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Revised Default Values for the BGP 'Minimum Route Advertisement Interval'

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Abstract

This document briefly examines what is known about the effects of the BGP MRAI timer, particularly on convergence. It highlights published work which suggests the MRAI interval as deployed has an adverse effect on the convergence time of BGP.

It then recommends revised, lower default values for the MRAI timer, thought to be more suited to today's Internet environment.

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1. Requirements Language

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The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [\[RFC2119\] \(Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels," February 2001.\)](#).

2. Background

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The proper functioning of the [\[BGP\] \(Rekhter, Y., Li, T., and S. Hares, "A Border Gateway Protocol 4 \(BGP-4\)," January 2006.\)](#) routing protocol is of great importance to the Internet. Issues regarding matters of its stability and convergence have been documented widely, such as in [\[BGP-STAB\] \(Li, T. and G. Huston, "BGP Stability Improvements," June 2007.\)](#), [\[bgp-converge\] \(Griffin, T. and B. Premore, "An Experimental Analysis of BGP Convergence Time," November 2001.\)](#) and [\[Potaroo0607\] \(Huston, G., "Damping BGP," June 2007.\)](#).

One such issue is the effect of 'Minimum Route Advertisement Interval' (MRAI).

2.1. The MRAI Timer

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The Minimum Route Advertisement Interval (MRAI) timer is specified in [RFC4271 \(Rekhter, Y., Li, T., and S. Hares, "A Border Gateway Protocol 4 \(BGP-4\)," January 2006.\)](#) [BGP]. This timer acts to rate-limit updates, on a per-destination basis. [\[BGP\] \(Rekhter, Y., Li, T., and S. Hares, "A Border Gateway Protocol 4 \(BGP-4\)," January 2006.\)](#) suggests values of 30s and 5s for this interval for eBGP and iBGP respectively.

The MRAI must also be applied to withdrawals according to [RFC4271 \(Rekhter, Y., Li, T., and S. Hares, "A Border Gateway Protocol 4 \(BGP-4\)," January 2006.\)](#) [BGP], a change from the earlier RFC1771. Some implementations apply this rate-limiting on a per-peer basis, presumably an adequate approximation. Some implementations apply it to withdrawal methods (often called "WRATE" in the literature). Some implementations do not apply MRAI at all.

2.2. Known effects of the MRAI timer on convergence

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The MRAI timer serves to suppress messages which BGP would otherwise send out to describe transitory states, and so allow BGP to converge with significantly fewer messages sent. This beneficial effect of the MRAI timer, in terms of # of messages, increases as the timer is increased until an optimum value is reached, after which the beneficial effect stabilises. [\[bgp-converge\] \(Griffin, T. and B. Premore, "An Experimental Analysis of BGP Convergence Time," November 2001.\)](#) [\[mrai-final\] \(Qiu, J., Hao, R., and X. Li, "An Experimental Study of the BGP Rate-limiting Timer," June 2003.\)](#)

In terms of convergence time, a similar beneficial effect is seen as the MRAI increases to the same optimum value. However as the timer value is increased past the optimum, the convergence time increases again linearly - the scale of this increase is worse with WRATE. [\[bgp-converge\] \(Griffin, T. and B. Premore, "An Experimental Analysis of BGP Convergence Time," November 2001.\)](#) [\[mrai-final\] \(Qiu, J., Hao, R., and X. Li, "An Experimental Study of the BGP Rate-limiting Timer," June 2003.\)](#)

The optimum MRAI timer value is dependent on several factors, most particularly the topology in its layout and propagation times. The optimum value will differ between different subsets of the Internet. [\[mrai-final\] \(Qiu, J., Hao, R., and X. Li, "An Experimental Study of the BGP Rate-limiting Timer," June 2003.\)](#)

It is believed to be infeasible to try directly calculate this value. However a useful approximation can be made from the diameter of the topology if it is known, along with some assumptions about the the topology, such as the latency between nodes. [\[mrai-internet\] \(Qiu, J., Hao, R., and X. Li, "The Optimal Rate-Limiting Timer of BGP for Routing Convergence," April 2005.\)](#)

The interaction between extensions to BGP designed to improve convergence, such as those that allow propagation of additional and/or backup paths, and the MRAI timer is as yet unknown. However, it seems reasonable to speculate these extensions might have the effect of leading to a lower optimum MRAI than would be indicated by an approximation based on the diameter of the BGP topology. Further work on these questions would be useful.

2.3. Interaction with Flap-Damping

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As the MRAI helps eliminate some updates, it interacts with [flap-damping](#) (Villamizar, C., Chandra, R., and R. Govindan, "BGP Route Flap Damping," November 1998.) [BGP-DAMP]. The lower the MRAI timer, the greater the risk of crossing below the threshold of the optimum value. If that threshold is crossed, there will be an increased number of updates somewhere within the BGP system, and hence an increased risk of paths being dampened, which otherwise would not.

