

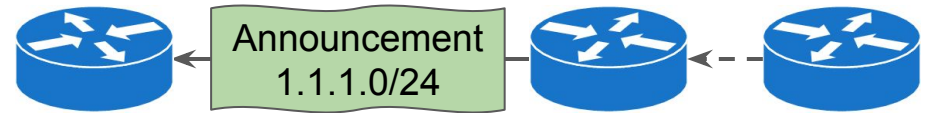
# Route Flap Damping in the Wild?!

RIPE 80 - May 2020

**Clemens Mosig, Randy Bush, Cristel Pelsser,  
Thomas C. Schmidt, Matthias Wählisch**

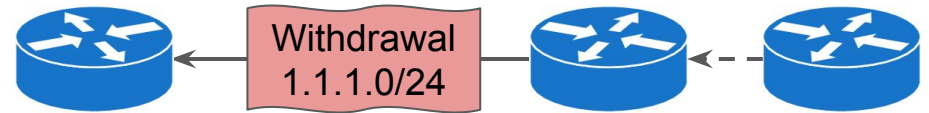
# Motivation: Flapping routes.

Flaky network interfaces



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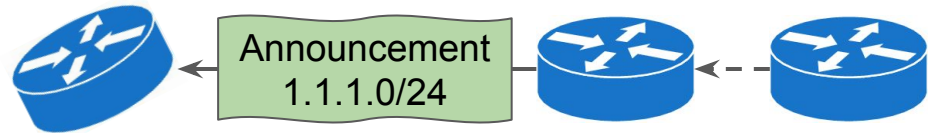
Flaky network interfaces



# Motivation: Flapping routes.

Flaky network interfaces

*Ahhhhh!*  
That's it, I'm out!



# RFD suppresses flapping routes

## Route

10.20.30.0/24

## Flap

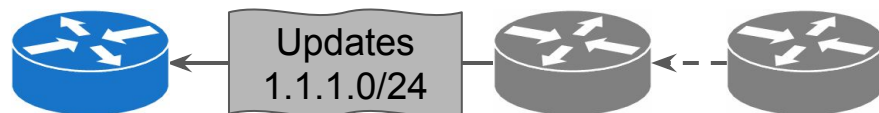


## Damping



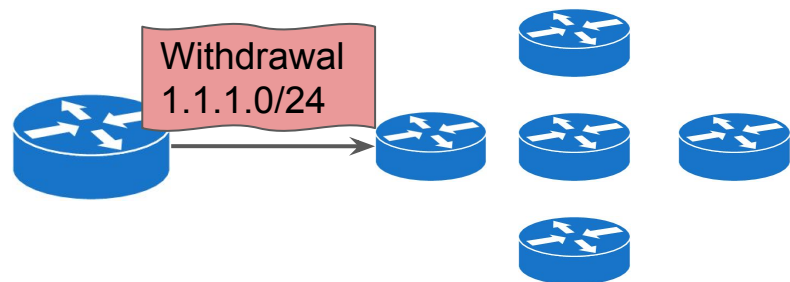
# Oh wait, what about BGP convergence process?

Flaky network interfaces

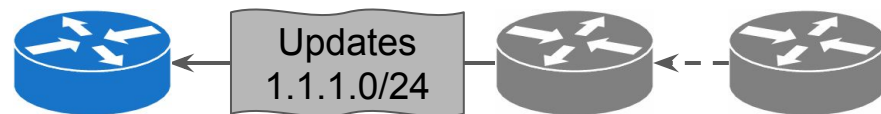


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BGP path hunting

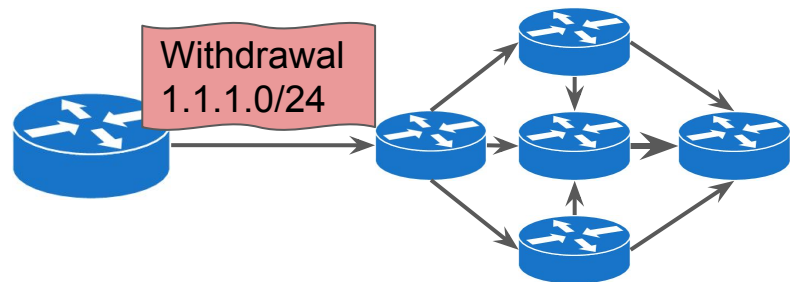


Flaky network interfaces

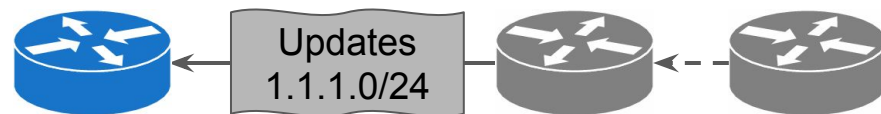


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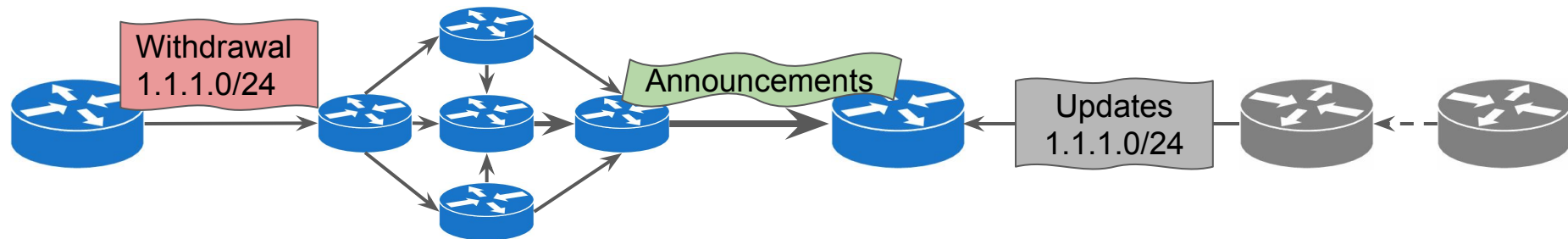




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BGP path hunting

Flaky network interfaces



One Withdrawal can cause several updates distant in topology and trigger Route Flap Damping.

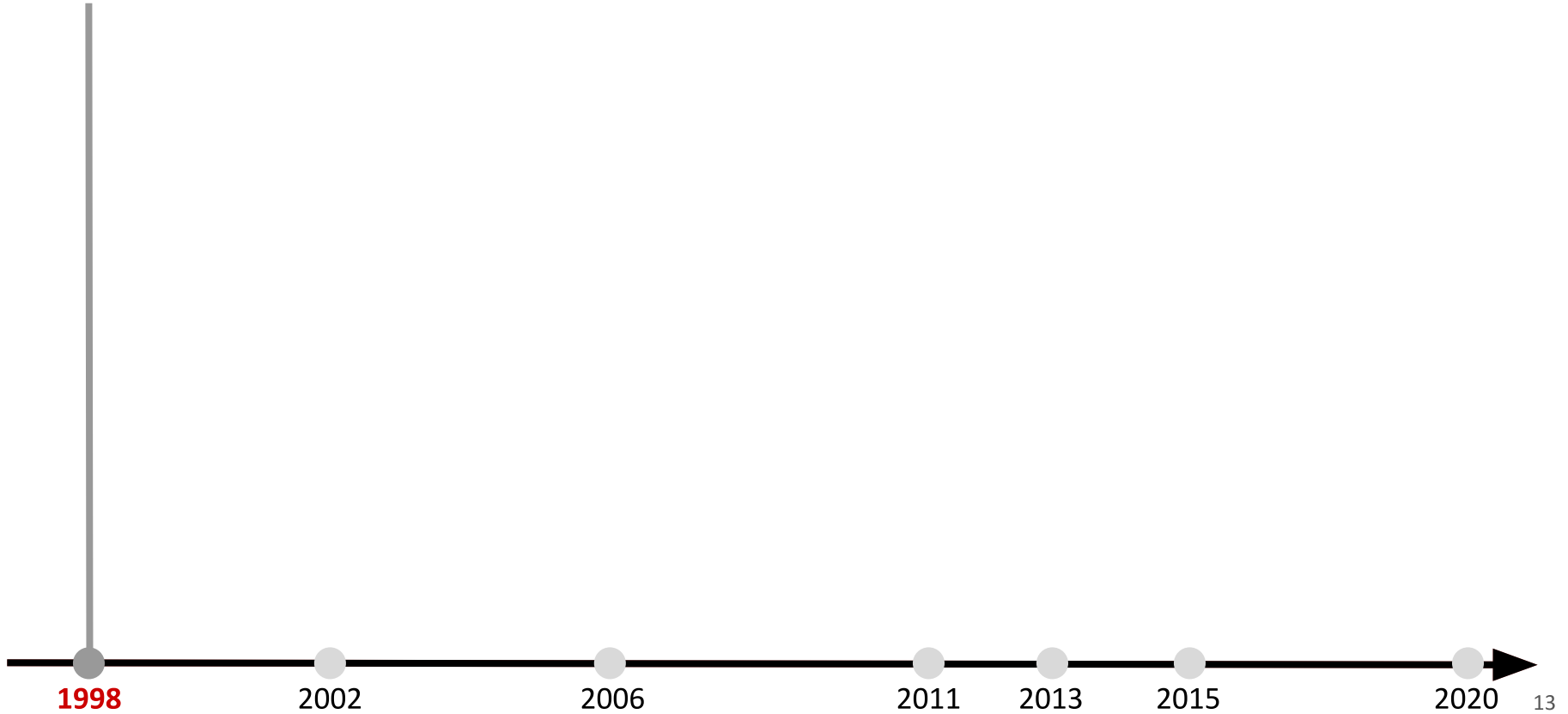
Route Flap Damping is  
controversial!

