# quick RFD Draft

mattia.milani

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## 1 Signaling

The signaling sequence used in all the experiments is AWAWAWA. In total 3 flaps. Advertisement and withdraws are separated by 300s 5 minutes. for this reason a simulation for sure can't endup before 1800s minutes (also the first advertisement is delayed by 300s).

MRAI doesn't affect withdraws, like specified in the Internet-Draft: Revisions to the BGP 'Minimum Route Advertisement Interval' published in 2012.

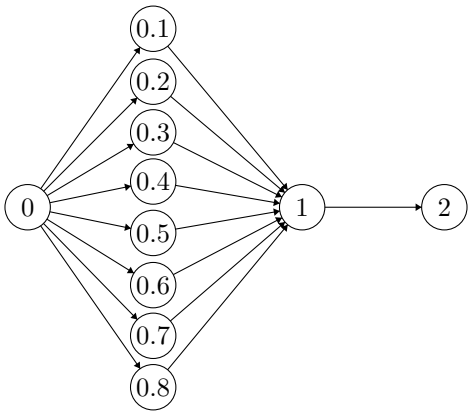
In all the experiments has been used the CISCO default set of values for RFD, presented in the table below.

| Parameter | Value |
|---|---|
| withdrawal penalty | 1.0 |
| re-advertisement penalty | 0.0 |
| attribute change penalty | 1.0 |
| suppress threshold | 2.0 |
| half-life (min) | 15 (900s) |
| Reuse Threshold | 0.75 |
| Max Suppress Time (min.) | 60 (3600s) |

Table 1: Cisco default RFD values

## 2 Complex line

### 2.1 Graph




In this graph I would like to study how the figure of merit of node 2 variate in function of the MRAI applied on all the edges.

MRAI value used: $[0, 1200]$ with a step of 50 seconds.

### 2.2 Results

Some figure of merit curve of the node 2 are below.

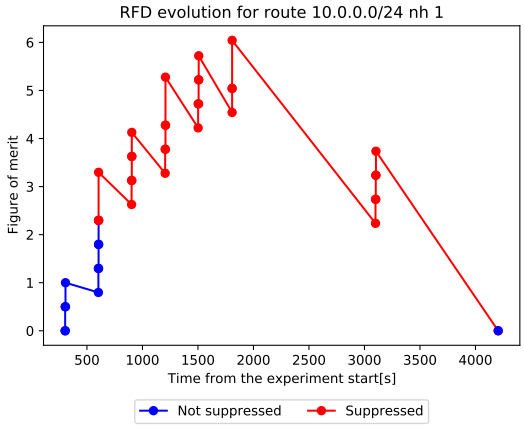



Figure 1: Constant MRAI at 0s

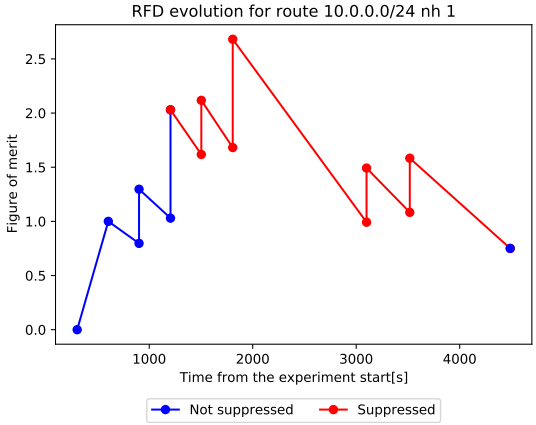



Figure 2: Constant MRAI at 500s

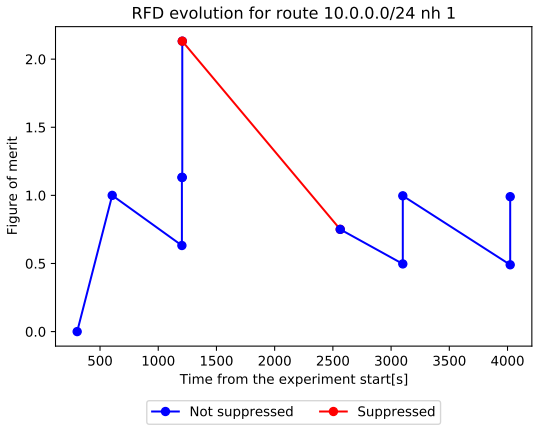



Figure 3: Constant MRAI at 1000s

Like is possible to see there is a variation on the figure of merit due to MRAI. The node 1 thanks to MRAI will be able to compress more messages and send less messages to node 2. Node 2 will receive less attribute variation.

