Route Flap Dampening

- **Route flap**
  - **Going up and down of path or change in attribute**
    - **BGP UPDATE followed by WITHDRAW = 1 flap**
    - **eBGP neighbour going down/up is NOT a flap**
  - **Ripples through the entire Internet**
  - **Wastes CPU**
- **Dampening aims to reduce scope of route flap propagation**

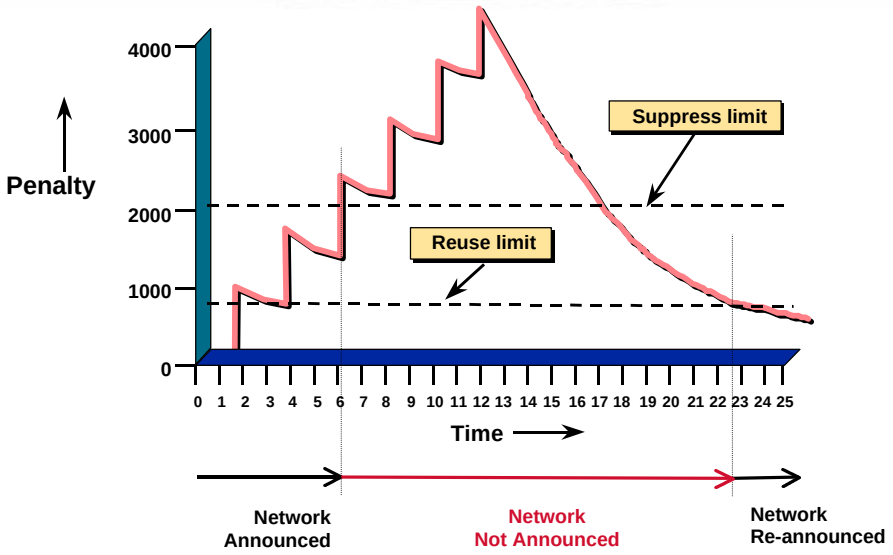
Route Flap Dampening (Continued)

- Requirements
  - Fast convergence for normal route changes
  - History predicts future behaviour
  - Suppress oscillating routes
  - Advertise stable routes
- Described in RFC2439

Route Flap Dampening Operation

- Add penalty for each flap
- Exponentially decay penalty
  - half life determines decay rate
- Penalty above suppress-limit
  - do not advertise route to BGP peers
- Penalty decayed below reuse-limit
  - re-advertise route to BGP peers

Route Flap Dampening



Route Flap Dampening Operation

- Only applied to inbound announcements from eBGP peers
- Alternate paths still usable
- Controlled by:
  - Penalty of 1000 per flap
  - Half-life (default 15 minutes)
  - reuse-limit (default 750)
  - suppress-limit (default 2000)
  - maximum suppress time (default 60 minutes)

Configuring Route Flap Dampening

Fixed dampening

```
router bgp 100
 bgp dampening [<half-life> <reuse-value> <suppress-
  penalty> <maximum suppress time>]
```

Selective and variable dampening

```
 bgp dampening [route-map <name>]
  route-map <name> permit 10
   match ip address prefix-list FLAP-LIST
   set dampening [<half-life> <reuse-value>
 <suppress-penalty> <maximum suppress time>]
ip prefix-list FLAP-LIST permit 192.0.2.0/24 le 32
```


Route Flap Dampening Operation

- **BGP WITHDRAW message received**
  - **penalty on prefix increased by 1000**
  - **prefix is marked as having flap history**
- **BGP UPDATE message received**
  - **if penalty > suppress-limit, prefix is not announced to any BGP peers and is marked as suppressed**
- **If prefix carries on flapping after being suppressed, penalty is incremented and decayed as normal**

Route Flap Dampening Operation

- Once prefix is stable, it will be suppressed according to the decay rate given by the half life time
- Penalty value is decayed every 5 seconds
  - Decay rate is same whether prefix is or is not in the BGP table
- Once penalty reaches reuse-limit, prefix is reannounced
- Once penalty is less than half reuse-limit, penalty is reset to zero

Route Flap Dampening Operation

- Example - IOS defaults
  - bgp dampening 15 750 2000 60
    - half-life of 15 minutes
    - reuse-limit of 750 and suppress time of 60 minutes means maximum possible penalty of 12000
    - once prefix stops flapping, penalty is decayed from a maximum possible value of 12000 to 750 - this will take 60 minutes
    - once penalty reaches 375, it is reset to zero

Route Flap Dampening Operation

- Care required when setting parameters
- Penalty must be less than reuse-limit at the maximum suppress time
- Maximum suppress time and half life must allow penalty to be larger than suppress limit
- Decay rate pre-calculated when flap dampening configured

  numbers must be feasible, IOS does not check

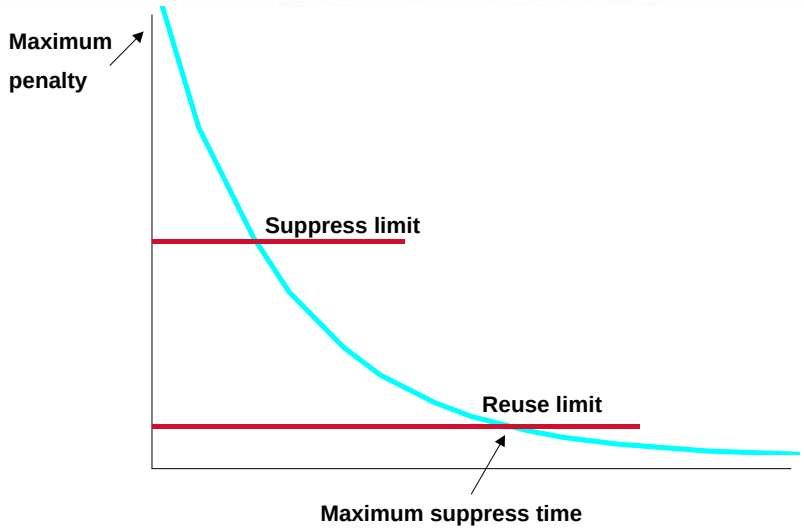
Route Flap Dampening Maths!

- Maximum value of penalty is

$$\text{max-penalty} = \text{reuse-limit} \times 2^{\left(\frac{\text{max-suppress-time}}{\text{half-life}}\right)}$$

- Always make sure that suppress-limit is LESS than max-penalty otherwise there will be no route dampening

Route Flap Dampening Setting Parameters



Route Flap Dampening Configuration

- **Examples - 8**

  bgp dampening 30 750 3000 60

  reuse-limit of 750 means maximum possible penalty is 3000 - no prefixes suppressed as penalty cannot exceed suppress-limit

- **Examples - 4**

  bgp dampening 30 2000 3000 60

  reuse-limit of 2000 means maximum possible penalty is 8000 - suppress limit is easily reached

Route Flap Dampening Configuration

- **Examples - 8**

  bgp dampening 15 500 2500 30

  reuse-limit of 500 means maximum possible penalty is 2000 - no prefixes suppressed as penalty cannot exceed suppress-limit

- **Examples - 4**

  bgp dampening 15 750 3000 45

  reuse-limit of 750 means maximum possible penalty is 6000 - suppress limit is easily reached

Route Flap Dampening Enhancements

- **Selective dampening based on**

  AS-path, Community, Prefix

- **Variable dampening**

  recommendations for ISPs

  http://www.ripe.net/docs/ripe-210.html

- **Flap statistics**

  ```
  show ip bgp neighbor <x.x.x.x> [dampened-routes
  | flap-statistics]
  ```