# What is this talk about? Measuring RFD deployment.

1. Route Flap Damping History.
2. How we detect RFD.
3. Which ASs deploy RFD?
4. Which RFD configurations are used?

Is Route Flap Damping  
recommended?

# RFD originally published in RFC 2439



# RFD originally published in RFC 2439

## Route Flap Damping Exacerbates Internet Routing Convergence

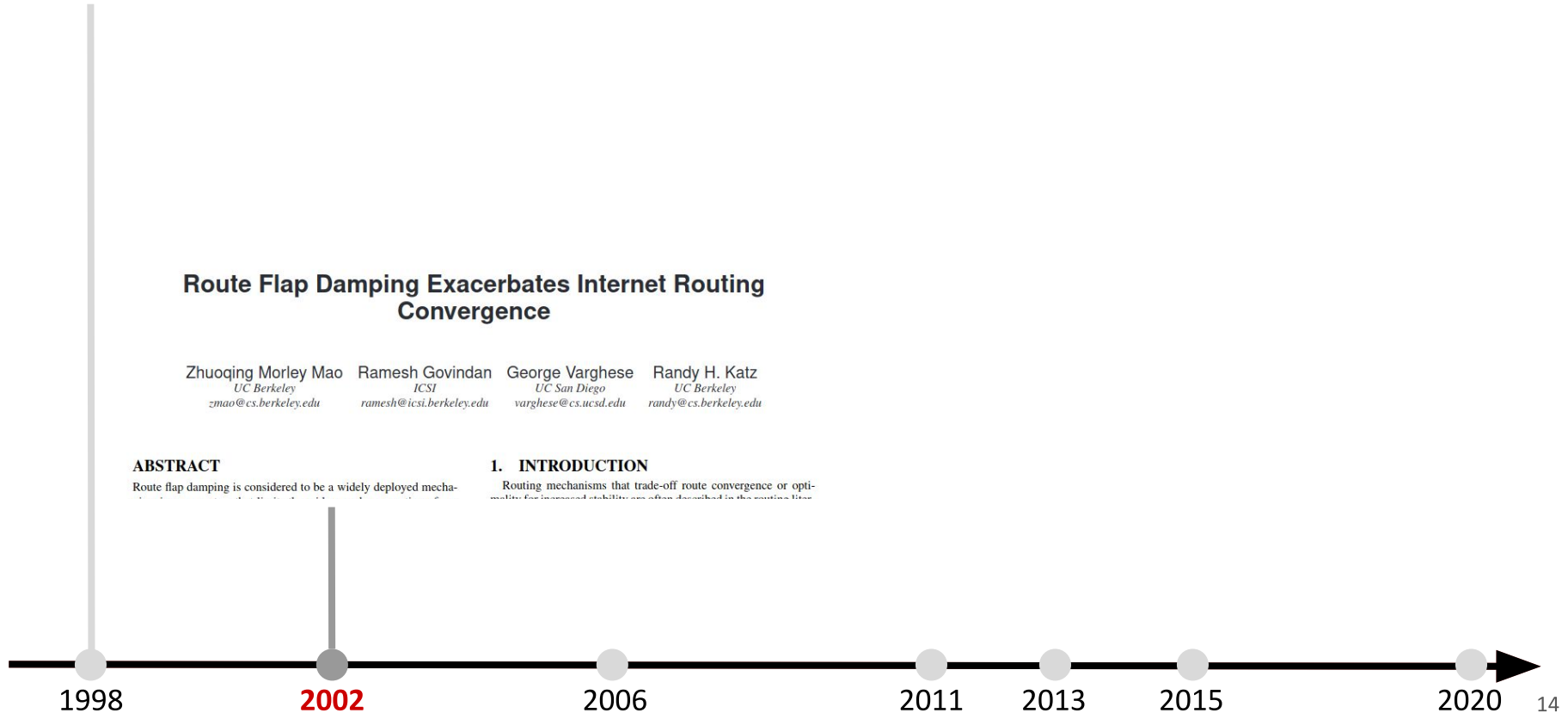
Zhuoqing Morley Mao *UC Berkeley* zmao@cs.berkeley.edu  
Ramesh Govindan *ICSI* ramesh@icsi.berkeley.edu  
George Varghese *UC San Diego* varghese@cs.ucsd.edu  
Randy H. Katz *UC Berkeley* randy@cs.berkeley.edu

### ABSTRACT

Route flap damping is considered to be a widely deployed mecha-

### 1. INTRODUCTION

Routing mechanisms that trade-off route convergence or opti-



RFD originally published in RFC 2439

RIPE-378 recommends disabling RFD as reaction to Maos' paper.

### Route Flap Damping Exacerbates Internet Routing Convergence

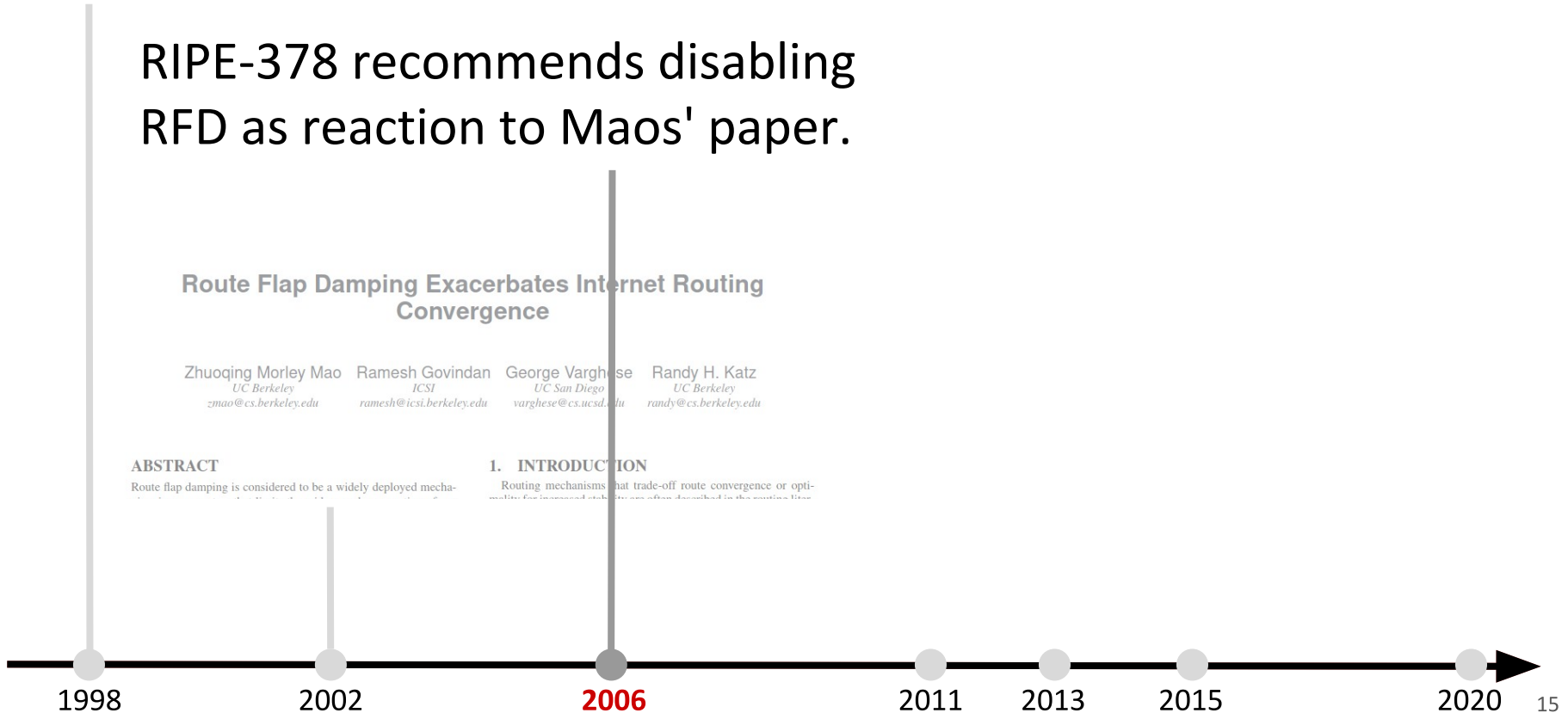
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#### ABSTRACT

Route flap damping is considered to be a widely deployed mechanism for stabilizing the Internet routing system. This paper shows that RFD can exacerbate convergence problems in the Internet routing system.

#### 1. INTRODUCTION

Routing mechanisms that trade-off route convergence or optimality for increased stability are often described in the routing literature as "route flap damping" (RFD). This paper shows that RFD can exacerbate convergence problems in the Internet routing system.



RFD originally published in RFC 2439

RIPE-378 recommends disabling RFD as reaction to Maos' paper.

