Id/Loc split 를 위한 BGP 기반 매핑 시스템

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A BGP based Distributed Mapping System for Id/Loc split

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Abstract

Locator and Identifier Split is considered as the solution to the scalability problem Internet is facing today. The separation approach of Locator and Identifier requires a third party called mapping system. The mapping system enables the inter-domain routing between two different edge networks. The design of this third party has generated many proposals, among them one approach use Border Gateway Protocol (BGP) for effective mapping information updates distribution. In this paper, we take advantage of this approach by considering the scalability in term of mapping information storage.
Our goal is to provide scalability in term of mapping information storage as well as effective mapping information updates distribution.

1. Introduction

The alarming growth of the DFZ [1] in the routing system has been the cause of the scalability problem of the Internet. Separating theses two functions have been discussed for a while now as a way of reducing the DFZ. The Identifier and Locator separation will solve current internet problem by mainly providing scalability in the routing system.

However, Identifier and Locator Split introduce a third party in charge of the inter-domain packet forwarding. This third party is known as mapping system. Hence, being a vital part of the future Internet in the locator and identifier split architecture; its design has generated many proposals. One of them being based on BGP called BILM [2]. This approach had the objective to provide an effective distribution of mapping information update over the Internet. But this approach doesn't scale well since using BILM approach all the mapping servers will hold the mapping information of the Internet.

Therefore, we propose a design which tackles the above problem of scalability under the BILM approach. Our approach makes use of an overlay peer to peer network made of Tiers1 mapping servers; where Tiers1 mapping Servers stores only their customers mapping information. This approach has the advantages of being scalable as well as inheriting the BILM advantages in term of updates convergence.

This paper is organized as follows. In the next section, we briefly enumerate related works in the design of a scalable mapping system for the Identifier and Locator Separation Protocol (LISP). The third section will describe our proposal in details. The fourth section will provide analysis and finally the conclusion as the last section will sum up our work

2. Related work

In the Locator and Identifier Split many proposals have been submitted for the mapping system design. Here we will enumerate some of them.

LISP-NERD: It stands for Not-so-novel EID to RLOC Database [3]. This database holds all the mapping information of identifier assigned to different organization. Ingress Tunnel routers pulls regularly the NERD data to get the new version in case of any update. The main goal of this proposal was to avoid any delay resolution before packet forwarding but the scalability it is a serious concern at the ITR.

LISP-CONS: It stands for "Content distribution Overlay Network Service for LISP" [4] with a hierarchical approach based on EID-prefix allocation. Edge network forward their Identifiers prefix to the Content Access Routers (CARS) and these one aggregate them upward to the Content Distribution Routers which will aggregate more to the highest level N of the hierarchy if it possible or advertise on the same level in a mesh topology.

LISP-ALT: It stands for LISP Alternative Topology [5]; it is so far the preferred mapping system for LISP. ALT routers communicate using BGP over GRE tunnels with the lowest level of ALT router connected to the authoritative ETR.

LISP-DHT: In this proposal the mapping information

is stored in Distributed Hash table and in [6] it is the proposal of a mapping system based on a modified Chord model. One of it biggest advantage is that prefi x owners keep control over their mappings. The only problem with this proposal it is the mapping system will inherit the DHT limitations, which for example in the case of Chord the more the nodes increases the more the lookup time increase.

BILM: stands for BGP-based Identifier-to-Locator Mapping [2]. As said above the objective is to provide an effective distribution of mapping information updates. And this approach provides also deployability as it is the case in LISP-ALT.

However, BILM approach does not scale well specially for mapping information storage. Therefore, our proposal will try to remove this limitation without loosing the BILM advantages as we will show in the rest of this work.

3. Proposed scheme

In this part, we provide components of our proposal and how they interact with each other. In our proposal we use LISP components (EID, RLOC, ITR, and ETR) as defined in [7]. The mapping system design is based on Tiers1 and we bring the idea of BILM [2] but with a distributed storage among Tiers1 mapping servers.Fig1 shows the components and their different positions over the Internet.

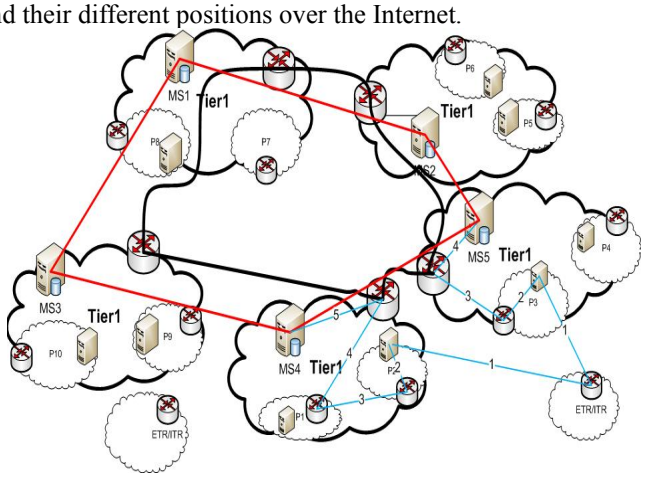

Fig1. Design overview

The highest nodes are the Tiers1 mapping servers. These servers are BILM enabled; they are in charge of storing the mapping information of all the customers of Tiers1.These nodes are configured with the RLOC space of their customers. Therefore, only the updates with ETR lying on that space will be saved in the Tiers 1 mapping server. Moreover, all the Tiers 1 mapping server peers in an overlay peer to peer network, for the purpose of mapping information retrieval between two different tiers1.

