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Making Route Flap Damping Usable
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Abstract

Route Flap Damping (RFD) was first proposed to reduce BGP churn in routers. Unfortunately, RFD was found to severely penalize sites for being well-connected because topological richness amplifies the number of update messages exchanged. Many operators have turned RFD off. Based on experimental measurement, this document recommends adjusting a few RFD algorithmic constants and limits, to reduce the high risks with RFD, with the result being damping a non-trivial amount of long term churn without penalizing well-behaved prefixes' normal convergence process.

Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" are to be interpreted as described in RFC 2119 [RFC2119] only when they appear in all upper case. They may also appear in lower or mixed case as English words, without normative meaning.

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1. Suggested Reading

It is assumed that the reader understands BGP, [RFC4271] and Route Flap Damping, [RFC2439]. This work is based on the measurements in the paper [pelsser2011]. A survey of Japanese operators' use of RFD and their desires is reported in [I-D.shishio-grow-isp-rfd-implement-survey].

2. Introduction

Route Flap Damping (RFD) was first proposed (see [ripe178] and [RFC2439]) and subsequently implemented to reduce BGP churn in routers. Unfortunately, RFD was found to severely penalize sites for being well-connected because topological richness amplifies the number of update messages exchanged, see [mao2002]. Subsequently,

many operators turned RFD off, see [ripe378]. Based on the measurements of [pelsser2011], [ripe580] now recommends that RFD is usable with some changes to the parameters. Based on the same measurements, this document recommends adjusting a few RFD algorithmic constants and limits, with the result being damping of a non-trivial amount of long term churn without penalizing well-behaved prefixes' normal convergence process.

Very few prefixes are responsible for a large amount of the BGP messages received by a router, see [huston2006] and [pelsser2011]. For example, the measurements in [pelsser2011] showed that only 3% of the prefixes were responsible for 36% percent of the BGP messages at a router with real feeds from a Tier-1 and an Internet Exchange Point during a one week experiment. Only these very frequently flapping prefixes should be damped. The values recommended in Section 6 achieve this. Thus, RFD can be enabled, and some churn reduced.

The goal is to, with absolutely minimal change, ameliorate the danger of current RFD implementations and use. It is not a panacea, nor is it a deep and thorough approach to flap reduction.

3. RFD Parameters

The following RFD parameters are common to all implementations. Some may be tuned by the operator, some not.

Parameter	Tunable?	Cisco	Juniper
Withdrawal	No	1000	1000
Re-Advertisement	No	0	1000
Attribute Change	No	500	500
Suppress Threshold	Yes	2000	3000
Half-Life (min)	Yes	15	15
Reuse Threshold	Yes	750	750
Max Suppress Time (min)	Yes	60	60

Default RFD Paramaters of Juniper and Cisco

Table 1

4. Suppress Threshold Versus Churn

By turning RFD back on with the values recommended in Section 6 churn is reduced. Moreover, with these values, prefixes going through normal convergence are generally not damped.

[pelsser2011] estimates that, with a suppress threshold of 6,000, the BGP update rate is reduced by 19% compared to a situation without RFD enabled. With this 6,000 suppress threshold, 90% fewer prefixes are damped compared to use of a 2,000 threshold. I.e. far fewer well-behaved prefixes are damped.

Setting the suppress threshold to 12,000 leads to very few damped prefixes (1.7% of the prefixes damped with a threshold of 2,000, in the experiments in [pelsser2011] yielding an average hourly update reduction of 11% compared to not using RFD.

Suppress Threshold	Damped Instances	% of Table Damped	Update Rate (one hour bins)
2,000	43342	13.16%	53.11%
4,000	11253	3.42%	74.16%
6,000	4352	1.32%	81.03%
8,000	2104	0.64%	84.85%
10,000	1286	0.39%	87.12%
12,000	720	0.22%	88.74%
14,000	504	0.15%	89.97%
16,000	353	0.11%	91.01%
18,000	311	0.09%	91.88%
20,000	261	0.08%	92.69%

Damped Prefixes vs. Churn, from [pelsser2011]. Note overly-aggressive current default Suppress Threshold

Table 2

5. Maximum Penalty

It is important to understand that the parameters shown in Table 1, and the implementation's sampling rate, impose an upper bound on the penalty value, which we can call the 'computed maximum penalty'.

In addition, BGP implementations have an internal constant which we will call the 'maximum penalty' which the current computed penalty may not exceed.

6. Recommendations

The following changes are recommended:

Router Maximum Penalty: The internal constant for the maximum penalty value MUST be raised to at least 50,000.

Default Configurable Parameters: In order not to break existing operational configurations, BGP implementations SHOULD NOT change the default values in Table 1.

Minimum Suppress Threshold: Operators wishing damping which is much less destructive than current, but still somewhat aggressive SHOULD configure the Suppress Threshold to no less than 6,000.

Conservative Suppress Threshold: Conservative operators SHOULD configure the Suppress Threshold to no less than 12,000.

Calculate But Do Not Damp: Implementations MAY have a test mode where the operator could see the results of a particular configuration without actually damping any prefixes. This will allow for fine tuning of parameters without losing reachability.

7. Security Considerations

It is well known that an attacker can generate false flapping to cause a victim's prefix(es) to be damped.

As the recommendations merely change parameters to more conservative values, there should be no increase in risk.

In fact, the parameter change to more conservative values should slightly mitigate the false flap attack.

8. IANA Considerations

This document has no IANA Considerations.

9. Acknowledgments

Nate Kushman initiated this work some years ago. Ron Bonica, Seiichi Kawamura, and Erik Muller contributed useful suggestions.

10. References

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