### Route Flap Damping Exacerbates Internet Routing Convergence

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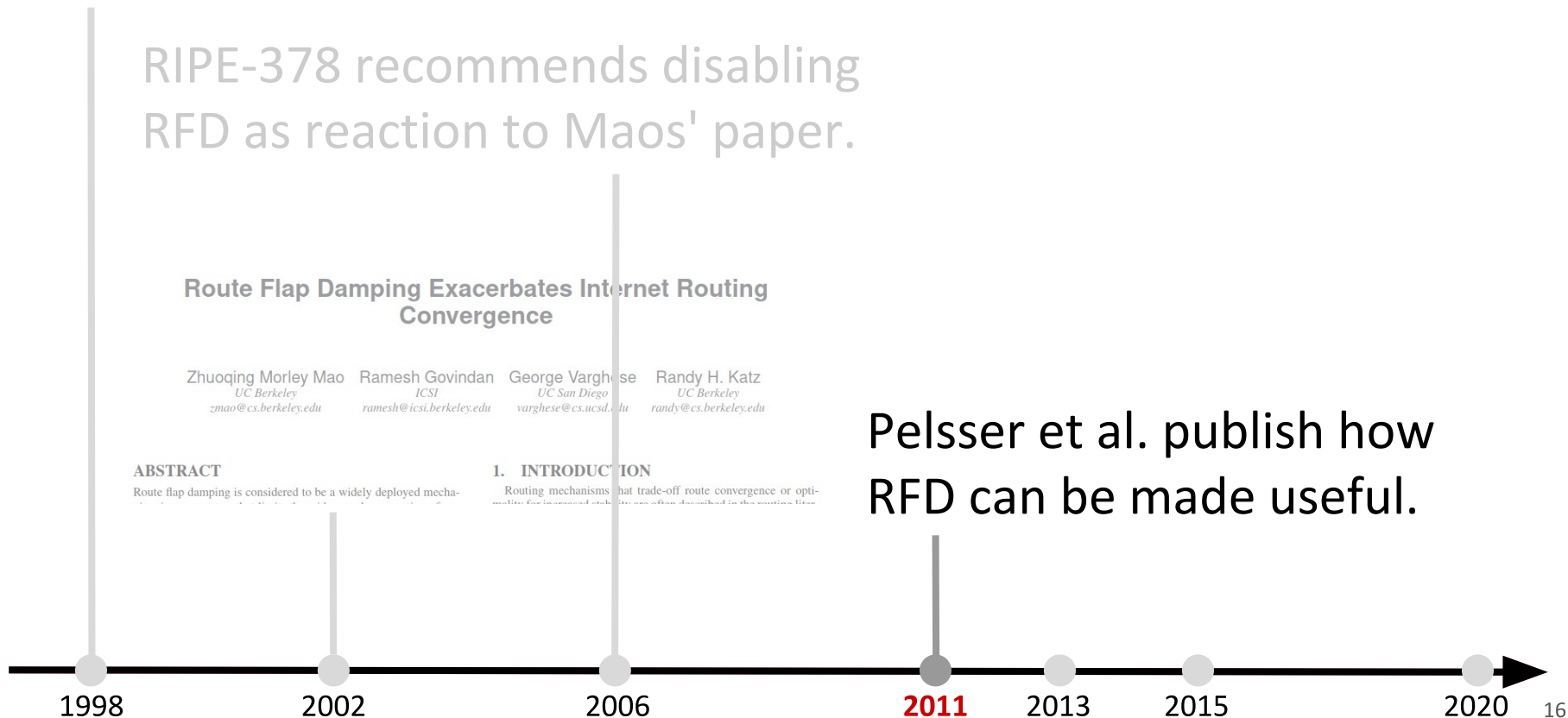
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Route flap damping is considered to be a widely deployed mechanism for reducing the impact of routing changes on the network.

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Pelsser et al. publish how RFD can be made useful.





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**Route Flap Damping Exacerbates Internet Routing Convergence**

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**ABSTRACT**

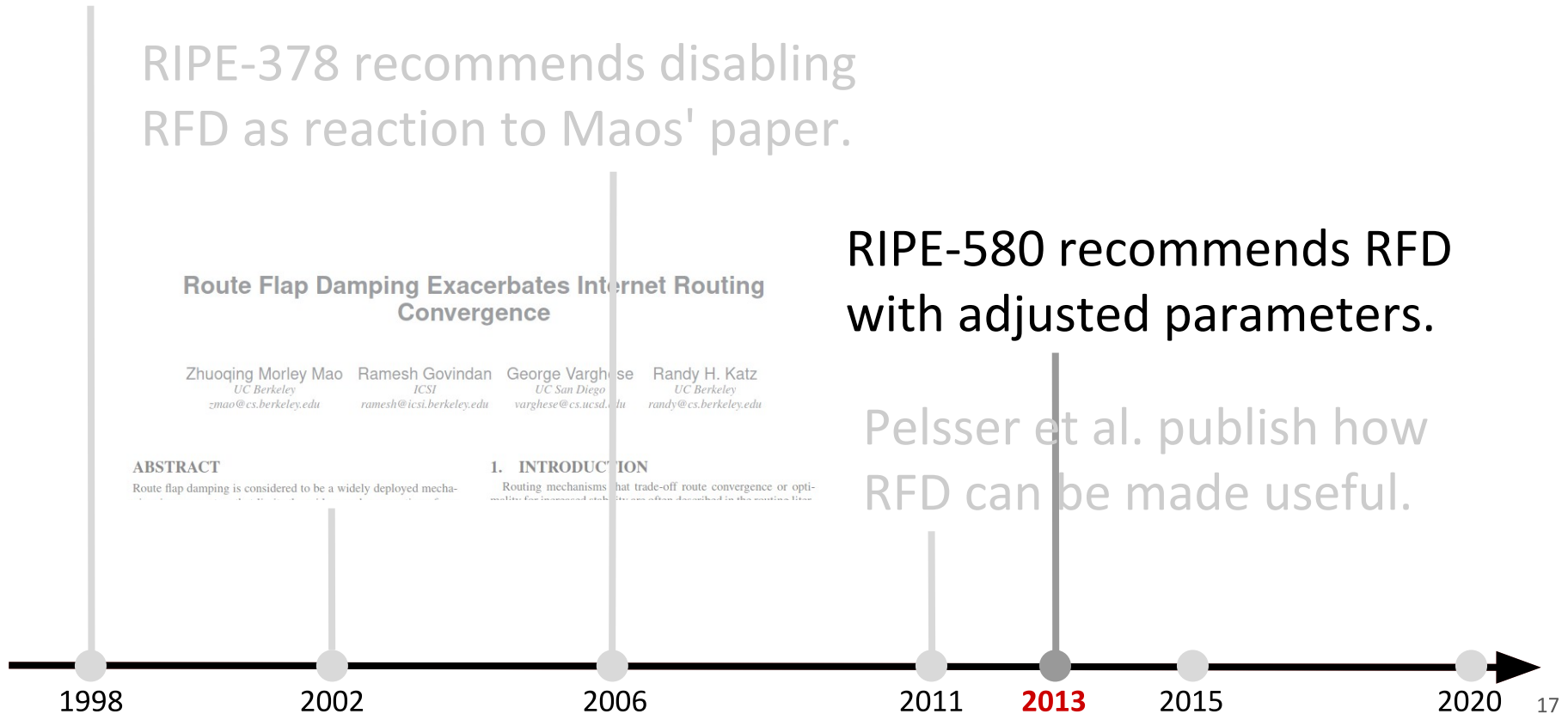
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**1. INTRODUCTION**

Routing mechanisms that trade-off route convergence or optimality for increased stability are often described in the routing literature.

RIPE-580 recommends RFD with adjusted parameters.

Pelsser et al. publish how RFD can be made useful.



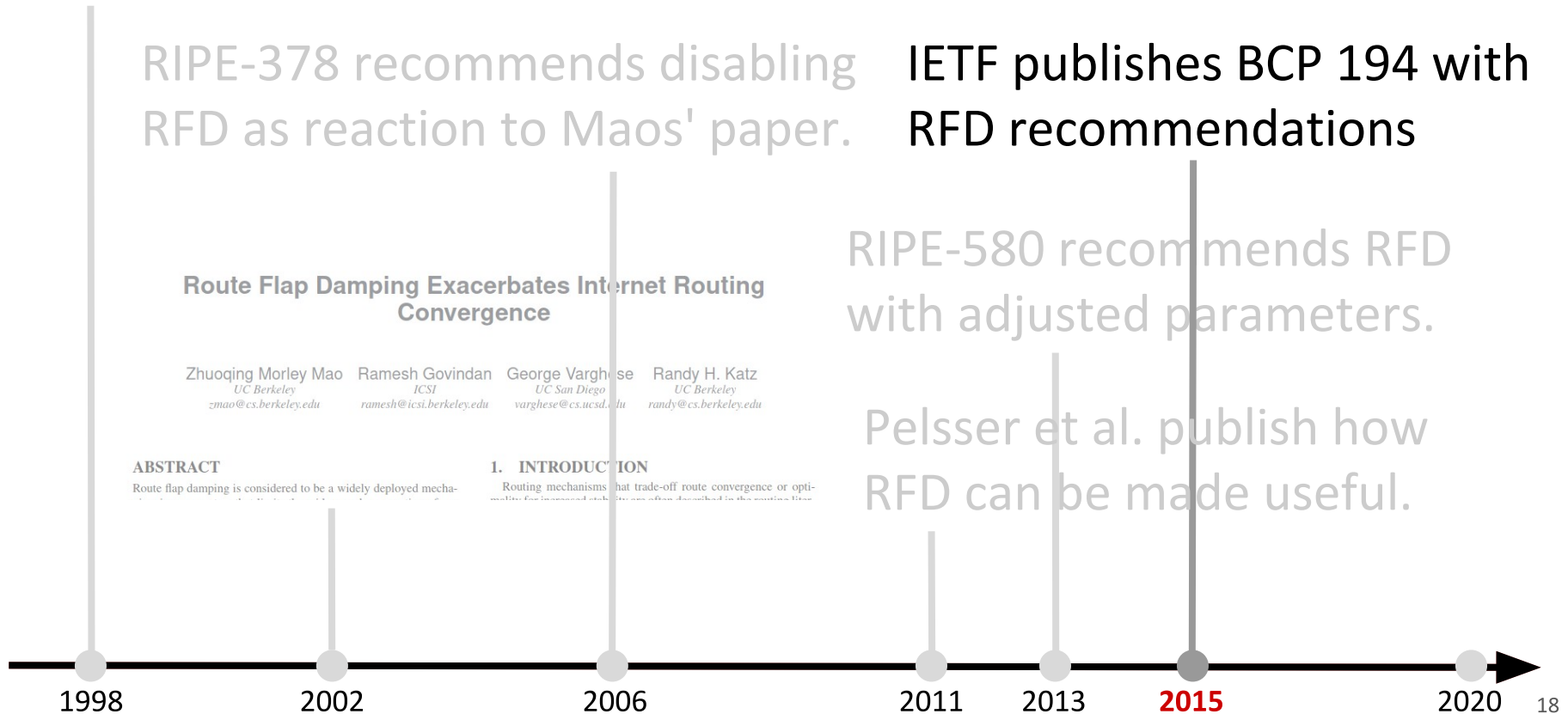
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RIPE-378 recommends disabling RFD as reaction to Maos' paper.

