Selective Updates in Inter-Domain Routing

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Outline

- Motivation
- Design Constraints
- RIFs: The Details
- Application: Policy Routing
- Application: IDR over ATM ... Curtis

Motivation

- Routing Information Loss in order that Routing will scale
  - Loss through aggregation
  - Loss due to intermediate routers dropping multiple routes to a given destination
- Occasional desire for more information
  - Need for more choice in available routes
  - Better quality of routes

Design Goals

- Need a mechanism for a domain to acquire more information as needed
- Ideally the price for such acquisition must be paid only by the domain that desires the additional information
- But, in practice, need to minimise the number of other entities involved

One Proposed Solution

- Go ask the domain where the information loss occurred for more detailed information.
- Constraints on this approach are:
  - The routers where the information loss occurred incur some cost
  - Need to know where the information loss occurred, so we know whom to ask
  - Both routers must talk some common protocol ... say, BGP, or IDRP

Mechanisms in BGP: Routing Information Filters[RIF(s)]

- RIF: Yet another filter
- Filter is only based on NLRI and not other route attributes
- Applicable to both BGP and IDRP
- RIFs work in the context of CIDR, understand the concept of "longest-match" etc.

Some applications of RIFs are:

- Selective deaggregation of routes
- Acquisition of Explicit Routes
- Provider Selection

RIF Overview

- RIF update contains tuples of the form:

  $\langle$Action, Scope, Base, NLRI$\rangle$

- Consider routes from the Information Base that satisfy the Scope criteria (with respect to given NLRI).

- Here are more details...

RIF Action semantics

Action tells remote peer what action is requested

- ALLOW exports all routes that satisfy the matching scope for the given NLRI

- RESTRICT exports all routes that **do not** satisfy the matching scope for the given NLRI

- REMOVE removes a RIF previously added
  - The existing peering session should not be terminated when this RIF is received.

RIF Scope semantics

Scope constrains the set of routes considered by the remote peer

- EXACT: consider routes with exact prefix and length match only

- REFINE: consider routes with more specific (longer) NLRI prefix match only

- NORMAL: Union of EXACT and REFINE NLRI

- REACHABILITY: consider routes that are best match for the given NLRI, or more specific (longer) NLRI prefix

RIF Base semantics

Base constrains the Information Base from which the routes will be returned. Base can be one of

1. Loc-RIB: Remote peer will
   - Apply the RIF filter to routes in the Loc-RIB.
   - Return the results as a normal BGP/IDRP update.

2. Adj-RIB-In: Remote peer will
   - Apply the RIF filter to routes in the Adj-RIB-In.
   - Return the results as a normal BGP/IDRP update.
   - If any of the routes returned is not present in its Loc-RIB, then the remote peer **must not** append its AS number to that route.

RIF Format

Action:	1 octet
Scope:	4 bits
Base:	4 bits
NLRI:	variable*

*Encoded just like the NLRI carried in a BGP/IDRP UPDATE message.

Carrying RIFs in the BGP/IDRP OPEN message

– Carried in the "Optional Parameters" field

- Parameter Type Code = 2
- Parameter Length = 2 + length{NLRI} [Bytes]
- RIFs

Carrying RIFs in the BGP UPDATE message

– Carried in the "Path Attributes" section of the BGP UPDATE message

– The "Network Layer Information Section" is empty

– Permits modifying RIFs installed earlier, either by a BGP OPEN, or earlier BGP UPDATE messages

- Attribute Type Code = 8
- Attribute Length = 2 + length{NLRI} [Bytes]
- RIFs

Carrying RIFs in the IDRP RIB_REFRESH message

– Carried in the "Optional Parameters" of the IDRP RIB_REFRESH message

– Permits modifying RIFs installed earlier, either by a IDRP OPEN, or earlier IDRP RIB_REFRESH messages

- Parameter Type Code = 2
- Parameter Length = 2 + length{NLRI} [Bytes]
- RIFs

An Application for RIFs: Explicit Routing Protocol[ERP]

- A Source desires route choices that are unavailable
- Routes unavailable probably due to route preferences upstream
- Source uses RIB Query as a tool to construct explicit routes

RIB Query

- Query a remote IDRP peer for routes to a given destination that are in the Peer's RIBs
- RIF Usage?
- Still leaves open the question of "Whom to Query?"

RIF Usage for ERP

- Use a RIF as:

  $\langle$ALLOW, REACHABILITY, Adj-RIB-Ins, $\langle$NLRI$\rangle\rangle$

- Returned routes to the destination will contain AS_PATHs that can be used to reach that destination
- These AS_PATHs can be used as ERP routes to that destination

Whom to Query?

- Use some heuristics
- Advertised Border Routers at well-known backbones
- Route Servers at an exchange point
- . . . Others in the short term? . . .
- Refine these as we gain empirical knowledge over time

Another Application for RIFS

Deaggregation in ATM clouds

. . . Curtis