The second component of our design is the mapping server locates inside networks which are not Tiers 1. These servers are also BILM enabled, but only in charge of generating updates and send them to the Tier1 mapping servers using BILM approach.

ETRs connect to this mapping server to record mapping information to the concerned Tier1 mapping server.

ITRs connect to one or more tiers1 nodes in the mapping system, to send map request as well as to get mapping replies. However, the map request is sent to the Tier1 of the provider with the highest priority, to avoid a duplicate map-request and reduce the load of the mapping system.

Each Tier1 or other networks have the possibility of managing more then one mapping servers for load balancing as well as reliability property.

Mapping information registration and retrieval process

The mapping information registration starts at ETR of the edge network after getting an RLOC from its provider. The ETR registers the mapping information to its local mapping server, and this one will generates a BGP accordingly to BILM [2]. The updates, once received by the concerned Tier1 mapping servers, are saved and when it is not the right Tier1 the mapping information is simply discarded.

The mapping retrieval is done via the ITR which connects to the Tiers1 mapping servers. ITR sends the map request to the Tiers1 server of it provider with the highest priority. If the destination is in the same Tier1 then the message is directly forwarded and the map reply sent to ITR and saved in the cache for a given period. But if the destination is in a different Tiers1, the map-request is flooded among the peers and the one responsible will reply and forward the first packet.

After the retrieval packet forwarding is made as showed in the bellow figure only using the step 1 then 7 and lastly 6.

This is due to the use of caching capability inside the ITR, which reduce the load of request toward the mapping system.

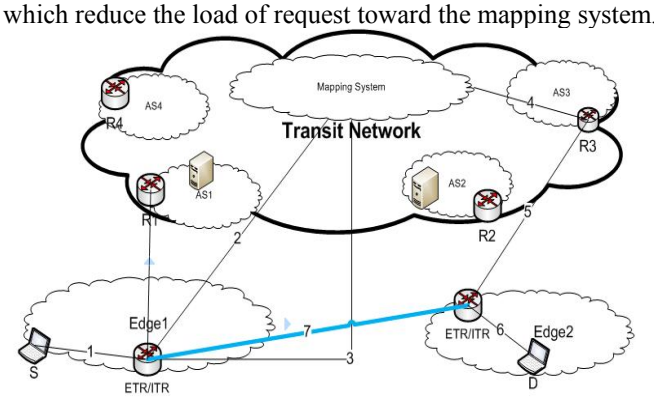

Fig2. Packet Forwarding

4. Performance Analysis

The main goal of this paper has been to provide scalability to the BILM mapping system approach. According to this formula [3] we can estimate the space required by different Tiers1.

E * (30 + 20 * (R - 1))

With **E,** corresponding to the number of EIDs and **R** is the number of RLOC.

But this space will be different depending on the number of customers in each Tiers1.But in any case the space will be feasible compared to available equipments for storage in the market.

Besides, mapping information are usually saved in term of prefix, this will significantly drop down the storage space needed in different servers. .

Ffig3 shows the analysis made in term of storage based on

the formula explained below. We considered the best case where the EIDS storage is equally distributed among the tiers1 mapping servers. The parameters considered are 10^8 as the overall number of EIDs with maximum of 4 RLOC. But due to the ISP business this best case will never be attended since customers are the one choosing their providers. However, the analysis shows just the impact of the idea of not storing all mapping information in each mapping server.

The proposed mapping system inherits the good convergence performance of BILM [2]. The updates load is not high because the mapping system is basically updated only in case of provider change. Therefore, the mapping information in the Tiers1 is stable.

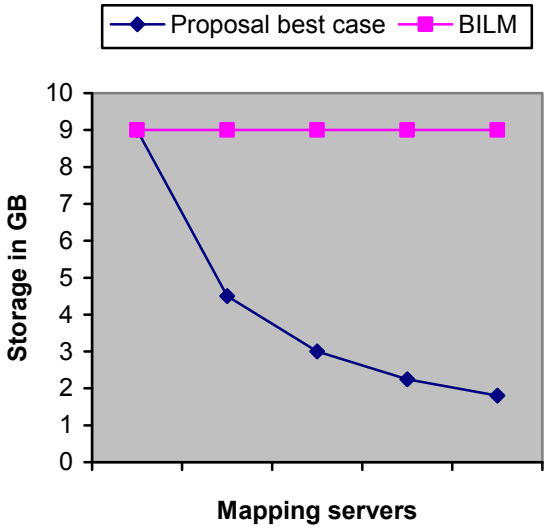

Fig3. Analysis

Under the same Tiers1 the lookup time is about the Round Trip Time (RTT). And in case of retrieval in another Tiers1 the lookup time depends on the number of hop between the source Tiers1 and the destination Tiers1.

This performance analysis does not pretend our design to be the ultimate solution using BGP approach. But we just show the feasibility and the reasonability of our approach further simulation would precise in the future, the viability of this proposal.

4. Conclusion

Identifier and Locator split aims to resolve scalability problem of today Internet routing system. However this approach requires high attention in the design of the mapping system, considered as vital for the inter domain routing process.

In this paper we focus in designing a scalable mapping system based on BGP for Identifier and Locator split architecture. The mapping system is made of Tiers1 mapping servers BILM enabled and other mapping servers located in the rest of Internet Service Providers. The first mapping servers are in charge of storage and the second mapping server generates the mapping information according to BILM approach.

We have showed with the analysis how this mapping system will keep the BILM advantages as well as providing scalability by a distributed storage procedure. A low lookup time is also provided if the source and destination are in the same tier1.

Acknowledgements

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Dr. CS Hong is corresponding author.

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