ISSN:0975-9646

K. Krishna Chaitanya et al. / (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 1 (5) , 2010, 389-391

An Approach to Shortest Path Technique for BGP Using OSPF

K.Krishna Chaitanya, Ch.Ravi Kishore

Dept. of Information Technology
Aditya Institute of Technology And Management(AITAM), Andhra Pradesh, India

Abstract:
The routing of traffic between Internet domains, or Autonomous Systems (ASs), a task known as interdomain routing, is currently handled by the Border Gateway Protocol (BGP). In this paper, we address interdomain routing in the view of Open Shortest Path First (OSPF) technique; here we apply the technique for finding the lowest and shortest path of BGP using OSPF. OSPF is a link-state protocol also it has routing updates.
Key words: *Routing, Routing protocols, OSPF, BGP.*

INTRODUCTION

The Internet is comprised of many separate administrative domains known as *Autonomous Systems* (ASs). Routing occurs on two levels, intradomain and interdomain, implemented by two different sets of protocols. Intradomain-routing protocols, such as OSPF, route packets within a single AS. Interdomain routing, currently handled by the Border Gateway Protocol (BGP), routes packets between ASs.

The Open Shortest Path First[1] (OSPF) protocol, defined as an Interior Gateway Protocol used to distribute routing information within a single Autonomous System. This paper examines how OSPF works and how it can be used to design and build large and complicated networks.

OSPF protocol was developed due to a need in the internet community to introduce a high functionality non-proprietary Internal Gateway Protocol (IGP) for the TCP/IP protocol family. The discussion of the creation of a common interoperable IGP for the Internet started in 1988 and did not get formalized until 1991. At that time the OSPF Working Group requested that OSPF be considered for advancement to Draft Internet Standard.

The OSPF protocol is based on link-state technology, which is a departure from the Bellman-Ford vector based algorithms used in traditional Internet routing protocols such as RIP. OSPF has introduced new concepts such as authentication of routing updates, Variable Length Subnet Masks (VLSM), route summarization, and so forth.

The Border Gateway Protocol[3] (BGP) is the core routing protocol of the Internet. It maintains a table of IP networks or 'prefixes' which designate network reachability among autonomous systems (AS). It is described as a path vector protocol. BGP does not use traditional Interior Gateway Protocol (IGP) metrics, but makes routing decisions based on path, network policies and/or rulesets.

BGP was created to replace the Exterior Gateway Protocol (EGP) routing protocol to allow fully decentralized routing in order to allow the removal of the NSFNet Internet backbone network. This allowed the Internet to become a truly decentralized system. Since 1994, version four of the BGP has been in use on the Internet. All previous versions are now obsolete. The major enhancement in version 4 was support of Classless Inter-Domain Routing and use of route aggregation to decrease the size of routing tables. Since January 2006, version 4 is codified in RFC 4271, which went through well over 20 drafts based on the earlier RFC 1771 version 4. The RFC 4271 version corrected a number of errors, clarified ambiguities, and also brought the RFC much closer to industry practices.

BGP[2] allows an AS to choose routes according to any one of a wide variety of local policies; shortest path routing is just one example of a valid policy, and, in practice, many ASs do not use it. Furthermore, most ASs do not allow non-customer transit traffic on their network. In this paper, we ignore general policy routing and transit restrictions; BGP does not currently consider general path costs;

2. Application of OSPF Technique to BGP

Link-State Algorithm

OSPF uses a link-state algorithm[1] in order to build and calculate the shortest path to all known destinations. The algorithm by itself is quite complicated. If we fallow the same steps for BGP path routing is very much easier and also decreases the cost of routing but it may increases the BGP routing table data. The following is a very high level, simplified way of looking at the various steps of the algorithm.

- Upon initialization or due to any change in routing information, a router will generate a linkstate advertisement. This advertisement will represent the collection of all link-states on that router.
- All routers will exchange link-states by means of flooding. Each router that receives a linkstate update should store a copy in its link-state database and then propagate the update to other routers.
- After the database of each router is completed, the router will calculate a Shortest Path Tree to all destinations. The router uses the Dijkstra algorithm to calculate the shortest path tree. The destinations, the associated cost and the next hop to reach those destinations will form the IP routing table.
- In case no changes in the network occur, such as cost of a link or a network being added or deleted, OSPF should be very quiet. Any changes that occur are communicated via linkstate packets, and the Dijkstra algorithm is recalculated to find the shortest path.