IETF publishes BCP 194 with RFD recommendations

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RFD originally published in RFC 2439

RIPE-378 recommends disabling RFD as reaction to Maos' paper.

IETF publishes BCP 194 with RFD recommendations

# We are measuring deployment of Route Flap Damping.

## Route Flap Damping Exacerbates Internet Routing Convergence

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### ABSTRACT

Route flap damping is considered to be a widely deployed mechanism for

### 1. INTRODUCTION

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with adjusted parameters.

Pelsser et al. publish how RFD can be made useful.



# Why should you care about RFD deployment?

Many **different recommendations** in the past.

Different configurations may lead to conflicting goals.

Deprecated default **parameters affect Internet reachability.**

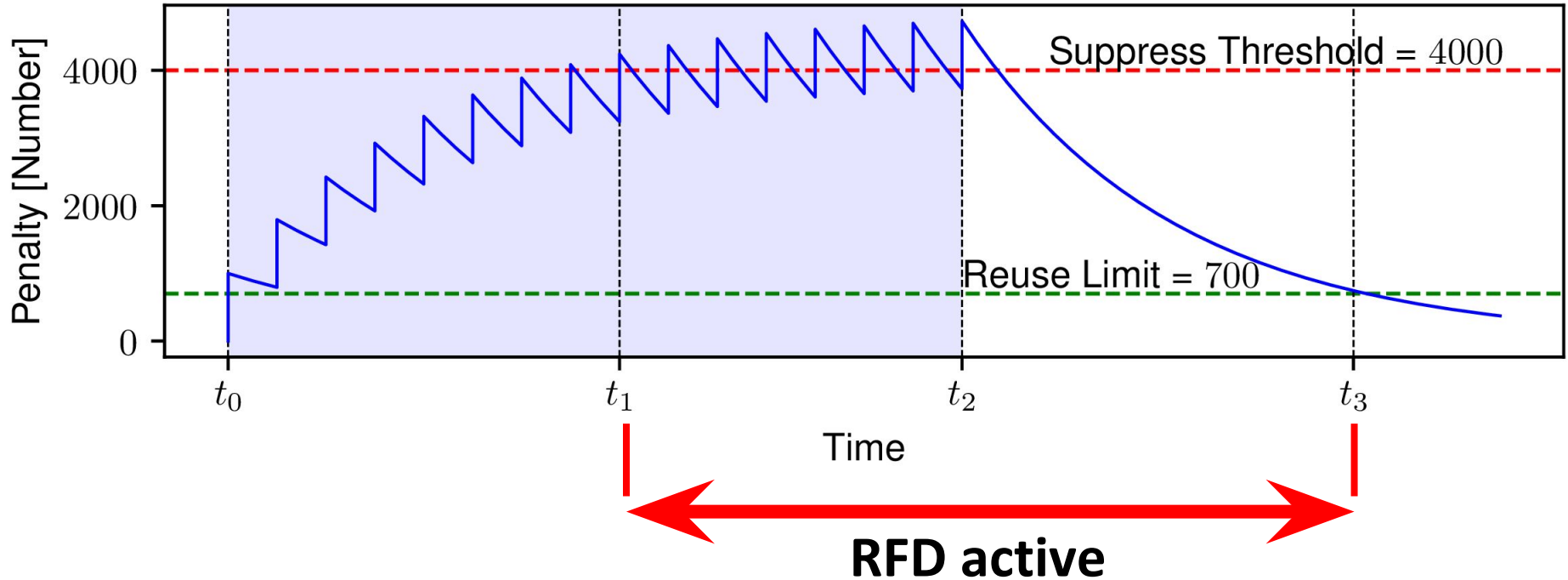
Especially in today's rich topology.

RFD **impacts** passive and active BGP **measurements.**

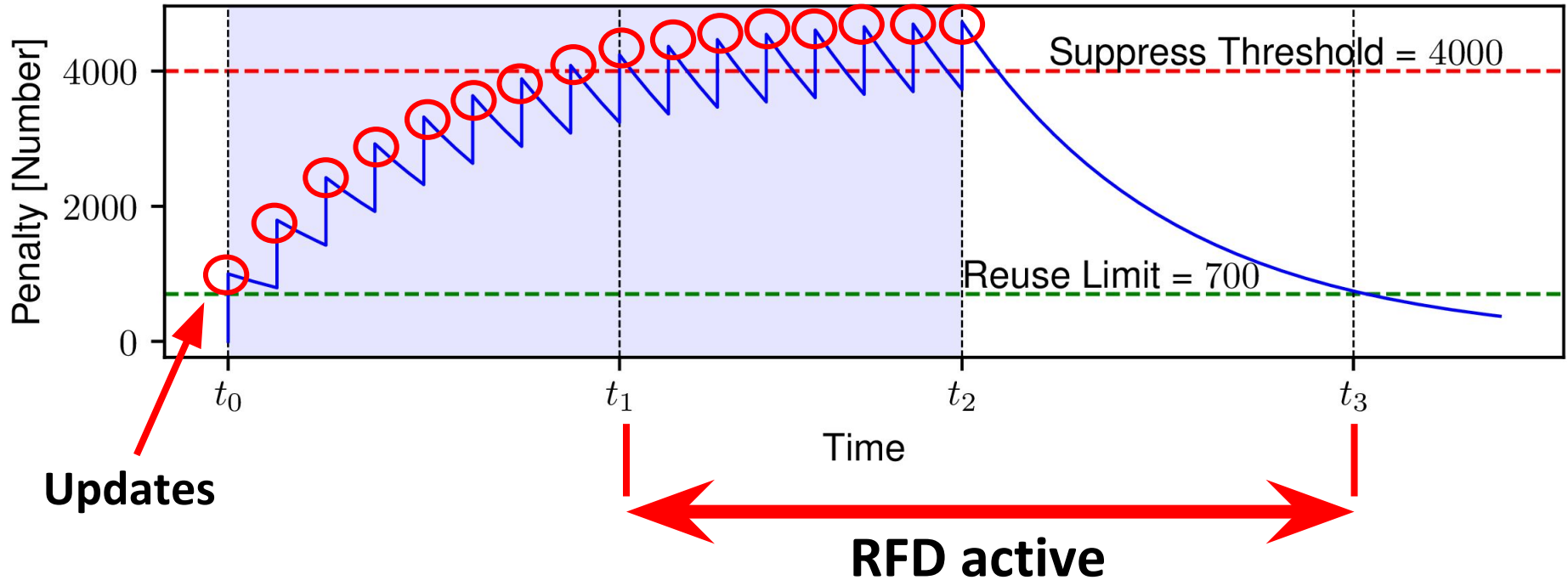
Current results on BGP Update noise may be an underestimation.

Let us measure deployment of RFD.

