Making BGP an Internet Standard

rfc4271bis

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BGP's standardization status

- BGP4 has been deployed for decades as a foundational protocol of the Internet.
- For most of that time it's been a Draft Standard.
  - DS is a now-deprecated maturity level above Proposed Standard but below Internet Standard.
- It's kind of nuts that it's not already an Internet Standard.
  - Also known as "full standard", or STD.
  - On the charter since 2010 (!) "Upgrade of the base BGP specification to Full Standard".
- Revisions to core aspects of the protocol have been deployed for decades, but the base document remains the same.
  - We can fix this. And we should.

Can it be an Internet Standard?

- RFC 6410, Section 2.2, definition:

> An Internet Standard is characterized by a high degree of technical maturity and by a generally held belief that the specified protocol or service provides significant benefit to the Internet community.

- Yup!
- If a document meets all the criteria given, it can be promoted to Internet Standard without being revised… it's just reclassified.
  - Can we do this?

BCP 9/RFC 6410 Section 2.2 criteria

explanation of how the criteria have been met. The criteria are:

(1) There are at least two independent interoperating implementations with widespread deployment and successful operational experience.

(2) There are no errata against the specification that would cause a new implementation to fail to interoperate with deployed ones.

(3) There are no unused features in the specification that greatly increase implementation complexity.

(4) If the technology required to implement the specification requires patented or otherwise controlled technology, then the set of implementations must demonstrate at least two independent, separate and successful uses of the licensing process.

Scope of work

- Because of (at least) criteria 2 and 3, we need to produce rfc4271bis.
  - I think we also have to add “there are no known errors” even if they haven’t been filed as errata.
- Also, an Internet Standard can include more than one RFC. RFC 1311 Section 2:

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Multiple Documents for One Standard:

   A STD number identifies a standard not a document.  A document is
   identified by its RFC number.  If the specification of a standard
   is spread over several documents they will each carry the same STD
   number.
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Errors and unused features

- Aggregation
  - Many of the features and language used in 4271 made sense at the time but the way we implement and use BGP is different.
  - Development of RFC 9774 (Deprecation of AS_SET and AS_CONFED_SET in BGP) involved a lot of research that will be relevant for us.
- Timers and delays
  - Notably MRAI. My impression is that implementations mostly diverge from what's documented in the spec.
- This list is not complete!
  - Or if it is, I'll be surprised…

Slippery slopes vs. boiling oceans

- RFC 4271 et seq suffer many rough spots and imprecisions
  - Example: we all know what a “key” is but it’s not part of the defined terminology
- It is tempting to want to fix them all
- And to fix aspects of the design, too
  - Example: non-key fields in NLRI
- We should not do this in RFC 4271bis
  - In particular, we MUST NOT change the design beyond what is deployed
  - We MAY change or clarify terminology as long as (a) it creates no normative change and (b) the change is justified (yes, that’s subjective)

Aside: what's a "justified change" in terminology?

- Some of the document's terms were invented on the spot.
  - Some stuck. We all talk about "the RIB" and "the FIB" now.
  - Some didn't. Making the document more conformant with common usage might be worthwhile.
- Some of the terminology is used inconsistently. This may lead to imprecision.
  - One key (sorry) example is the inconsistent usage of "NLRI", "prefix", and other terms throughout the document.
  - At the time, there was no concept of an NLRI that wasn't an address prefix.
  - There's also imprecision between referring to *an* NLRI and the NLRI *section* of the message.
  - It's not a big deal, we have existence proof.
  - Still, if we can do better, we should.

On SHOULD vs. MUST

- There are several SHOULDs in RFC 4271 that are questionable.
  - “In what cases would it be right that an implementor not do this?”
- We should scrub these and consider either upgrading to MUST or providing additional description.
- It might be reasonable to upgrade to MUST for cases known to already be common practice.
  - Examples: zeroing empty (sub)fields, sending EoR.
  - The goal being, the only “change” required for an RFC 4271-compliant implementation to comply with rfc4271bis would be a code audit.

The work is never done

- Once we've done the work, we can consider rfc4271ter if we still have energy!
  - "Ter" is what comes after "bis" in Latin. ☺
  - We can gather work items for *ter* as part of this effort.
  - This would be the place to make normative changes.
- Examples of what *might* go in a *ter*:
  - ECMP
  - Opaque key field

What goes in the STD?

- rfc4271bis is to be a minimal(ish) revision.
- But we all know a plain RFC 4271 implementation is not, by itself, very useful. (Only IPv4, no Capabilities, etc.)
  - It's also unlikely the IESG would approve an IPv4-only Full Standard.
- Our goal should be that STD NNN includes (at least) all the components needed for a "table stakes" implementation.
  - Can be as separate RFCs.
    - Keeping in mind that to go into the STD they all have to pass the RFC 6410 §2.2 criteria.
  - Can be as part of the bis.
    - Heuristic: only if *not* doing it would be "unnatural" (more subjective…)

Part of the bis (non-exhaustive)

- RFC 6286 (Autonomous-System-Wide Unique BGP Identifier for BGP-4)
- RFC 7606 (Revised Error Handling)
- RFC 7607 (Codification of AS 0 Processing)
- RFC 8212 (Default External BGP (EBGP) Route Propagation Behavior without Policies)

Part of the bis, *but*

- RFC 9774 (Deprecation of AS_SET and AS_CONFED_SET in BGP)
- This one is “special” because it might arguably not meet the “bake time” criterion of RFC 6410…
- … but it seems like a massive fail to publish 4271bis with text that tells the implementor they’re supposed to use AS_SET.
- One option would be to include a helpful pointer to RFC 9774 anywhere we talk about AS_SET.
- We could also take the plunge and finish deprecating AS_SET out of the bis. This might be better in the long run.

Could go into the bis but doesn't *have to*

- RFC 6608 (Subcodes for BGP Finite State Machine Error)

Independent RFCs (MUST)

- RFC 4760 (Multiprotocol BGP)
  - Required for IPv6 support.
  - There are several errata, so rfc4760bis is required.
- RFC 5492 (Capabilities)
  - Required for MP-BGP
  - There are no errata (one rejected), so it would be reasonable to simply reclassify the existing RFC as Internet Standard.
- Others can be considered as part of follow-on work.

Independent RFCs (SHOULD)

- RFC 6793 (4 Octet AS)
  - We might also want to start an effort to deprecate 2-byte ASNs

Independent RFCs (MAY), a.k.a. “but what about… ?”

- There are many other worthy RFCs that might be candidates to add to STD NNN.
  - The ones listed were chosen as a bare-bones collection that is necessary to produce a credible BGP implementation that can operate in the Internet *at all*.
  - Others can be added, once the initial effort is complete.
  - Strong candidates include the zoo of BGP Community variants.

Next Steps

- No document(s) to adopt (yet)
- Inviting discussion here and on list
  - Is this scope of work correct?
- Work needed
  - Writing on rfc4271bis (underway)
  - Writing on other bis RFCs
  - Validation of implementation status vs. BCP 9/RFC 6410 Section 2.2 criteria
  - Review document set for omissions/inclusions
  - *And so on…*

Method of work

- Like RFC 4271, the bis will be a *working group effort*.
  - All WG documents are, but especially this.
  - The editor is there to do an initial pass, to integrate contributions, and to… edit.
  - There are no “authors” in the sense of individuals driving and “owning” the technology
- As a reminder: *no new technology will be specified as part of this effort.*
  - To repeat: we MUST NOT change the design beyond what is deployed.

Discussion?