Shortest Path Algorithm

The shortest path is calculated using the Dijkstra algorithm. The algorithm places each router at the root of a tree and calculates the shortest path to each destination based on the cumulative cost required to reach that destination. Each router will have its own view of the topology even though all the routers will build a shortest path tree using the same link-state database.

The following sections indicate what is involved in building a shortest path tree.

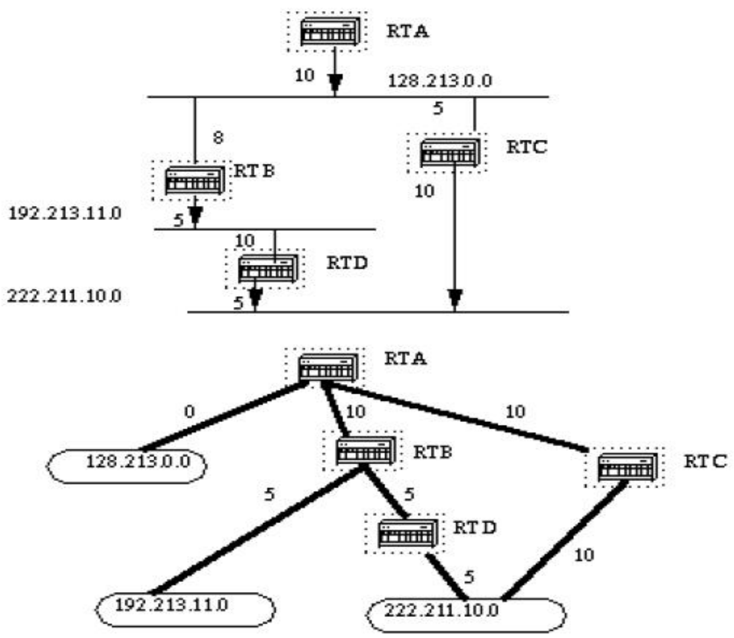
Lowest cost:

The cost (also called metric) of an interface in OSPF is an indication of the overhead required to send packets across a certain interface. The cost of an interface is inversely proportional to the bandwidth of that interface. A higher bandwidth indicates a lower cost. There is more overhead (higher cost) and time delays involved in crossing a 56k serial line than crossing a 10M ethernet line.

The formula used to calculate the cost is:

cost= 10000 0000/bandwith in bps

For example, it will cost 10 EXP8/10 EXP7 = 10 to cross a 10M Ethernet line and will cost 10EXP8/1544000 = 64 to cross a T1 line.



Shortest Path Tree

Assume we have the following network diagram with the indicated interface costs. In order to build the shortest path tree for RTA, we would have to make RTA the root of the tree and calculate the smallest cost for each destination.

The above is the view of the network as seen from RTA. Note the direction of the arrows in calculating the cost. For example, the cost of RTB's interface to network 128.213.0.0 is not relevant when calculating the cost to 192.213.11.0. RTA can reach 192.213.11.0 via RTB with a cost of 15 (10+5). RTA can also reach 222.211.10.0 via RTC with a cost of 20 (10+10) or via RTB with a cost of 20 (10+5+5). In case equal cost paths exist to the same destination, implementation of shortest path will keep track of up to six next hops to the same destination.

After the router builds the shortest path tree, it will start building the routing table accordingly. Directly connected networks will be reached via a metric (cost) of 0 and other networks will be reached according to the cost calculated in the tree.

3. Conclusion:

Motivated by the extensive operation experience behind BGP we proposed this paper. In this paper we discussed a basic approach to BGP for shortest and lowest cost routing based on the OSPF technique, this is mainly useful in mobile Ad-hoc networks for efficient power management. Here may be BGP routing table data increases but decreases the lot of cost to transfer the data to destination.

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K. Krishna Chaitanya received, M.Tech(IT) GITAM University and M.Sc(Physics) from Acharya Nagarjuna University. Presently working as Asst. Professor in the dept.of Information Technology in Aditya Institute of Technology And Management.

Ch. Ravi Kishore received M.Tech from Birla Institute of Technology(Mesra) and M.Sc(Mathematics) from Andhra University. Presently working as Asst. Professor in the dept.of Information Technology in Aditya Institute of Technology And Management.