Then lets see how many suppression happen in the network in function of MRAI in the next plot.

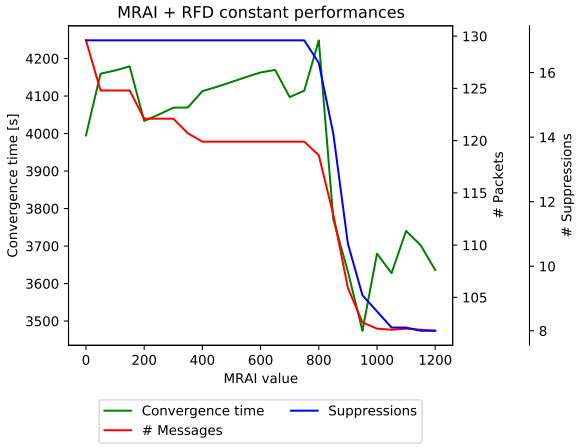
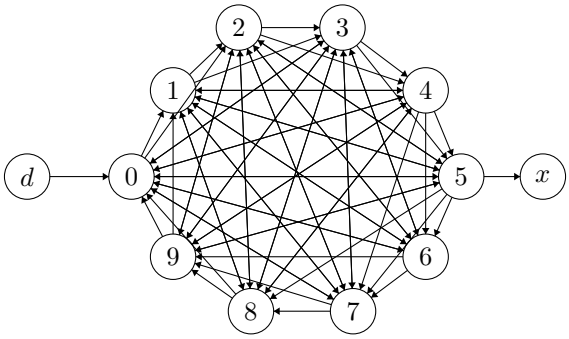



Figure 4: Evolution of the performances changing the constant MRAI in the links

In fig. 4 is possible to see that around 850/900 there is a variation all the trends. This is due to the fact that All the nodes start using a huge MRAI, so is possible for example that node 0.2 will cache two subsequent advertisement and don't send the second one. For this reason node 1 will have to recompute less times the best path. This gives the possibility to the nodes also to have a smaller figure of merit for route, most of the nodes giving as result a smaller convergence time, not affected by all the suppressions.

# 3 clique

Let's see what happen in a more complex network, I took a clique of dimension 10 with 2 more nodes, one that shares the destination to the clique and the second one that absorb the routes. The figure of the clique is the following, not all the arrow have been represented:




## 3.1 Results

This time the MRAI in the set $[0, 120]$ with steps of 5 seconds. We saw that there is a correlation with high MRAIs, unrealistic MRAIs? lets see what happen with more realistic values.

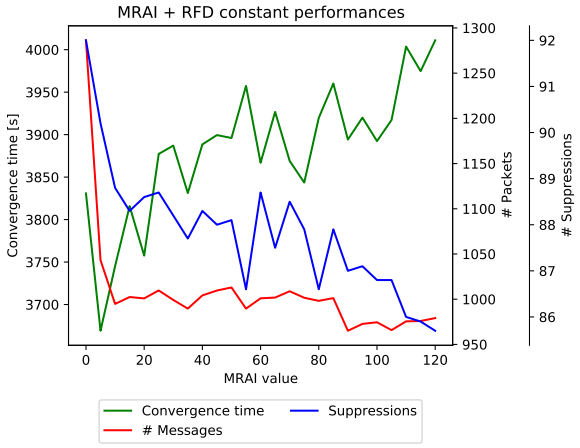
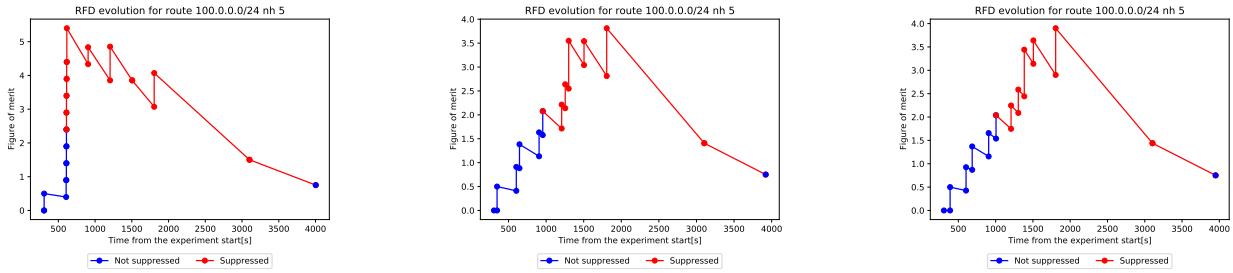



