Halo – A Performance Approach

Lakshmana Kumar.S[1] Dr. D.Ramya Dorai[2]
[1]P.G Scholar [2]Professor
[1,2]Department of Computer Science Engineering
[1,2]Adhiyamaan College, Hosur, Tamilnadu

Abstract— Attempts are actually made for as much as decades to boost the efficiency of routing especially link state routing. The objective of the paper is to make the routing optimal through decreasing the cost of carrying traffic over packet switched networks. The Link state routing protocols including Open shortest path first and Intermediate System - Intermediate System gather higher than the distance vector routing protocols like RIPv1, RIPv2, EIGRP. Aforementioned statement is achieved using the techniques called flooding and triggered update techniques. In link state hop by hop routing protocols the updates are flooded at once and estimated parallel. The convergence time will get improved by using the triggered updating techniques through routers send update messages instantly upon learning of a route change. These revised updates are triggered through events for as much as new link flattering available whereas the failure of existing link. The main disadvantages are CPU overhead and memory requirements. Our method iteratively and individually updates the fraction of traffic fated in near future to the node that leaves the beginning node on each of its outgoing links. For each and every iteration ever updates are calculated based on the shortest path on each destination as determined by the marginal cost of the networks links. These costs are obtained by link state updates which are flooded through the network after each iteration. The HALO and PEFT technique is adaptive which automatically converges the new optimal routing assignment for apparently static network changes. The main objective is to eliminate the tradeoff between optimality and ease of implementation in routing.
Key words: Link State, Hop by Hop, Optimal, Adaptive

I. INTRODUCTION

Computers that specialize in sending packets over the data network. They are responsible for interconnecting networks by selecting the best path for a packet to travel and forwarding packets to their destination. Routers are the network center. Routers generally have two connections. They are WAN connection (Connection to ISP) and LAN connection. Data is sent in form of packets between two end devices. Routers are used to direct packet to its destination. Routers examine a packet's destination IP address and determine the best path by enlisting the aid of a routing table. Router Interface is a physical connector that enables a router to send or receive packets. Each interface connects to a separate network. Routing is performed for many kinds of networks, including telephone network (circuit switching), electronic data networks (such as the Internet), and transportation networks. This work is concerned primarily with routing in electronic data networks using packet switching technology. The hop count refers to the number of intermediate devices (like routers) through which data must pass between source and destination, rather than flowing directly over a single wire. Each router along the data path constitutes a hop, as the data is moved from one Layer to another. Hop count is therefore a basic measurement of distance in a network. Hop count is a rough measure of distance between two hosts. A hop count of n means that n gateways separate the source host from the destination host. There are several protocols used in data networking to describe the capability of a network to 'route around' damage, such as loss of a node or a connection between nodes:

- RIP
- OSPF
- IS-IS
- IGRP/EIGRP

Systems that do not implement adaptive routing are described as using static routing, where routes through a network are described by fixed paths (statically). A change, such as the loss of a node, or loss of a connection between nodes, is not compensated for. This means that anything that wishes to take an affected path will either have to wait for the failure to be repaired before restarting its journey, or will have to fail to reach its destination and give up the journey.

II. DEFINITIONS

A. Optimal Routing

It can be defined as the process of finding the routes that minimize the cost of carrying traffic through packet switched networks. Since the early 1970s, since the advent of ARPANET this has been the fundamental area of research and practical interest.

B. Link State Routing

A link-state routing protocol is one of the two main classes of routing protocols used in packet switching networks for computer communications (the other is the distance-vector routing protocol). Examples of link-state routing protocols include open shortest path first (OSPF) and intermediate system to intermediate system (IS-IS).

C. Dynamic Routing

Dynamic Routing, also called adaptive routing, describes the capability of a system, through which routes are characterized by their destination, to alter the path that the route takes through the system in response to a change in conditions. The adaptation is intended to allow as many routes as possible to remain valid (that is, have destinations that can be reached) in response to the change. The traffic demand matrix is not required by the algorithm as an explicit input to compute link weights. The algorithm recognizes and adapts to the changes in the network topologically and according to the traffic variations.

D. Link state

The periodically flooded link state updates help the routers to have the knowledge of state of all the network links. Routing decisions are made based on the states of the link states.

III. LITERATURE SURVEY

Broadly, the existing work can be divided into OSPF-TE, MPLS-TE, traffic demand agnostic/oblivious routing protocol design, and optimal routing algorithms. The work on OSPF has visualized on using good heuristics to increase the centralized link weight calculations. Eventhough these techniques have been shown to improve the algorithm's performance significantly by finding better weight settings, the results are still far from optimal. With this idea in mind, in the time between network changes when the topology and input traffic is static, we can do the following.

