Withdrawal Symptoms: Filtering of Announcements from a Route Collector System

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ABSTRACT

In January 2020 the RIPE NCC announced a new /12 in BGP, the first /12 allocation from IANA to any Regional Internet Registry in over twelve years. This gave us a unique opportunity to investigate announcing new address space onto the Internet today. During that study, we noted artefacts around how networks filter routes originating from the route collector system. We discuss this behaviour in this paper.

CCS CONCEPTS

• **Networks → Routing protocols**; **Public Internet**;

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INTRODUCTION

The RIPE Routing Information Service (RIS) [6] is a critical resource for understanding global BGP visibility. RIS Route Collectors (RRCs) are typically located at Internet exchange points (IXPs) around the world. Networks can peer [5] with an RRC using BGP and we request that they announce all IPv4 and IPv6 routes to the RRC.

In addition to route collection, each RRC announces a *beacon* prefix and an *anchor* prefix [4] from AS12654. Beacon prefixes are repeatedly announced and withdrawn; anchor prefixes are long-term stable. These prefixes provide the research community with valuable and predictable resources for routing analysis.

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BGP Prefix	IRR	ROA	BGP Prefix	IRR	ROA
2a10::/12	no	no			
2a10:4::/32	yes	yes	2a10:3:4::/48	yes	yes
2a10:5::/32	no	yes	2a10:3:5::/48	no	yes
2a10:6::/32	yes	no	2a10:3:6::/48	yes	no
2a10:7::/32	no	no	2a10:3:7::/48	no	no

Table 1: Configuration of test prefixes.

In January 2020, we announced a recently allocated /12 and eight subprefixes drawn from it from RRC03. These test prefixes are listed in Table 1. Each prefix is configured differently in terms of corresponding route objects in the Internet Routing Registry (IRR) and/or having RPKI Route Origin Authorizations (ROAs) to allow investigation into prefix filtering via common out-of-band signals. 2a10::/12 was announced on 13 Jan at 09:24:04 UTC, and the others on 15 Jan at 10:49:39 UTC. All nine were withdrawn on 20 Jan at 10:04:36 UTC. More on this study can be found in [7].

While announced, we observe that the test prefixes drawn from the new address space, the RRC03 anchor prefix, and the RRC03 beacon prefix, are each observed by a different number of peers across all RRCs. On withdrawal of the test prefixes and the beacon prefix, we also observe a brief increase in the number of peers sharing the prefixes with RIS. Here, we will focus on these details. We believe there is value to the research community in understanding the behaviour of new IPv6 address space, but also in being aware of the operational quirks and realities of the RIS system and what this means for public routing resources.

INCOMPLETE VISIBILITY

A user of RIS data may assume that a prefix announced by RRC03, using AS12654, would be visible at RRC03 via AS12654's peers. In general, however, we do not observe all of RRC03's peers propagating announcements directly back to RRC03. This is likely partially caused by default router behaviour, to reduce redundant BGP updates (*e.g.*, [3]).

Looking at all RRCs, the test prefixes are visible at varying numbers of peers; 2a10:4::/32 and 2a10:6::/32 have maximum visibility prior to withdrawal of 256 simultaneous peers, and 2a10:3:5::/48 is seen only at 246. The anchor prefix is typically visible via 265 peers for the duration of this study, and the beacon prefix typically via 260 when announced.

At RRC03, prior to withdrawal, the nine test prefixes are visible at 15–18 unique peers (19 distinct peers in aggregate). However, only 10 peers observe the beacon prior to its withdrawal, and only 11 peers observe the anchor prefix throughout the experiment. Externally announced prefixes are typically visible via more than 20 peers at RRC03, where 23 peers during the study shared full tables. This suggests different filtering policies for the old and new prefixes originating from AS12654.

Across all RRCs, only four AS paths of length two (*i.e.*, originating at AS12654 and returned to any RRC via any peer) were observed for any of the test prefixes, the RRC03 anchor, or the RRC03 beacon prefixes. Two of those peer networks were AS20495 (We Dare B.V.), and AS64271 (rixCloud, Inc.), both of which propagate the announcements back to RRC03 only. In addition, AS8218 (Zayo France SAS) propagates various prefixes to six RRCs but not back to RRC03 itself, and AS6939 (Hurricane Electric) does not propagate any of the test prefixes to *any* RRC, only propagating RRC03's anchor and beacon prefixes to three and one RRCs respectively. Prior to withdrawal, 60 distinct AS paths are visible for the test prefixes at RRC03. 37 of these AS paths have length 3, traversing only peers of RRC03: AS12654, then a chain of two peers.