Figure 5: Evolution of the performances changing the constant MRAI in the links, graph clique

In fig. 5 is possible to see that also in a smaller MRAI set there are some changes in the number of suppression that happens on average for each experiment. Also the number of messages decreases rapidly and reaches what seems a constant value around 980. The convergence time seems to be really stable around 2806s with some small spikes.

How the node X figure of metit reacts with different MRAIS?




(a) MRAI = 0s (b) MRAI = 50s (c) MRAI = 100s

Figure 6: Evolution of the figure of merit in the node X with different MRAIs

But what about a comparison between the use of RFD and the same network without it?

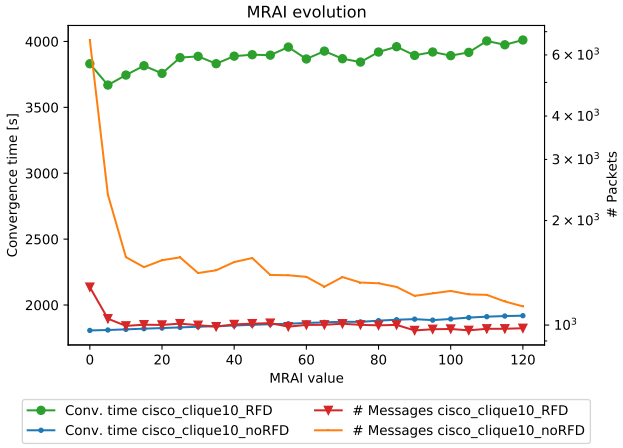



Figure 7: Comparison of the CLIQUE with RFD and the clique without it

Figure 7 present the difference between the usage of RFD and the evolution without it. The RFD permits to have less messages, thanks to the fact that it blocks some routes for a certain amount of time. Notice that the packets axis is in log scale. The difference with a small MRAI is huge.

The convergence time grows linearly without RFD, while with RFD is almost constant. My supposition about this is that there is at least one node that for every MRAI suppress the best path of X without permitting

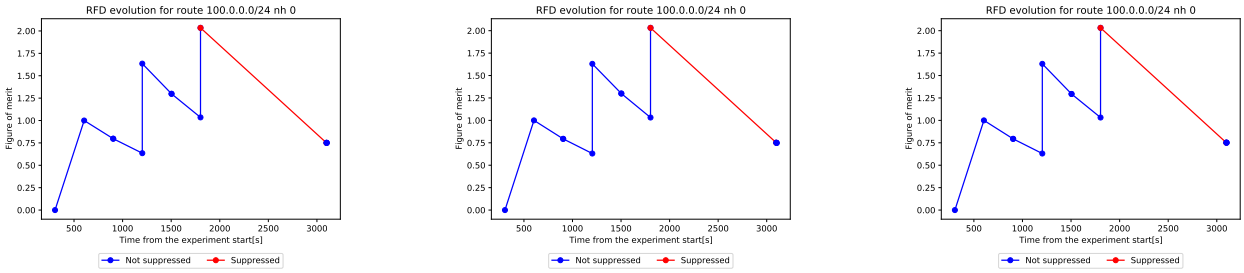
the network to converge faster.

Like we saw in fig. 5 there is a variation on the number of suppression while the MRAI grows considering the previous supposition true we can say that:

While MRAI grows less nodes suppress the route but the convergence time is highly affected by a small subset of the node set that still suppress the destination, causing the huge convergence time.

### 3.2 node 5 evolution

I suppose the node that mostly affect the convergence time of the network is the node 5 that delays the convergence of the node X. The RFD refers to the couple (destination, nh) knowing that the node 5 has a relation with all the other nodes it will keep a data structure in the RFD table for all the possible couples, for this reason I show only the evolution of the figure of merit for the couple (destination, 0) that is the best path for node 5. Lets see in the next figure how node 5 figure of merit evolves with different MRAIs.