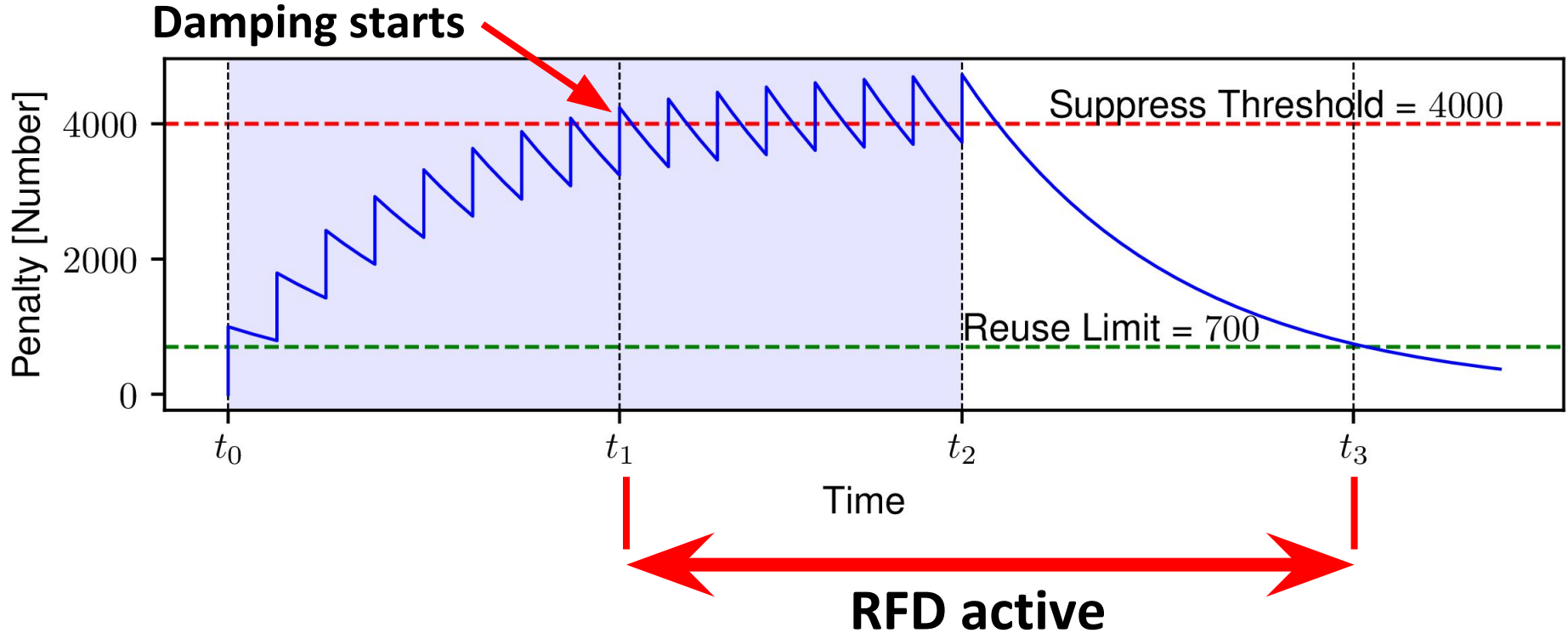
# How does Route Flap Damping work?