WITHDRAWAL

Immediately following withdrawal, there is a visible jump in the number of peers actively propagating the test prefixes to RRCs; see Figure 1. In these moments, the nine test prefixes are observed via an additional 17 peers across all RRCs. Eight of these peers are at RRC03. We see a similar pattern on the beacon prefix in Figure 2. Peak visibility of `2a10:4::/32`, `2a10:6::/32`, `2a10:3:4::/48`, and `2a10:3:6::/48` (*i.e.*, the prefixes with IRR entries) is similar to that of the anchor prefix, which peaked at 270 peers during the study. All test prefixes were fully withdrawn by 20 Jan at 11:33:40 UTC.

During the withdrawal, we observe no additional AS paths of length 2; only longer, indirect paths are observed. Revealing additional BGP links during withdrawal is a well-known technique [1, 2]. Additional peers at RRC03 are observed in this phase, confirming that many RIS peers will propagate announcements back to AS12654, but not directly back along the path they were initially received. The observed path lengths increase during withdrawal, matching intuition, up to paths of length 10.

By the end of the study, the nine test prefixes were visible at RRC03 via 285 AS paths via 55 ASNs, with 225 paths and 23 ASNs revealed only during the withdrawal. At RRC03 the beacon prefix is observed via 136 AS paths via 52 ASNs, of which 124 paths and 36 ASNs were revealed after withdrawal. The number of ASNs discovered during withdrawal suggests some were not propagating the new address space.

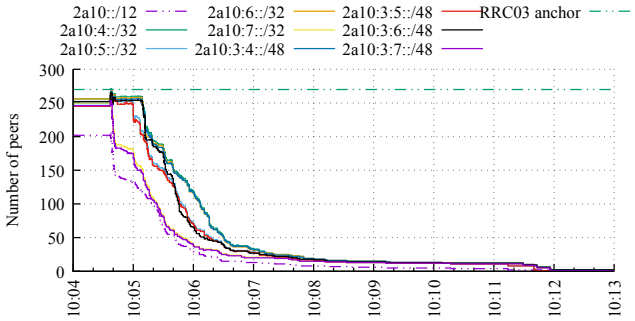

Figure 1: `2a10::/12` and subprefix withdrawal on 20 Jan.

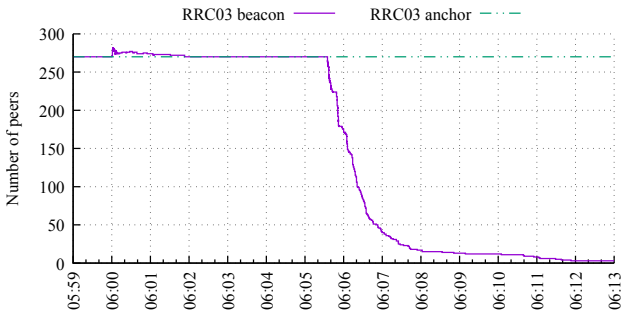

Figure 2: RRC03 beacon withdrawal on 20 Jan.

CONCLUSION

As a distributed routing protocol where networks independently elect to propagate announcements along the best available path at a point in time, BGP does not reveal all paths and is not always consistent with which paths it reveals across a set of prefixes. The test prefixes, drawn from previously unallocated address space and created with well-defined configurations, provide a useful datapoint to further investigate path propagation with new IPv6 space.

We are able to identify peers of RRC03 that are propagating announcements out from AS12654, but not back to the origin. While this behaviour may not be unexpected, it initially appears more common on the anchor and beacon prefixes than the test prefixes. In any case, this filtering in general may contradict with user expectations, and it is worthwhile to consider which RRCs to inspect when studying prefixes originating from AS12654.

Further, given the above, the test prefixes and the beacon prefix all become visible at more peers during their withdrawal. This suggests the origin of an announcement is one of the poorest locations to observe that announcement, an important consideration in experimental design.

Finally, we observe additional paths at RRC03 during withdrawal given the nondeterministic "path-hunting" behaviour. These AS paths are not studied in detail in this paper, but their existence in the data shine light on the propagation of new IPv6 space.

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