A. Network Node Configuration

Iteratively adjust each router's split ratios and move traffic from one outgoing link to another. This only controls the next hop on a packet's path leading to hop-by-hop routing. If instead we controlled path rates, we would get source routing.

B. Path Design

Increase the split ratio to the link that is part of the shortest path at each iteration even though the average price via the next-hop router may not be the lowest. If instead we forwarded traffic via the next-hop router with the lowest average price, we get Gallager's approach, which is a distance vector solution.

C. Link Management

Adapt split ratios dynamically and incrementally by decreasing along links that belong to non shortest paths while increasing along the link that is part of the shortest path at every router. If instead split ratios are set to be positive instantaneously only to the links leading to shortest paths, then we get OSPF with weights.

IV. OSPF

OSPF is a standardized Link-State routing protocol, designed to scale efficiently to support larger networks. OSPF adheres to the following Link State characteristics. OSPF employs a hierarchical network design using Areas. OSPF will form neighbor relationships with adjacent routers in the same Area. Instead of advertising the distance to connected networks, OSPF advertises the status of directly connected links using Link-State Advertisements (LSAs) OSPF sends updates (LSAs) when there is a change to one of its links, and will only send the change in the update. LSAs are additionally refreshed every 30 minutes. OSPF traffic is multicast either to address 224.0.0.5 (all OSPF routers) or 224.0.0.6(all Designated Routers). OSPF uses the Dijkstra Shortest Path First algorithm to determine the shortest path. OSPF is a classless protocol, and thus supports VLS Ms. OSPF can operate within a hierarchy, unlike RIP. The largest entity within the hierarchy is the autonomous system (AS), the autonomous system is a collection of networks under a common administration which share a common routing strategy. OSPF is an intra-AS routing protocol, even though it is capable of receiving routes from and sending routes to other ASs. An autonomous system can be divided into different areas, which are groups of different networks and their attached hosts. Routers which have multiple interfaces can participate in multiple areas. These routers, which are called Area Border Routers, help in maintaining separate topological databases for each area. An area's topology is invisible to entities outside the area. By keeping the area topologies separate, OSPF helps in passing less routing traffic than it would if the autonomous system were not partitioned.

The technique of area partitioning creates two different types of OSPF routing, depending on whether the source and the destination are in the same area or different areas. Intra-area routing occurs when the source and destination are in the same area; inter-area routing occurs in the cases where they are in different areas. An OSPF backbone is responsible for distributing routing information between areas. It comprises of all Area Border Routers, networks not wholly contained in any area, and their attached routers.

V. PEFT

This routing algorithm gives a solution to an open question with a positive answer: Optimal traffic engineering or optimal multi-commodity flow can be obtained using link-state routing protocols along with hop-by-hop forwarding technique. Present typical versions of these protocols, Open Shortest Path First (OSPF) and Intermediate System-Intermediate System (IS-IS), split traffic evenly over shortest paths based on link weights also known as marginal weights of the links. However, the process of optimizing link weights for Open Shortest Path First (OSPF) and Intermediate System-Intermediate System (IS-IS) to the offered traffic is a known to be a NP-hard problem, and even the best setting or adjusting of the weights can deviate quite significantly from an expected optimal distribution of the traffic. In PEFT, the process includes splitting traffic over multiple paths with an exponential penalty on longer paths. Unlike the previous forms, DEFT, PEFT protocol provably achieves optimal traffic engineering also retaining the simplicity of the hop-by-hop forwarding. This protocol also leads to a significant reduction in the time needed to compute the best link weights. Both the protocol and the computational methods are developed in a conceptual framework, called Network Entropy Maximization that is used to identify the traffic distributions that are both optimal and realizable by link-state routing.

VI. GALLAGER'S ROUTING

One of the most famous and adaptable routing algorithm is Gallager‟s algorithm for minimum delay routing. The merit of Gallager‟s routing is its rigorous mathematical approach to a problem, which is more often taken care of using heuristics. The approach is founded on a very well designed mathematical network model, which is customized to describe the minimum total delay routing problem. Mathematical observations on the model lead to two conditions for achieving global optimization, which are based on the marginal delay of links and neighbors. From these observations and conditions an iterative and distributed routing algorithm is naturally derived. Gallager finished his analysis by proving in detail that the algorithm achieves total minimum delay routing.

VII. THE EXISTING SYSTEM AND THE PROBLEMS

The information routers require to build their databases is provided in the form of Link State advertisement packets (LSAP). Routers do not advertise their entire routing tables, instead each router advertises only its information regarding immediately adjacent routers. The existing algorithms are good but not optimal like what is expected. The main area of interest in networking presently is improving the efficiency of the network by making best use of the available resources. Due to poor resource utilization from OSPF, network administrators are forced to overprovision their network in order to handle peak traffic. Most network links run at just 30%-40% utilization.

