Analysis of MRAI Timer on BGP Convergence

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Abstract-The Border Gateway Protocol (BGP) is the ssde facto inter-domain routing protocol used to exchange reach ability information between Autonomous Systems in the Internet. In Today's scenario BGP protocol does not perform well, because of slow convergence time. Instabilities in the topology such that failure of link can increase the convergence time. Data transfer is not possible until all routes are stable after link failure or route withdrawals or any policy changes As soon as stable state is achieved by the AS's, networks converges more quickly In this paper we perform the analysis of BGP convergence time in perspective of MRAI Timer and no of updates.

Keywords: BGP, Convergence Time, MRAI, Routing Protocol

I. INTRODUCTION

The Internet consists of numerous heterogeneous networks without a centralized control. These networks are clustered in groups called Autonomous Systems (AS), where each AS is controlled by a common administrative entity. Communication between ASs requires a common protocol. Border Gateway Protocol (BGP) is the de facto standard inter-domain routing protocol in today's Internet [1]. BGP is categorized as a path vector protocol, a variant of distance vector protocol. Instead of distributing link cost information, it propagates full path. information to avoid cycles. BGP employs TCP as its transport protocol, which ensures transport reliability and eliminates the need for BGP to handle retransmission, acknowledgement, and sequencing.

Routers that use BGP are called BGP speakers. Two BGP speakers that participate in a BGP session are called neighbors or peers. Peer routers exchange four types of messages: open, update, notification, and keep-alive. The update message carries routing information while the remaining three messages handle session management [1]. BGP suffers from long convergence time. The BGP convergence time is time elapsed from the moment when a change occurs in a network until all routers accordingly adjust their routing tables [2]. This updating of route information is called the BGP convergence process. During this process, routing tables may contain obsolete routing information, which may cause inaccessibility of ASs, packet loss, and additional overhead to routers [3], [4].

II. MRAI

A previous research shows that if a BGP speaker responds to received updates instantaneously by sending updates to its peers, the number of update messages and BGP convergence time would increase [5]. A BGP speaker cannot wait indefinitely to receive the best route. Hence, it has to minimize the number of update messages and react in a timely manner to changes in the Internet topology. A solution, proposed in RFC 1771, is rate limiting: it limits the frequency of route advertisements by imposing a minimal interval of time that should pass between two consecutive advertisements of the same destination sent from a BGP speaker to one of its peers [6]. This interval is called the Minimal Route Advertisement Interval (MRAI) or the MRAI round. In the case of multiple paths to a destination, several MRAI rounds may be needed until the best route is found and convergence achieved.

The rate limiting is applied only to advertisements between neighboring ASs and it does not affect route advertisements within an AS. Furthermore, withdrawal rate limiting (WRL) is not applied because it leads to an increase of BGP convergence time [7]. WRL has not been endorsed by RFC 1771 [1]. It is not used in the majority of routers. RFC 1771 specifies the duration of an MRAI round to be 30 s, which is controlled by using MRAI timers [1]. However, manufacturers may use different values for the duration of MRAI round. For example, Juniper's default configuration sets MRAI to 0 s [8], [9]. To avoid synchronization and possible peaks in the update messages distribution, RFC 1771 proposes using values of MRAI multiply by a uniform jitter in the range 0.75 – 1. Nevertheless, the majority of BGP speakers in the Internet do not implement this MRAI modification [10], [11].

III. BGP CONVERGENCE TIME

Convergence Time: Convergence Time is the time elapsed between first update to last update when there are changes in network topology and all routers adjust their routing table accordingly.

Minimum Convergence Time:(N-3) * MRAI [12]

Maximum Convergence Time: P * MRAI [13]

Average Convergence Time:(N-3+P) * MRAI / 2

Where N= no of nodes

P= maximum no of hops

Convergence Time in UP Phase: Time gap between first updates received and last updates. Convergence Time in DOWN Phase: When any destination is withdrawal, then the time gap between first update after withdrawal to last update received.