(a) MRAI = 0s (b) MRAI = 50s (c) MRAI = 100s

Figure 8: Evolution of the figure of merit in the node X with different MRAIs

Node 5 always block the best path for more or less 1000 seconds. But this suppression happen around 2000 seconds, while node X has already suppressed the route around. But we can see that thanks to the suppression of node 5 around 2000 seconds node X doesn't update anymore it's figure of merit, until it receives another update from node 5 around 3000 seconds.

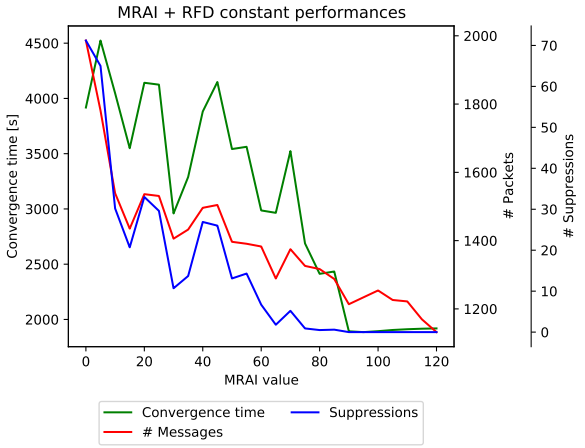
Node X require almost 4000 seconds to converge because of the big fluctuations of node 5 that suffer of the path exploration problem, and the change in the path attribute is considered a bad behaviour by the RFD filter of X.

## 4 RFD made usable?

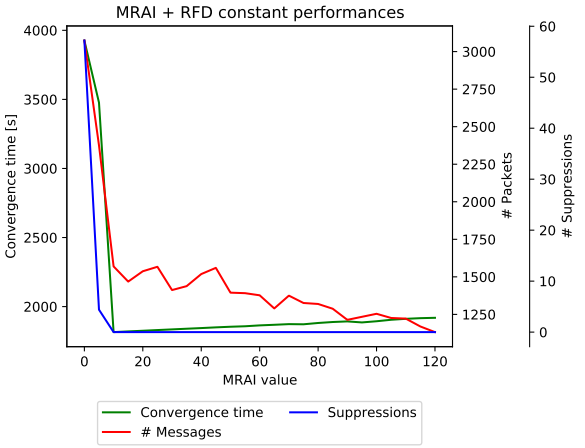
Inside the RFC 7196 is explained that those value of RFD presented in Table 1 are too much restrictive, so they suggest two new approaches.

- Aggressive: suppression threshold at 6.0
- Conservative: suppression threshold at least 12.0

How MRAI affect in those situations? I have done the same clique experiments with also those configurations.




(a) RFD 7196 Aggressive on the clique topology

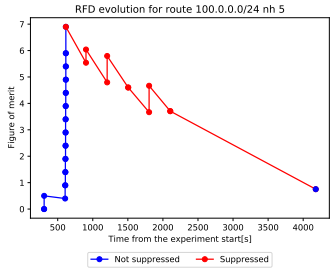



(b) RFD 7196 Conservative on the clique topology

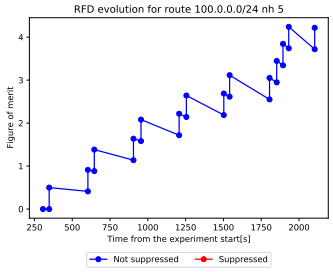
Figure 9: MRAI influence with different RFD thresholds

Is possible to see in Figure 9 that for both RFD configurations the suppression rate change a lot while MRAI grows. we pass from a value of 70/60 suppression to 0 after a certain point. Is also interesting the fact that the convergence time is almost equal to the case where RFD is not applied after a certain threshold. That because if there is no suppression all the nodes ribs converges without unnecessary waiting time.

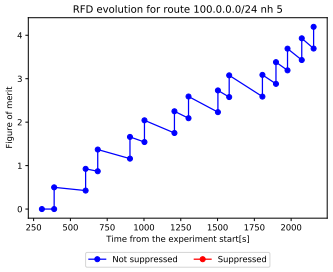
This is also noticeable looking to the figure of merit of the node $x$.




