Evaluation of a Sample of RFC Produced in 2018
draft-huitema-rfc-eval-project-02

Abstract

This document presents a first attempt at evaluating the recently published RFC. We analyze a set of randomly chosen RFC approved in 2018, looking for history and delays. The average RFC was produced in 3 years and 4 months, of which 2 years and 10 months were spent in the working group, 3 to 4 months for IETF consensus and IESG review, and 3 to 4 months in RFC production. The main variation in RFC production delays comes from the AUTH48 phase.

We also measure the number of citations of the chosen RFC using Semantic Scholar, and compare citation counts with what we know about deployment. We show that citation counts indicate academic interest, but correlate only loosely with deployment or usage of the specifications.

The measurement of delays could be automated by processing dates and events recorded in the data tracker. The measurement of published RFC could be complemented by statistics on abandoned drafts, which would measure the efficiency of the IETF triaging process.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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This Internet-Draft will expire on April 9, 2020.
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1. RFC Evaluation project

As stated on the organization's web site, "The IETF is a large open international community of network designers, operators, vendors, and researchers concerned with the evolution of the Internet architecture and the smooth operation of the Internet." In this memo, we attempt to evaluate the RFC production process.

The IETF data tracker provides information about RFC and drafts, from which we can infer statistics about the production system. We can measure how long it takes to drive a proposition from initial draft to final publication, and how these delays can be split between Working Group discussions, IETF reviews, IESG assessment, RFC Editor delays and final reviews by the authors.

Just measuring production delays may be misleading. If the IETF simply rubber-stamped draft proposals and published them, the delays would be short but the quality and impact might suffer. We hope that most of the RFC that are published are useful, but we need a way to measure that usefulness. We try to do that by measuring the number of references of the published RFCs in Semantic Scholar, and also by checking whether the protocols and technologies defined in the RFCs were implemented and used on the Internet.

In order to limit the resource required for this study, we selected at random 20 RFC published in 2018, as explained in (#sample-selection). For comparison purposes, we also selected at random 20 RFC published in 1998 and 20 published in 2008. The information gathered for every RFC in the sample is presented in (#sample-rfc-analysis). In (#process-analysis) we analyze the production process and the sources of delays, comparing the 2018 sample to the selected samples for 1998 and 2018. In (#citation-numbers) we present citation counts for the RFC in the samples, and analyze whether citation counts could be used to evaluate the quality of RFC. Finally, we present the conclusion of the study and propose next steps in (#conclusion).
2. Selecting a random sample of RFC

Basic production mechanisms could be evaluated by processing data from the IETF tracker, but subjective data requires manual assessment of results, which can be time consuming. Since our resources are limited, we will only perform this analysis for a small sample of RFC, selected at random from the list of RFC approved in 2018. Specifically, we will pick 20 RFC at random between:

- RFC 8307, published in January 2018, and

In order to avoid injecting personal bias in the random selection, we use a random selection process similar to the Nomination Committee selection process defined in [RFC3797]. The process is seeded with the text string "vanitas vanitatum et omnia vanitas", and the results are:

Picking 20 numbers between 8307 and 8511, using MD5(vanitas vanitatum et omnia vanitas)

- Rank 1: 8411 -- md5=daba041224a879199b698748808f917d
- Rank 2: 8456 -- md5=f5570484d91ada6a672eddbca61d080c
- Rank 3: 8446 -- md5=8340e918bb8af69d197f79c9a58d7b8
- Rank 4: 8355 -- md5=19474df74efd9917cf3fe8acce2ac374
- Rank 5: 8441 -- md5=5acce2b730f3c24a4a91a5fc1921d1cd
- Rank 6: 8324 -- md5=411c11alcf4c292f8345865599c6921
- Rank 7: 8377 -- md5=ac16a89192c0f0727febd35aaccbc1f24
- Rank 8: 8498 -- md5=bb4a4f2ba1ab240a1265a82ab71f7e02
- Rank 9: 8479 -- md5=1653606b0af95d529473a8f85ffaa4
- Rank 10: 8453 -- md5=0cbfe105667c5a83b027dcfa85062f98
- Rank 11: 8429 -- md5=fa51d7738562d990926a0d199fbb060b8
- Rank 12: 8312 -- md5=96d061523b1a57343356ae7a1e498ca5
- Rank 13: 8492 -- md5=1b727b46eb0f5f79f40ed2b3faccbe8
- Rank 14: 8378 -- md5=645833b936d36cdcc79725618d7c483
- Rank 15: 8361 -- md5=2064622c868e410be0d9c180dbc522c
- Rank 16: 8472 -- md5=ca8a823072a21df011d0ea8b96a6a47
- Rank 17: 8471 -- md5=01b293a7d0793e6f3297f2a973cd7e3
- Rank 18: 8466 -- md5=8e411babe271557fe83bcdeecce1643f
- Rank 19: 8362 -- md5=8a1ba3efdd82856a12b2b35fc5237e1b7
- Rank 20: 8468 -- md5=57ae50ee0e1e0708d356d96d16dbfe1