IV. PROPOSED METHODOLOGY: EFFECT OF MRAI TIMER ON BGP CONVERGENCE TIME

To investigate the effect of mrai we perform the simulations on different topology with different MRAI values. We have performed the simulations on following topologies:

1. Line Topology with 6 nodes

2. Focus Topology with 6 nodes

3. Ring Topology with 15 nodes

4. Grid topology with 9 nodes

5. Crystal Topology with 5 nodes

6. Completely Connected Graph with 15 nodes

7. Topology with 45 nodes

We have find the influence of MRAI timer on the basis of following metrics:

1. Convergence time in advertisement phase T up phase

2. Convergence time in withdrawal phase T down phase

3. No of updates in advertisement and withdrawal phase

MRAI	Convergence Time	No of updates
5	50.3	39
10	53.3	39
15	57.3	39
20	62.3	38
25	69.01	35

Table1. Convergence Time of Line Topology with Different MRAI Values In Up Phase

T down Phase: MRAI	Convergence Time	No of updates
5	2.45	55
10	2.65	54
15	2.76	53
20	2.75	48
25	9.96	45
30	25.96	44

Table2. Convergence Time of Line Topology with Different MRAI Values in Down Phase

V. SIMULATION/EXPERIMENTAL RESULTS

This section describe experimental/simulation results with graphs

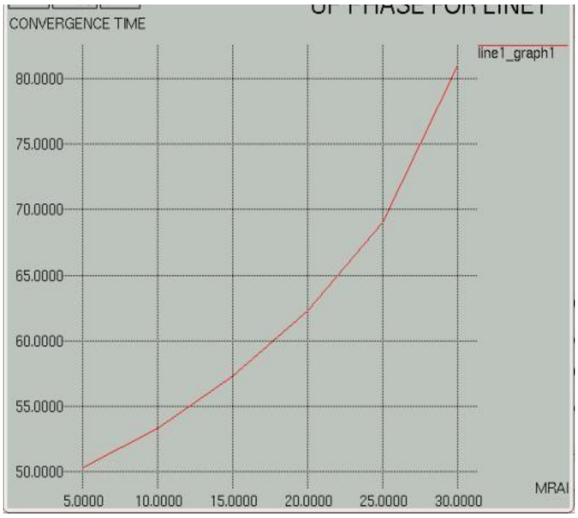

Fig. 1.Convergence Time Vs MRAI Graph in UP Phase

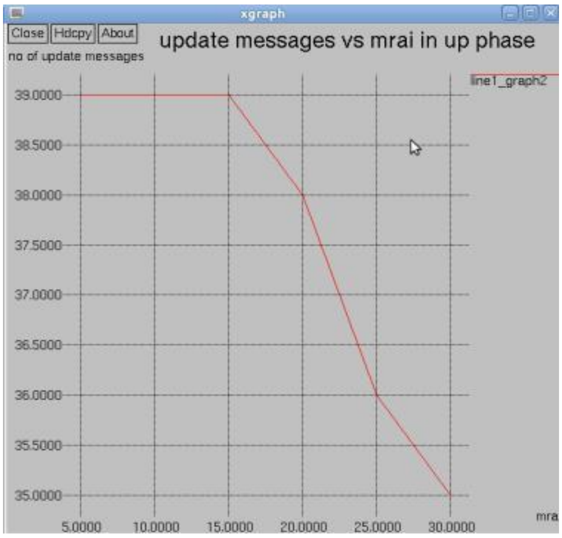

Fig. 2. Update Message Vs MRAI Graph in UP Phase

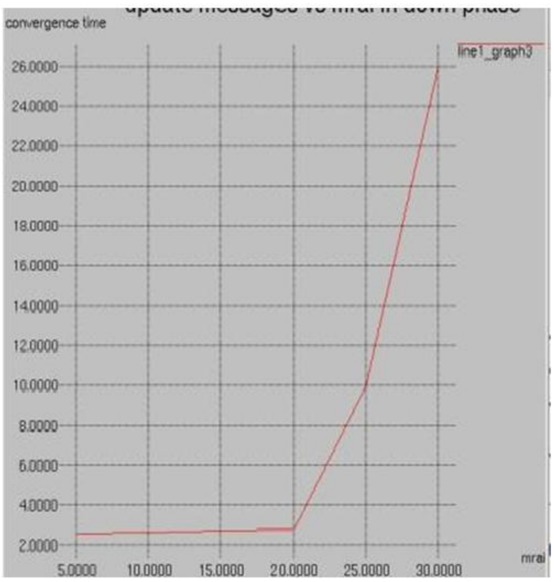

Fig.3. Convergence Time Vs MRAI Graph in Down Phase

Fig. 4. Update Message Vs MRAI Graph in Down Phase

1. Line Topology with 5 Nodes:

Convergence Time and No. of Updates using Default MRAI Timer (30)

Convergence Time = 81.035 sec No. of Updates = 36

Convergence Time and No. of Updates when MRAI Timer value = 5

Convergence Time = 50.3 sec No. of updates = 39