# How does Route Flap Damping work? AIMD Principle.

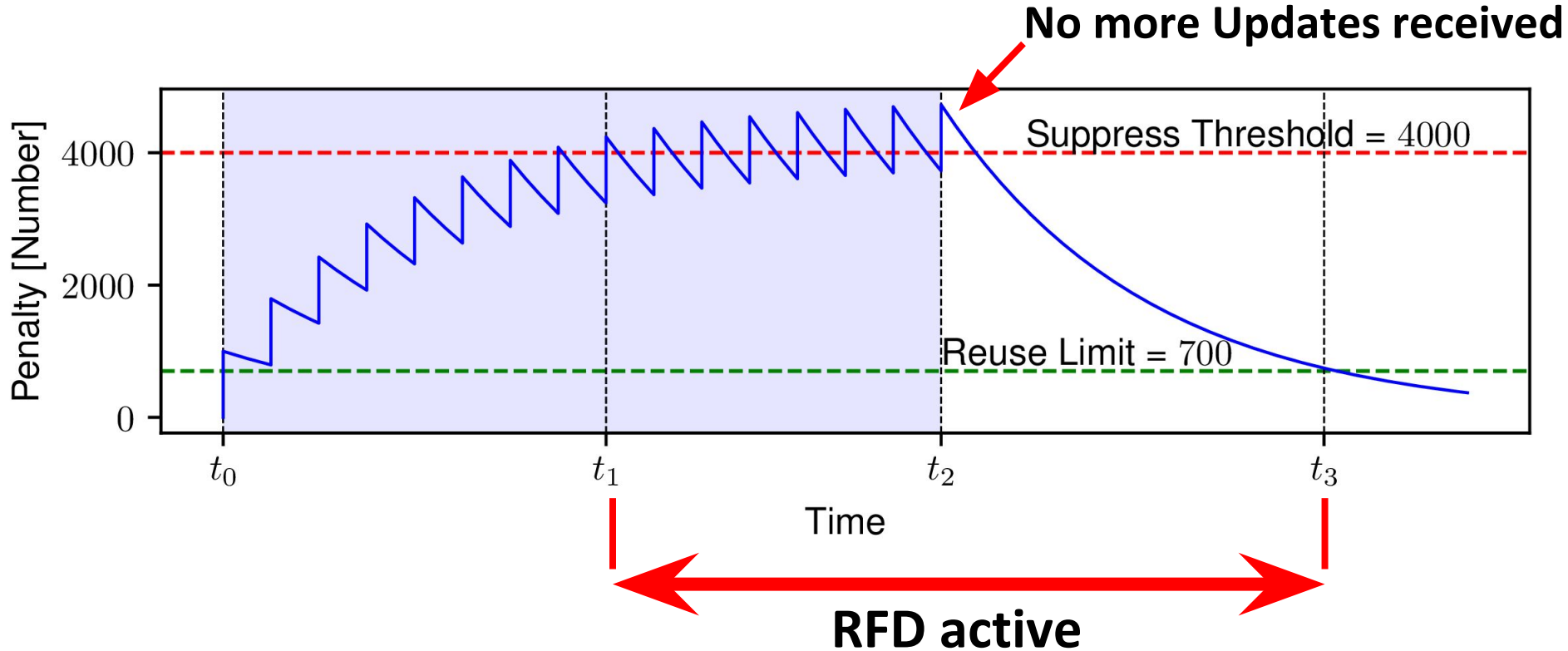


# How does Route Flap Damping work? Start.

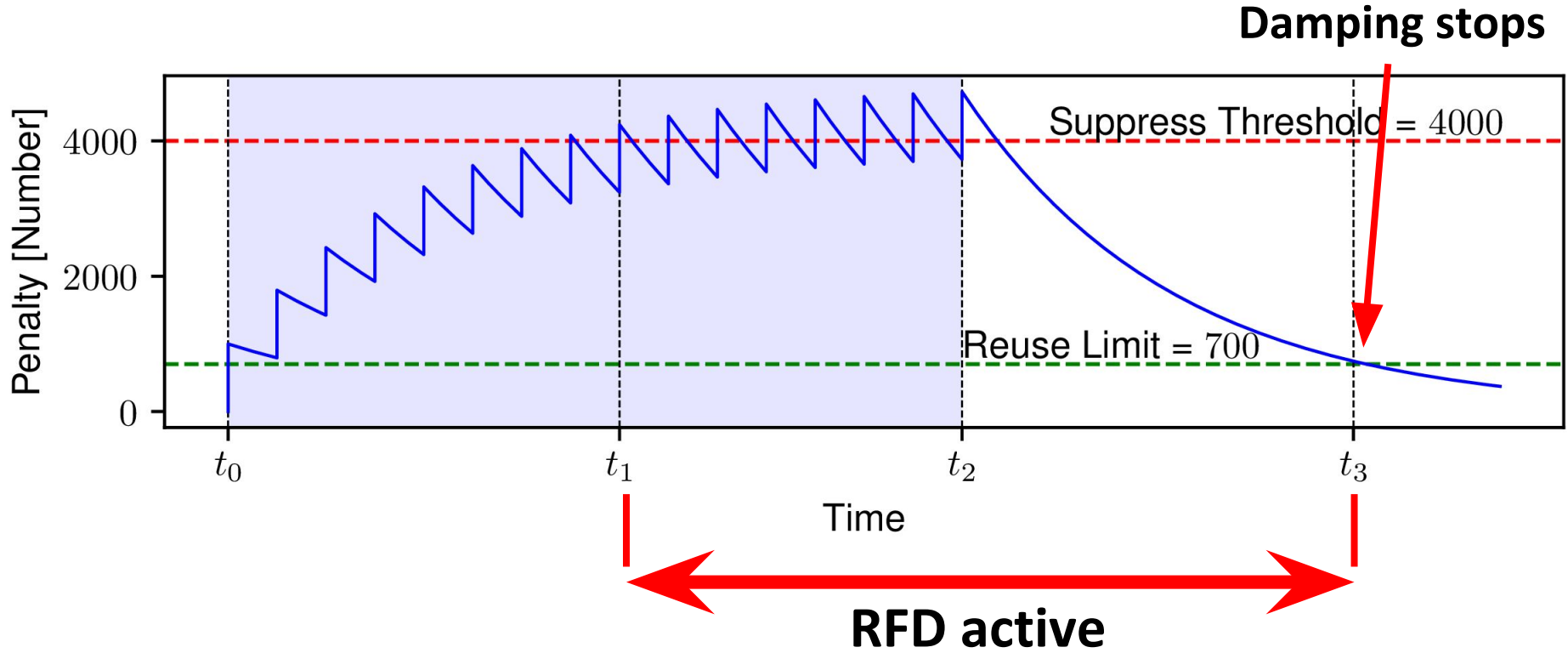




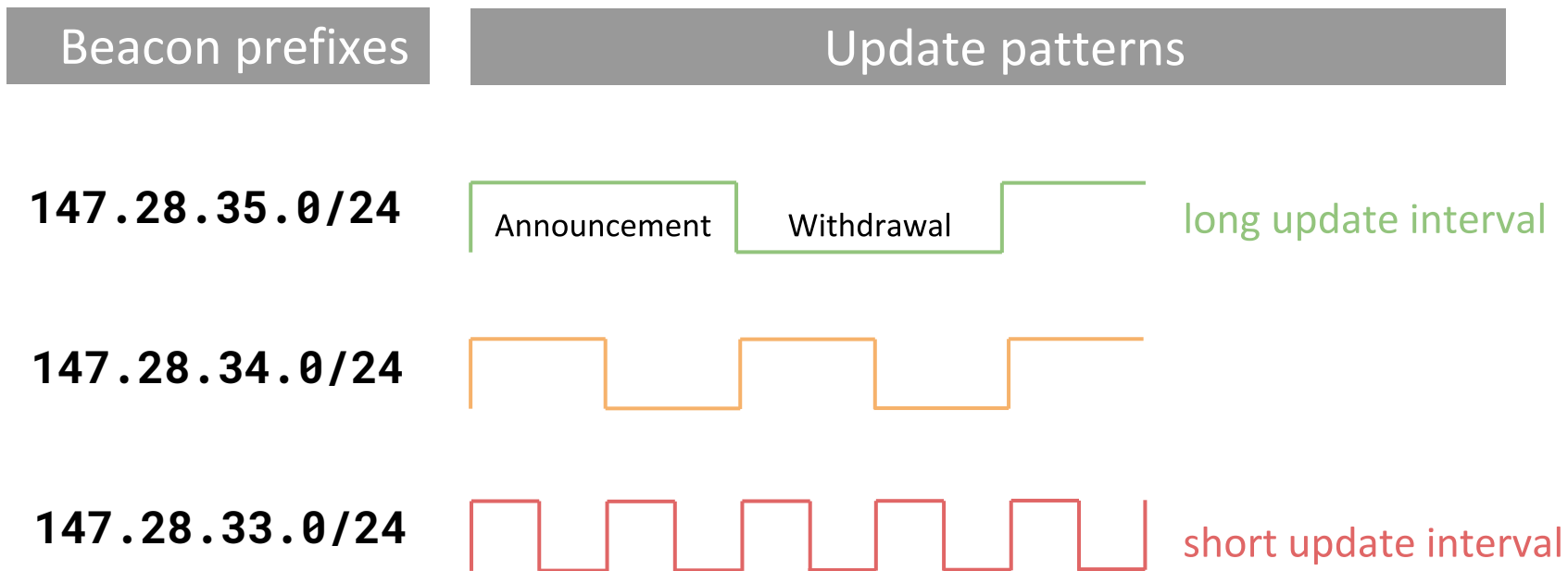
# How does Route Flap Damping work? Wait.



# How does Route Flap Damping work? Release.

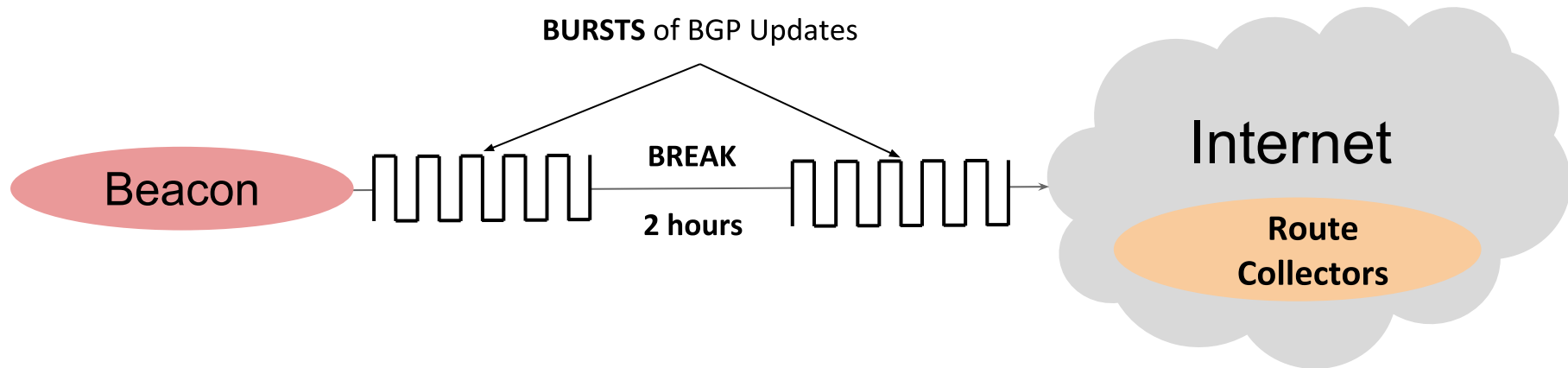


# BGP Beacons with different frequencies



Details see <https://rfd.rg.net/beacons.html>

# Sending Burst and Breaks



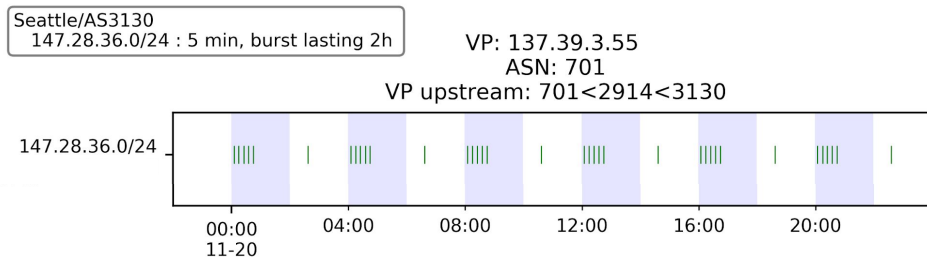
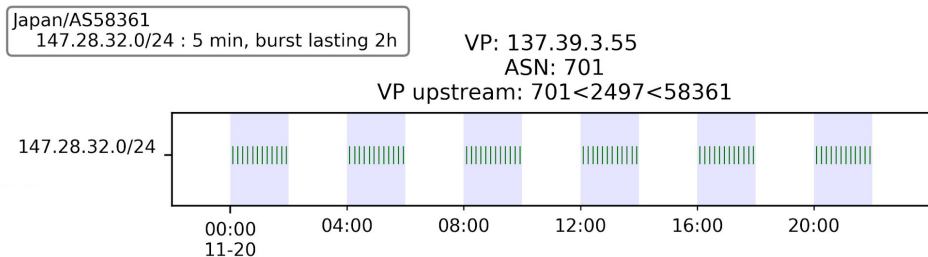
**BGP Update Bursts TRIGGER RFD** somewhere on the Internet

**Breaks RESET** the **PENALTY** for our prefixes in routers to 0.

RFD causes a very recognizable pattern.

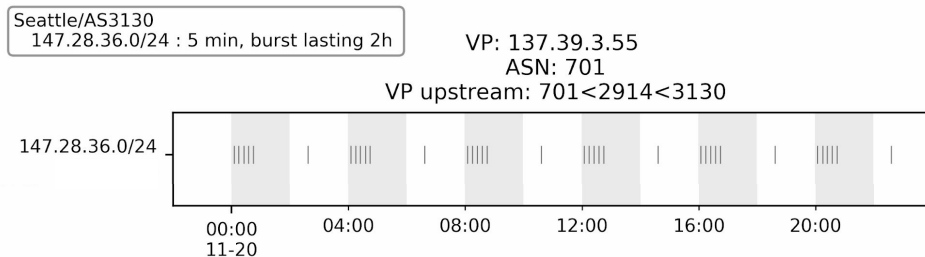
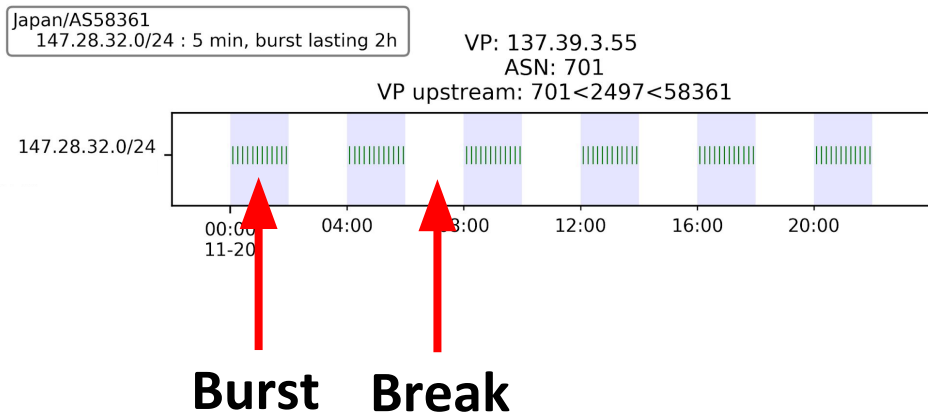
# View from a Vantage Point

Our prefixes are damped during the Burst (Blue) and re-advertised during the Break (White).