When evaluating delays and impact, we will compare the year 2018 to 2008 and 1998, 10 and 20 years ago. To drive this comparison, we pick 20 RFC at random among those published in 2008, and another 20 among those published in 1998. We use the same nomcom-like methodology.
For 2008, we picking random RFC numbers between RFC 5134 (January 2008) and RFC 5405 (December 2008), using the sentence "sed fugit interea fugit irreparabile tempus" as a seed. We actually list here 21 numbers, because the random draw place RFC 5315 in 20th position, but that RFC was never issued. We replace it by RFC 5301, which came in 21st position.

Picking 21 numbers between 5134 and 5405, using MD5(sed fugit interea fugit irreparabile tempus)

Rank 1: 5227 -- md5=61e5b3cd97fda4e75450e93df0744b6d
Rank 2: 5174 -- md5=eed49542394e9d392bcd756ee0f5beed
Rank 3: 5172 -- md5=72055ca953d6a8ee0d60a9fc0b8d738
Rank 4: 5354 -- md5=7a00ef158974799d1d15255159f6d8674
Rank 5: 5195 -- md5=54813be7bb56f48a05af8c894799b51f
Rank 6: 5236 -- md5=153263bbd8c0349501b75a33f3d66f6c
Rank 7: 5348 -- md5=b2d19aa9c1250ef2ddf169045f6e99d7
Rank 8: 5281 -- md5=1c3e61643d46dida4ba16f0fd7a0aff5
Rank 9: 5186 -- md5=5e87001b830183b1a9427d479a7b0e42
Rank 10: 5326 -- md5=024347839f83d808259c08bdfalb43e
Rank 11: 5277 -- md5=049a83016ab08552841c59400480cd9d
Rank 12: 5373 -- md5=1ce374aaebddCCA2e7d6eef039d970
Rank 13: 5404 -- md5=fb065b582a27c34175e39de3358556
Rank 14: 5329 -- md5=df043ef1f94d2ba12a03a8443d26ead
Rank 15: 5283 -- md5=c40d39f66bc7800d6508d3d2d2f371d
Rank 16: 5358 -- md5=6f6a5dbdb26b19e68befd7409a9cb335d
Rank 17: 5142 -- md5=a8844b73287781762e65a8f6f533508
Rank 18: 5271 -- md5=c19eb02984265efce4ca076f2c160cfa
Rank 19: 5349 -- md5=33756f81bf6e40ff344cf5caaf29f13
Rank 20: 5315 -- md5=d4c30875f88328d72c9f78def2d1d0e5
Rank 21: 5301 -- md5=3356419e5560901f0d31309b39d1a80

For 1998 we picking random RFC numbers between RFC 2257 (January 1998) and RFC 2479 (December 1998), using the sentence "pulvis et umbra sumus" as a seed.
Picking 20 numbers between 2257 and 2479, using MD5(pulvis et umbra sumus)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Number</th>
<th>MD5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2431</td>
<td>6eba444bb3349339fcde7e2be726f0f0</td>
</tr>
<tr>
<td>2</td>
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<tr>
<td>3</td>
<td>2387</td>
<td>53726e77ffeed903d244155d28e30f10</td>
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<tr>
<td>4</td>
<td>2348</td>
<td>69fca2b2d20855555bac9eb0e0f4346523</td>
</tr>
<tr>
<td>5</td>
<td>2391</td>
<td>93358a26a7fcee9faa61a31cfd87b7</td>
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<tr>
<td>6</td>
<td>2267</td>
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<tr>
<td>7</td>
<td>2312</td>
<td>2505b0bed4af0a00ee663891c6f29a8d</td>
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<tr>
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<td>6ede4b0dafa935f6ca656a5104b8dc5d0</td>
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<tr>
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<td>5312bcfe5a9ca45563eb0d35510d8daa</td>
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<td>2398</td>
<td>7748a6deec3860898678f99200b22792</td>
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<td>2382</td>
<td>d1f667ac3e464a529872e08823df</td>
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<tr>
<td>13</td>
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<td>14</td>
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<td>6b3df671a0b9f9f42d203b59ac0d8</td>
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<td>e1b6819e5355924f456eb79f93beb8fd</td>
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<td>2449</td>
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<td>2317</td>
<td>40eee3b536abe4afdb8834a0650ca04</td>
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<tr>
<td>18</td>
<td>2394</td>
<td>044f09c53fc9f1c50f6bd0c39318e1</td>
</tr>
<tr>
<td>19</td>
<td>2297</td>
<td>78ee7e128436c969c80900f80c075c</td>
</tr>
<tr>
<td>20</td>
<td>2323</td>
<td>ea6935bbda5f6d977563df5c3e2f7db</td>
</tr>
</tbody>
</table>

