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

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

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

Selective and variable dampening

```bash
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

Example - IOS defaults

```bash
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 damping 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

Maximum penalty

Suppress limit

Reuse limit

Maximum suppress time

Route Flap Dampening
Configuration

• Examples - ✗
  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 - ✓
  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 - ✗
  
  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 - ✓
  
  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]