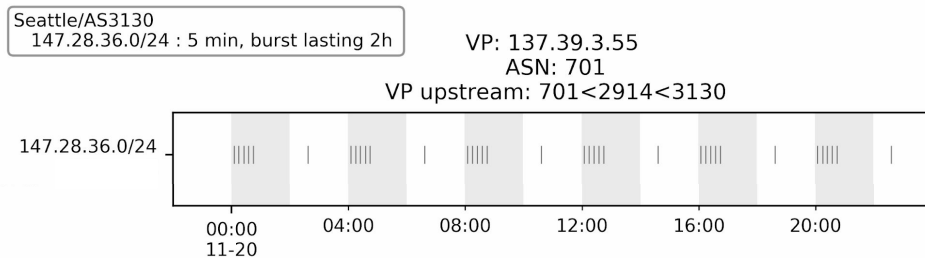
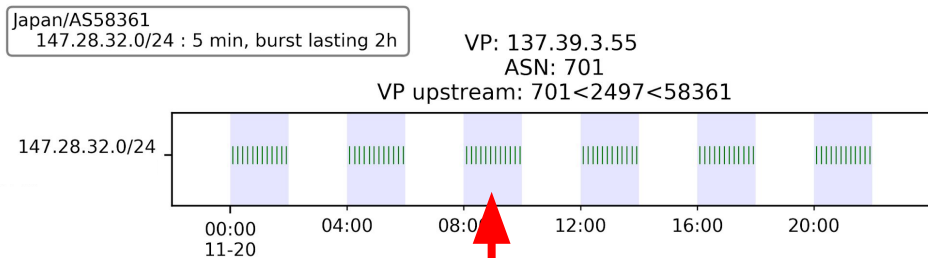
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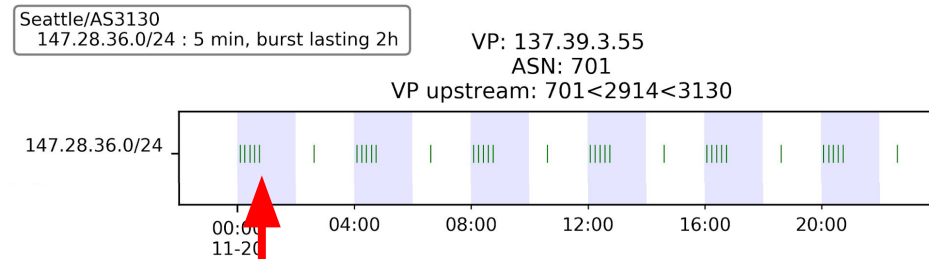
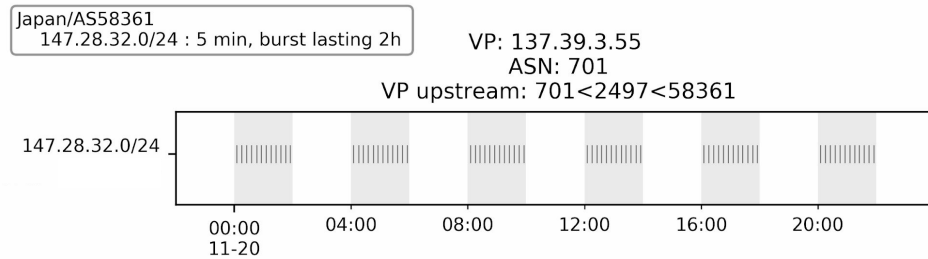


**NO Route Flap Damping**



# View from a Vantage Point

Our prefixes are damped during the Burst (Blue) and re-advertised during the Break (White).



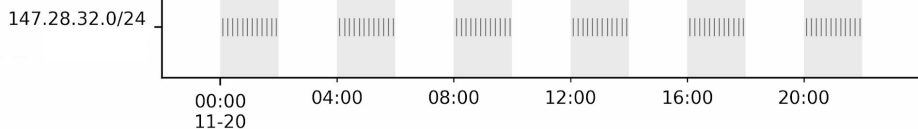
**Signal Stops**

# View from a Vantage Point

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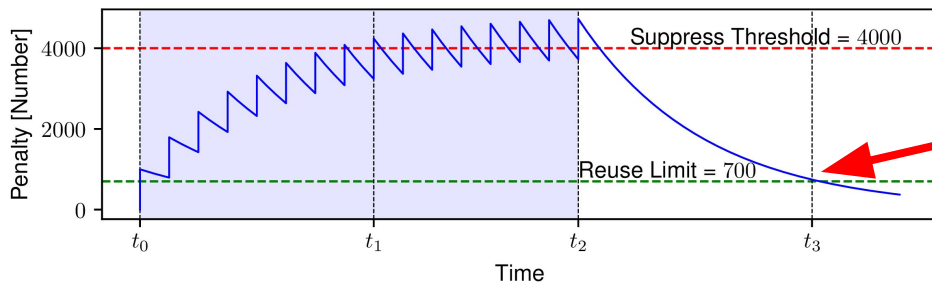
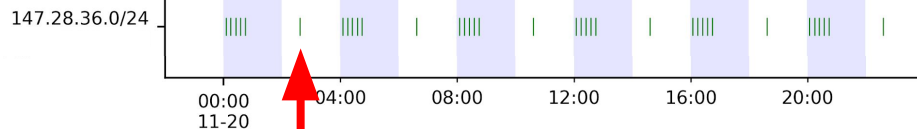
Japan/AS58361  
147.28.32.0/24 : 5 min, burst lasting 2h

VP: 137.39.3.55  
ASN: 701  
VP upstream: 701<2497<58361



Seattle/AS3130  
147.28.36.0/24 : 5 min, burst lasting 2h

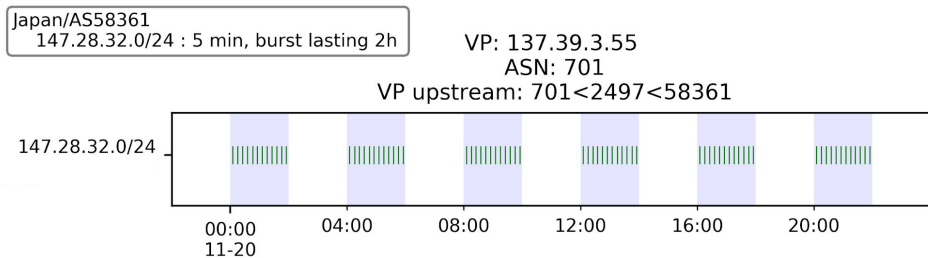
VP: 137.39.3.55  
ASN: 701  
VP upstream: 701<2914<3130



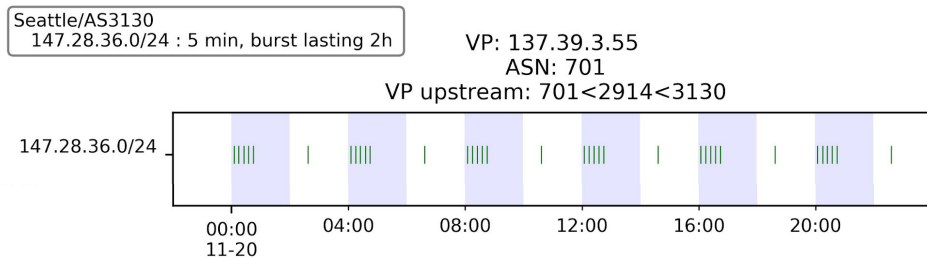
**Re-advertisement**

# View from a Vantage Point

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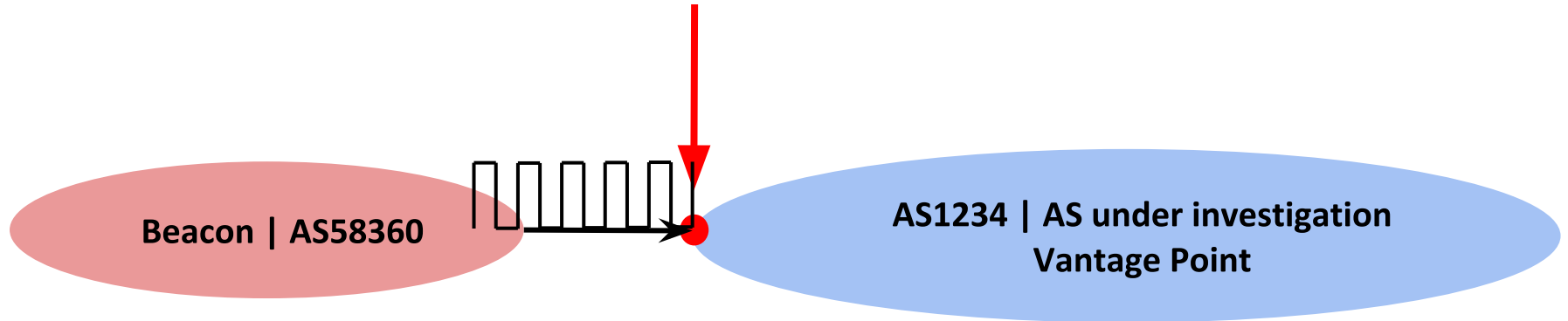
**NO Route Flap Damping**



**Route Flap Damping**

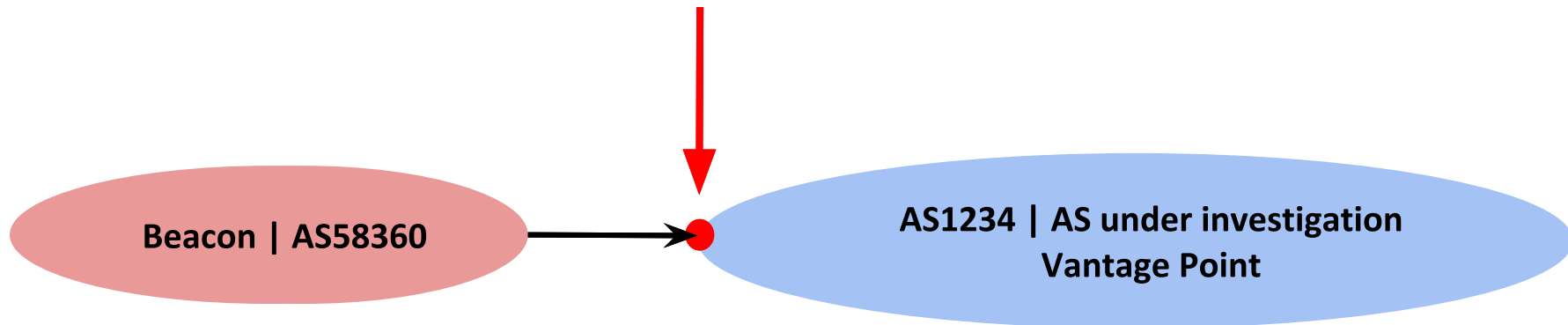
# Utopian Solution

With this setup we are able to tell whether this border router uses RFD.