(a) MRAI = 0s, RFD 7196 Aggressive, clique topology




(b) MRAI = 50s, RFD 7196 Aggressive, clique topology




(c) MRAI = 100s, RFD 7196 Aggressive, clique topology

Figure 10: Evolution of the figure of merit in the node X with different MRAIs, with RFD 7196 aggressive in a clique topology

The difference between figs. 10a and 10b is huge, in the first case at the beginning of the figure of merit has a huge spike because of all the attribute changes that node 5 communicate to node $x$. In Figures 10b and 10c is noticeable that node 5 has the time to send a smaller number of messages to $x$, making the figure of merit increase slower.

# 5 RFD 2439 VS RFD 7196

Using also this time the clique topology is possible to compare the results.

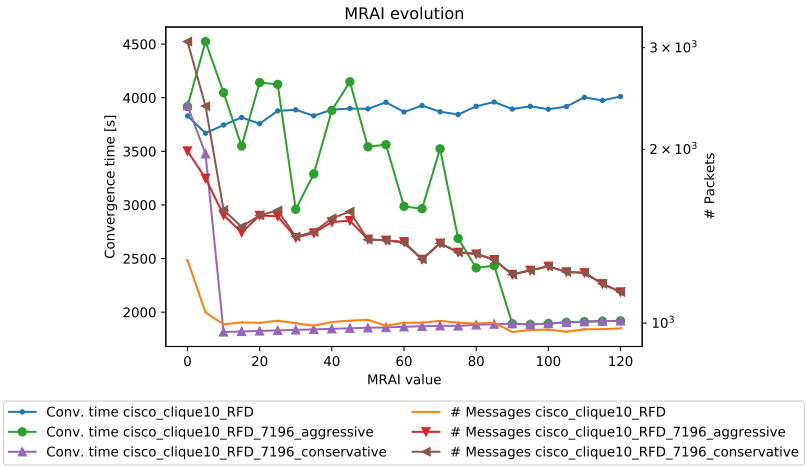
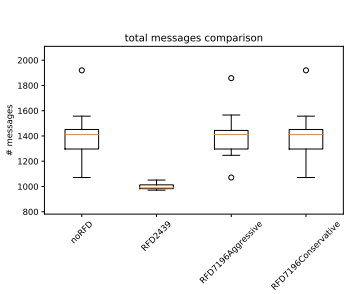
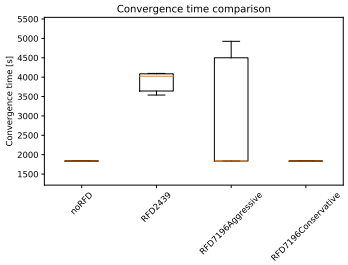



Figure 11: Comparison of the CLIQUE with RFD 2439 and the clique with RFD 7196

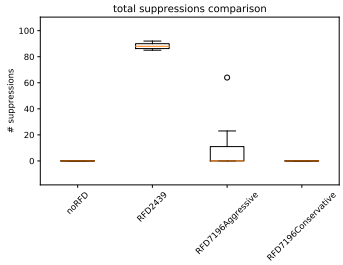
But most of the time in real networks MRAI is left to the default value of 30s how RFD influence the clique network keeping the MRAI value equal to 30s?




(a) clique topology, MRAI=30s, 10 runs, Messages comparison




(b) clique topology, MRAI=30s, 10 runs, Convergence time comparison




(c) clique topology, MRAI=30s, 10 runs, Number of suppressions comparison

Figure 12: Clique topology, MRAI=30s, 10 runs, comparison of the network performances

Is possible to notice that the RFD 7196 Conservative is almost equal as not having RFD at all, that because with an MRAI of 30s, like has been presented in Figure 9b, the number of suppressions is 0. With as strong RFD, like the RFD in the 2439 the number of messages is low but the convergence time and the number of suppressions is completely different from the other cases. In Figure 12a is also noticeable that with the RFD 7196 aggressive the number of messages is similar to other two cases but with a less varaince. This is not the case in the convergence time presented in Figure 12b where with the RFD 7196 aggressive the mean is comparable to not having RFD at all but with the possibility to have a higher time also of the more restrictive RFD.