3. Analysis of 20 selected RFC

We review each of the RFC listed in (#methodology) for the year 2018, trying both to answer the known questions and to gather insight for further analyzes. In many cases, the analysis of the data is complemented by direct feedback from the RFC authors.

3.1. 8411

IANA Registration for the Cryptographic Algorithm Object Identifier

Range [RFC8411]:

Informational, 5 pages
4 drafts (personal), first May 8, 2017. Published August 2018.
Last call announced 2017/10/09
IESG evaluation starts 2017/12/28
Approved 2018/02/26, draft 03
Auth 48 2018/04/20
Auth 48 complete 2018/07/17
Published 2018/08/06
IANA action: create table

The draft underwent minor copy edit before publication.
The long delay in Auth48 is probably due to clustering with [RFC8410], which entered AUTH 48 on 06/05. The MISSREF tracker code was cleared then.

3.2. 8456

Benchmarking Methodology for Software-Defined Networking (SDN) Controller Performance [RFC8456]:

Informational, 64 pages
2 personal drafts, 9 WG drafts, first in March 2015
Last call announced 2018-01-19
IESG evaluation starts 2018-02-27
IESG approved 2018-05-25
Auth 48 2018-08-31
Auth 48 complete 2018-10-16
Published 2018-10-30

The draft underwent very extensive copy editing, covering use of articles, turn of phrases, choice of vocabulary. The changes are enough to cause pagination differences. The "diff" tool marks pretty much every page as changed. Some diagrams see change in protocol elements like message names.

According to the author, the experience of producing this draft mirrors a typical one in the Benchmarking Methodologies Working Group (BMWG). There were multiple authors in multiple time zones, which slowed down the AUTH process somewhat, although the Auth48 delay of 46 is only a bit longer than the average draft.

The RFC was part of cluster with [RFC8455].

BMWG publishes informational RFCs centered around benchmarking, and the methodologies in RFC 8456 have been implemented in benchmarking products.

3.3. 8446

The Transport Layer Security (TLS) Protocol Version 1.3 [RFC8446], as the title indicates, defines the new version of the TLS protocol. From the datatracker, we extract the following:
Proposed standard
160 pages
29 WG drafts first April 17, 2014.
Last call announced 2018/02/15
IESG evaluation starts 2018/03/02
Approved 2018/03/21, draft 28
Auth 48 2018/06/14
Auth 48 complete 2018/08/10
Published 2018/08/10

The RFC was a major effort in the IETF. Working group members developed and tested several implementations. Researchers analyzed the specifications and performed formal verifications. Deployment tests outlined issues that caused extra work when the specification was almost ready. These complexity largely explains the time spent in the working group.

Comparing the final draft to the published version, we find relatively light copy editing. It includes explaining acronyms on first use, clarifying some definitions standardizing punctuation and capitalization, and spelling out some numbers in text. This generally fall in the category of "style", although some of the clarifications go into message definitions. However, that simple analysis does not explain why the Auth48 phase took almost two months.

This document’s Auth48 process was part of the "Github experiment", which tried to use github pull requests to track the AUTH48 changes and review comments. The RPC staff had to learn using Github for that process, and this required more work than the usual RFC. Author and AD thoroughly reviewed each proposed edit, accepting some and rejecting some. The concern there was that any change in a complex specification might affect a protocol that was extensively reviewed in the working group, but of course these reviews added time to the Aouth48 delays.

There are 21 implementations listed in the Wiki of the TLS 1.3 project. It has been deployed on major browsers, and is already used in a large fraction of TLS connections.