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There are 60,000 ASs on the Internet.  
We cannot setup this many Beacons and VPs! :(

We sent Beacons from 7 different locations.

# Locations of our BGP Beacons

Bangkok, TH

Johannesburg, ZA

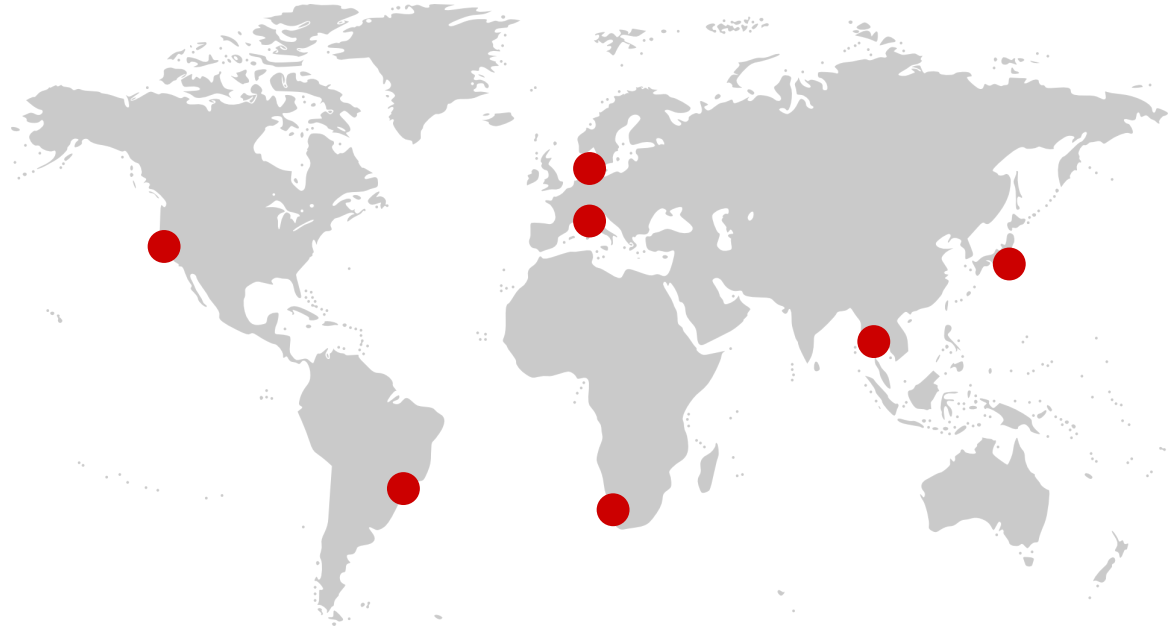
København, DK

München, DE

São Paulo, BR

Seattle, US

Tokyo, JP



# Locations of our BGP Beacons

Bangkok, TH

Johannesburg, ZA

**Many thanks to the operators who host our Beacons :)!**

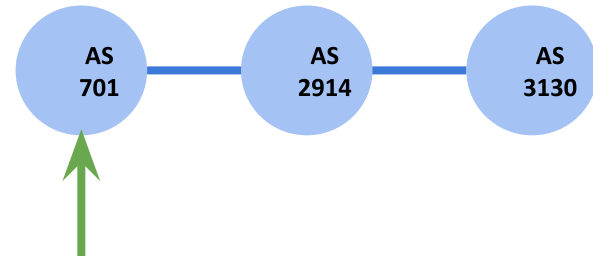
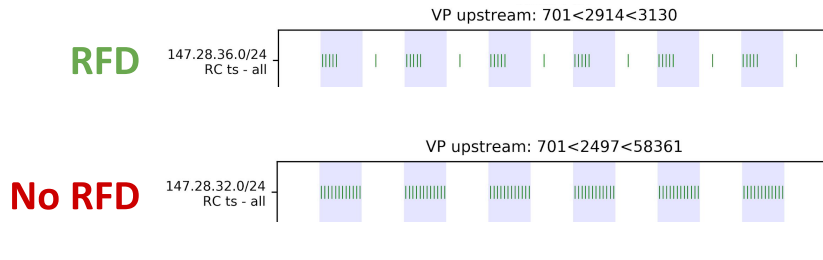
São Paulo, BR

Seattle, US

Tokyo, JP



# We analyze updates from route collectors by Isolario, RIPE RIS, and Routeviews.



# Challenges

- 1) If we find the Route Flap Damping pattern at some vantage points, **the damper could be anywhere on the AS path** between the vantage point and the Beacon.
- 2) Some ASs use **Route Flap Damping selectively** on a subset of neighbors.
- 3) BGP is an excellent **information hiding protocol**.

We have developed a **heuristic** to determine which AS is using Route Flap Damping on the Internet.

# Our heuristic is based on three principles

## 1: Signal Ratio

Relative occurrences of an AS on a path showing Route Flap Damping signal.

## 2: Alternative Paths

Damped routes are withdrawn.  
Neighboring AS may announce alternative paths to vantage point.

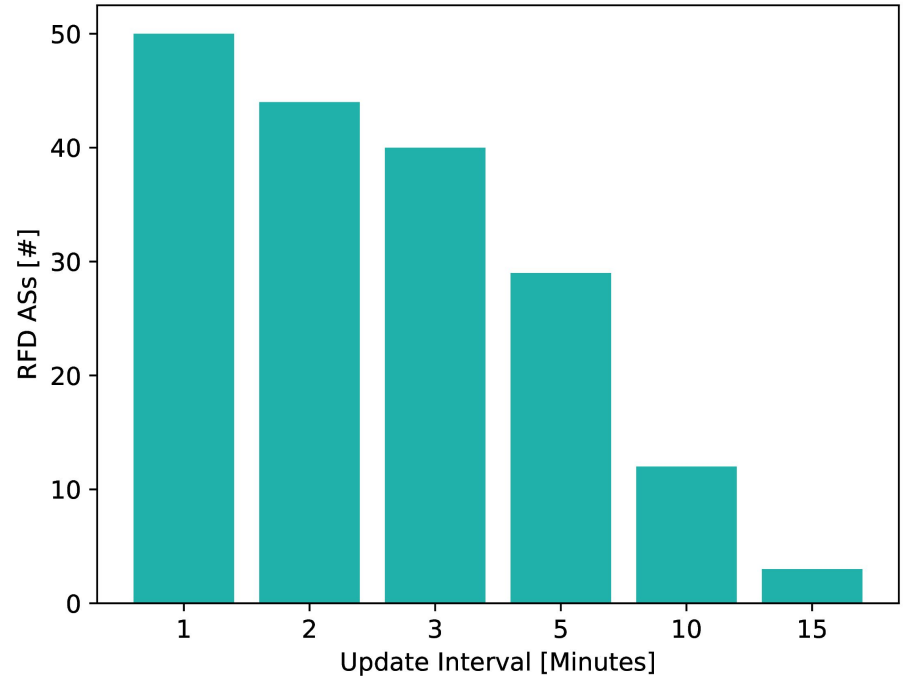
## 3: Update Distribution

On average, damping ASs should send fewer updates towards the end of the burst.

# How many ASs are damping?

**Small ISPs** as well as **Tier 1 providers** such as Telia utilize Route Flap Damping.

At least **8% of 610 measured ASs** are using Route Flap Damping.



# Which RFD parameters are deployed?

Most ASs use **deprecated** vendor default configurations.

This could be you!

# Some ASs report usage of RFD in whois records.

Most ASs are referencing RIPE-229, which is the  
(outdated) recommendation from 2001.

```
$ whois AS...
```

```
-----  
remarks:  
remarks:   Applied Route Flap Damping Policy conformant to RIPE-229  
remarks:  
remarks:  
-----
```

# Validating Results

To validate our findings we contacted all identified RFD ASs.

We have **received replies from 27 ASs** and we have 1 false positive. Most ASs are using vendor default parameters!



## Expectation

vs.

## Reality

- The networking community thinks **RFD is rarely used**
- **IETF + RIPE recommendation** are used in practise

- **RFD is not uncommon** - multiple Tier 1 providers use RFD
- Most ASs use deprecated default **values from 2001**

# Lessons learned

RFD is used on the Internet.

Tier1 provider as well as small ISPs  
deploy RFD.

Most vendors provide deprecated,  
harmful default configurations. Most  
ASs use them.

# Recommendations to you!

Thank you!

1. Check the **configurations of your routers** whether you have unpurposely enabled RFD.
2. Check whether your **whois entries** are up to date.
3. Consider using **recommended parameters** (adjusting suppress-threshold) or disabling RFD.

See <https://www.ripe.net/publications/docs/ripe-580>

# You do want to help improving our results?

Give feedback on our results!

Confirm our observations, send us your RFD configuration ;) ...

<https://rfd.rg.net> | **[clemens.mosig@fu-berlin.de](mailto:clemens.mosig@fu-berlin.de)**