So, in presence of significant flap-damping deployment and given the uncertainty of what the optimum is, it is reasonable to err towards selecting a value of the MRAI timer significantly higher than the optimum.

However, given that flap-damping increasingly is discouraged [\[RIPE-378\]](#) (Smith, P. and P. Panigł, "RIPE RRG: Recommendations on Route-flap Damping," May 2006.) in Internet routing, this particular need to be conservative in the choice of MRAI timer value may be less important.

2.4. Current Status of the MRAI

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The current recommended value of 30s may be far higher than is optimal for the Internet, based on observations of certain parameters related to its topology. In [\[mrai-final\]](#) (Qiu, J., Hao, R., and X. Li, "An Experimental Study of the BGP Rate-limiting Timer," June 2003.) it is suggested that the optimal value may be between 5s ('semi-safe') to 15s ('safe'). The estimation of the 'safe' value here is of no relevance if WRATE is universally deployed, as in such a case the 'semi-safe' value and 'safe' value are the same. Further empirical work by the same authors [\[mrai-internet\]](#) (Qiu, J., Hao, R., and X. Li, "The Optimal Rate-Limiting Timer of BGP for Routing Convergence," April 2005.) suggests that the optimal, Internet MRAI may be below 5s.

Further, [\[BGP-STAB\]](#) (Li, T. and G. Huston, "BGP Stability Improvements," June 2007.) and [\[Potaroo0607\]](#) (Huston, G., "Damping BGP," June 2007.) argue that operational conditions (e.g. different routers using different MRAI values) mean the MRAI is having an adverse effect even on the number of messages sent, and so further exacerbating convergence problems in the global BGP system, such as path hunting. The [\[BGP-STAB\]](#) (Li, T. and G. Huston, "BGP Stability Improvements," June 2007.) document goes further still and argues that MRAI be deprecated in favour of some better way of damping BGP UPDATES, however there are no clear proposals before the IDR as of this writing for such changes to BGP.

3. Risk Evaluation in the Choice of MRAI Time

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Though there is an optimum value for the MRAI, it's unlikely that it can be determined empirically or otherwise for the general Internet. It may even not be possible, as the optimum MRAI will differ for different subsets of the Internet. Some degree of guesstimation at a reasonable value for the MRAI is required, which is an exercise in risk; whether to err towards fast convergence at the risk of a disproportionate increase in BGP messaging, or to err to the side of an optimal number of messages at the expense of convergence.

Arguably, economising on bandwidth and control-plane processing power is today less important than the convergence time of BGP, than in times past. Presuming this, any new recommendations for the MRAI should seek to err slightly to the side of convergence, rather than erring towards minimising BGP traffic.

Further, if we assume most implementations apply the MRAI to withdrawals, then the Internet BGP topology effectively is WRATE-enabled, and [\[mrai-final\] \(Qiu, J., Hao, R., and X. Li, "An Experimental Study of the BGP Rate-limiting Timer," June 2003.\)](#) suggests there is even less benefit to erring toward a higher MRAI. The most definite risk of lowering the MRAI is the increased risk of flap-damping, if the value is set too much below the optimum. Therefore, taking into account estimations of that optimum is required. That said, at least one BGP implementation by default does not apply any MRAI at all.

4. Recommended values for the MRAI

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The suggested default values for the MinRouteAdvertisementIntervalTimer given in [RFC4271 \(Rekhter, Y., Li, T., and S. Hares, "A Border Gateway Protocol 4 \(BGP-4\)," January 2006.\)](#) [BGP] are hereby revised to be 5s or less for eBGP connections, and 1s or less for iBGP connections, for use on Internet topologies.

These values may not be suitable for topologies which differ from the internet, be that in scale, arrangement or otherwise. Such non-internet, BGP topologies very likely would have significantly lower optimum values, assuming they are always significantly smaller in scale than the Internet BGP topology.

5. IANA Considerations

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There are no requests made to IANA in this document.

6. Security Considerations

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This document raises no new security considerations.

7. Acknowledgements

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The authors of the cited documents are thanked for their contributions to the understanding of BGP, of which this document is a simple summary.

8. References

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8.1. Normative References

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[BGP]	Rekhter, Y., Li, T., and S. Hares, " A Border Gateway Protocol 4 (BGP-4) ," RFC 4271, January 2006.
[RFC2119]	Bradner, S., " Key words for use in RFCs to Indicate Requirement Levels ," RFC 2119, BCP 14, February 2001.

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Author's Address

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	Paul Jakma
	Sun Microsystems
	Springfield
	Linlithgow, West Lothian EH49 7LR
	Scotland
Phone:	+44 1506 673150
Email:	paul.jakma@sun.com

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