

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Abstract. *A frequent subject in forums, academia and industry is the evolution of the Internet in terms of routing. Basically, the scalability in the Default Free Zone related to (1) the growing rate of the routing tables and (2) the convergence of the routing system, are pointed by routing experts as the main concerns of the current mechanism. Several approaches have emerged, but they normally require a mapping system to translate from identifiers to locators (IP). We contribute with this discussion by introducing our XOR-based Flat Routing mechanism for Internet-like topologies. Essentially, the proposed mechanism routes directly on top of flat ASes identifiers, eliminating the need for mapping systems. In this work we present a mechanism for building the routing tables over the XOR-based scenario in conjunction with a reachability service developed using the concepts of Landmark and Bloom filters. We also present our recent results related to the usage of the flat routing mechanism in data centers based on hipercube topologies.*

1. General overview

This proposal employs an XOR-based routing mechanism which is used to build a mesh network structure, as opposed to the virtual ring organization proposed in VRR [Caesar et al. 2006a] and ROFL [Caesar et al. 2006b]. Basically, XOR-based routing mechanisms are available in the literature [Ford 2003, Maymounkov and Mazières 2001], and this work leverages their routing tables organization model and forwarding mechanism, proposing a brand new process for building the routing tables over such XOR-based routing mechanism which (1) removes the need for any kind of underlay (tunneling) network providing communication between nodes, and (2) considers the concept of physical proximity in number of hops for building the routing tables. The first difference has the benefit of totally eliminating the need for mapping systems, and the second difference provides the fundamental basis for controlling the signaling overhead (convergence of the overall routing system) due to the adopted regionalism approach.

The convergence is also pointed by routing experts as one important scale-limiting factor of current routing mechanisms. Since the current mechanisms require 100% of information (global knowledge) in the DFZ about the network condition, a change in a given part requires messaging throughout all the network in order to converge to the updated network condition. Consequently, a routing mechanism which requires only regional messaging (not global convergence), and regional information (not global knowledge) in

the routing tables, becomes a promising research topic to tackle some problems so far identified.

The proposed routing mechanism is evaluated over several Internet-like (Power-law) topologies. All the evaluations were conducted using our developed emulation tool, and the thorough evaluation considers more than 620 million paths (it was computed 100% of the paths for all evaluated topologies), allowing an insightful discussion around the proposed routing mechanism.

References

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