Based on above results we can conclude that convergence time is reduced from 81.035 sec to 50.30 sec and no. of update messages is increased from 36 to 39 in up phase.

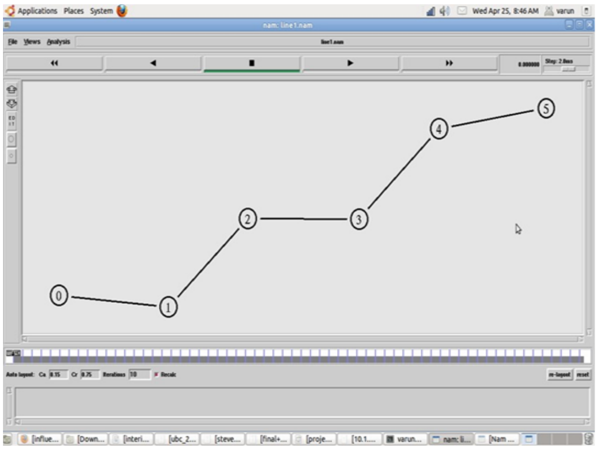

Fig. 5 NAM of Line Topology with 5 Nodes

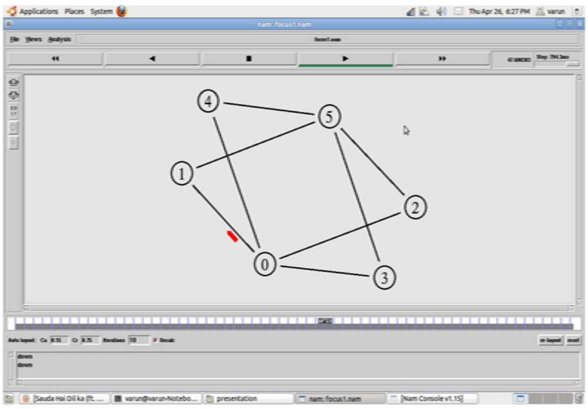

Fig.6. NAM of Line Topology with 5 Nodes

When we perform the simulation on above topology using default and different MRAI Timer setting we can find the convergence time and no of updates as shown in below:

From above table we can conclude that convergence time is reduced from 81 sec to 62.3 sec in up phase and

19.75 to 19.70 sec in down phase. While no. of update messages is increased from 91 to 95 in up phase and 104 to 119 in down phase.

Convergence Time and No. of Updates using Default MRAI Timer:

Convergence Time = 80.9987 sec No. of Updates = 91

Convergence Time and No. of Updates when MRAI Timer = 5

Convergence Time = 62.2987 sec No. of updates = 95

Based on above results we can conclude that convergence time is reduced from 80.9987 sec to 62.2987 sec and no. of update messages is increased from 91 to 95 in up phase.

Based on the above figures we can state that convergence time increases when we increases the value of mrai timer in both up and down phase and no of updates decreases when we increases the value of mrai timer

VI. CONCLUSION

In this study, we have found the influence of MRAI Timer on the Convergence Time and no of update messages received. Based on the simulation results, we can state that convergence time increases when we increase the MRAI Timer Interval while no of updates decreases when MRAI Timer Interval increases. In future we will try to derive a formula based on that we can set the MRAI value and we will try to find the effect of our approach on BGP Instability problems.

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