Link State protocols in comparison to Distance Vector protocols have:

1) Bigger memory requirements.
2) Shortest path computations require many CPU circles.
3) If network is stable little bandwidth is used; react quickly to topology changes.
4) Announcements cannot be "filtered". All items in the database must be sent to neighbors.
5) All neighbors must be trusted.
6) Authentication mechanisms can be used to avoid undesired adjacencies.
7) No split horizon techniques are possible.

VIII. EXPERIMENTS DONE ON NS2

A. HALO and PEFT Implementation

1) Discrete Implementation
2) High-Frequency Link-State Updates
3) Splitting Traffic
4) Interaction with Single-Path Routing

B. The HALO and PEFT can be numerically evaluated with respect to

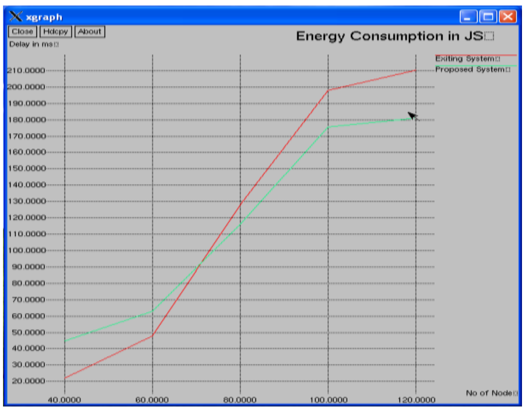
1) Convergence
2) Performance
3) Adaptivity
4) Asynchronous implementation
5) Coexistence with single-Path Protocol
6) Dependence on Initial Conditions
7) Different Algorithms Can End up with Different Split Ratios

C. The HALO and PEFT can be experimentally evaluated with respect to

1) Implementing HALO in any tool (NS2, NetFPGA)
2) Verifying Optimality
3) Performance with Varying input traffic
4) Latency Comparison

Fig. 1:

IX. RESULTS AND DISCUSSIONS



X. CONCLUSION

In this paper, we developed HALO, the first link-state, hop-by-hop routing algorithm that optimally solves the traffic engineering problem for intra domain routing on the Internet. Furthermore, we showed that based on energy, overhead, delay, packet delivery ratio. We also provided guidelines on implementing HALO by translating the theoretical model to a discrete implementation for numerical evaluations and then to a simulation testbed built on NS2 boards. Importantly, although they did not satisfy the theoretical assumptions about continuous split ratio updates and synchronization between the routers, the numerical and experimental evaluations backed up our theoretical predictions about the performance of HALO. In terms of future directions, there are still interesting areas to be explored. For instance, the convergence rate of the algorithm needs to be analyzed. Another direction involves developing the theory behind the performance of algorithm in the absence of synchronous link-state updates and executions.

ACKNOWLEDGMENT

I am thankful to Adhiyamaan college of Engineering (Autonomous), Hosur which gives me opportunity to do implementation work as a post graduate scholar.

REFERENCES

[1] N. Michael, A. Tang, and D. Xu,"Optimal link-state hop-by-hop routing," in Proc. IEEE ICNP, 2013, pp. 1–10.
[2] R. Gallager, "A minimum delay routing algorithm using distributedcomputation,"IEEETrans.Commun.,vol.COM -25,no.1,pp.73–85, Jan. 1977.
[3] D.Xu, M.Chiang, and J.Rexford, "Link-state routing with hop-by-hop forwarding can achieve optimal traffic engineering,"IEEE/ACMTrans. Netw., vol. 19, no. 6, pp. 1717–1730, Dec. 2011.
[4] A. Sridharan, R. Guerin, and C. Diot, "Achieving near-optimal traffic engineering solutions for current OSPF/IS-IS networks," IEEE/ACM Trans.Netw., vol. 13, no. 2, pp. 234–247, Apr. 2005.
[5] M. Wang, C. W. Tan, W. Xu, and A. Tang, "Cost of not splitting in routing: characterization and estimation," IEEE/ACM Trans. Netw., vol. 19, no. 6, pp. 1849–1859, Dec. 2011.
[6] S. Srivastava, G. Agrawal, M. Pioro, and D. Medhi, "Determining link weight system under various objectives for OSPF networks using a lagrangian relaxation-based approach," IEEE Trans. Netw. Service Manag., vol. 2, no. 1, pp. 9–18, Nov. 2005.
[7] Lakshmana kumar.S received the B.Tech degree in Information Technology from Adhiyamaan College of Engg.,Anna University Chennai. He is currently pursuing an M.E., degree at Adhiyamaan college of Engineering, Hosur.