3.4. 8355

Resiliency Use Cases in Source Packet Routing in Networking (SPRING) Networks [RFC8355] is an informational RFC. It originated from a use case informational draft that was mostly used for the BOF creating the WG, and then to drive initial work/evolutions from the WG.
Informational, 13 pages.
2 personal drafts (personal), first January 31, 2014. 13 WG drafts.
Last call announced 2017-04-20
IESG evaluation starts 2017-05-04, draft 09
Approved 2017-12-19, draft 12
Auth 48 2018-03-12
Auth 48 complete 2018-03-27
Published 2018-03-28

Minor set of copy edit, mostly for style.

No implementation of the RFC itself, but the technology behind it
such as Segment Routing (architecture RFC 8402, TI-LFA draft-ietf-
rtgwg-segment-routing-ti-lfa) is widely implemented and deployment is
ongoing.

According to participants in the discussion, the process of adoption
of the source packet routing standards was very contentious. The
establishment of consensus at both the working group level and the
IETF level was difficult and time consuming.

3.5. 8441

Bootstrapping WebSockets with HTTP/2 [RFC8441]

Proposed standard, 8 pages. Updates RFC 6455.
3 personal drafts (personal), first 10/15/2017. 8 WG drafts.
Last call announced 2018-05-07, draft 05
IESG evaluation starts 2018-05-29, draft 06
Approved 2018-06-07, draft 07
Auth 48 2018-08-13
Auth 48 complete 2018-09-15
Published 2018-09-21
IANA Action: table entries

This RFC defines the support of WebSockets in HTTP/2, which is
different from the mechanism defined for HTTP/1.1 in [RFC6455]. The
process was relatively straightforward, involving the usual type of
discussions, some on details and some on important points.

Comparing final draft and published RFC shows a minor set of copy
edit, mostly for style. However, the author recalls a painful
process. The RFC includes many charts and graphs that were very
difficult to format correctly in the author’s production process that
involve conversions from markdown to XML, and then from XML to text.
The author had to get substantial help from the RFC editor.
There are several implementations, including Firefox and Chrome, making RFC 8441 a very successful standard.

3.6. 8324

DNS Privacy, Authorization, Special Uses, Encoding, Characters, Matching, and Root Structure: Time for Another Look? [RFC8324]. This is an opinion piece on DNS development, published on the Independent Stream.

Informational, 29 pages. Independent stream.
5 personal drafts (personal), first June 2, 2017.
ISE review started 2017-07-10, draft 03
IETF conflict review and IESG review started 2017-10-29
Approved 2017-12-18, draft 04
Auth 48 2018-01-29, draft 05
Auth 48 complete 2018-02-26
Published 2018-02-27

This RFC took only 9 months from first draft to publication, which is the shortest in the 2018 sample set. In part, this is because the text was privately circulated and reviewed before the first draft was published. The nature of the document is another reason for the short delay. It is an opinion piece, and does not require the same type of consensus building and reviews than a protocol specification.

Comparing the final draft and the published version shows only minor copy edit, mostly for style. According to the author, because this is because he knows how to write in RFC Style with the result that his documents often need a minimum of editing. He also makes sure that the document on which the Production Center starts working already has changes discussed and approved during Last Call and IESG review incorporated rather than expecting the Production Center to operate off of notes about changes to be made.

3.7. 8377

Transparent Interconnection of Lots of Links (TRILL): Multi-Topology [RFC8377]
3 personal drafts (personal), first September 3, 2013. 7 WG drafts.
Last call announced 2018-02-19, draft 05
IESG evaluation starts 2018-03-02, draft 06
Approved 2018-03-12, draft 05
Auth 48 2018-04-20, draft 06
Auth 48 complete 2018-07-31
Published 2018-07-31
IANA Table, table entries

Minor set of copy edit, mostly for style, also clarity.

3.8. 8498

A P-Served-User Header Field Parameter for an Originating Call Diversion (CDIV) Session Case in the Session Initiation Protocol (SIP) [RFC8498].

Informational, 15 pages.
5 personal drafts (personal), first March 21, 2016. 9 WG drafts.
Last call announced 2018-10-12, draft 05
IESG evaluation starts 2018-11-28, draft 07
Approved 2018-12-10, draft 08
Auth 48 2019-01-28
Auth 48 complete 2019-02-13
Published 2019-02-15
IANA Action, table rows added.

Copy edit for style, but also clarification of ambiguous sentences.

3.9. 8479

Storing Validation Parameters in PKCS#8 [RFC8479]

Informational, 8 pages. Independent stream.
5 personal drafts (personal), first August 8, 2017.
ISE review started 2018-03-29, draft 02
IETF conflict review and IESG review started 2018-03-29
Approved 2018-08-20, draft 03
Auth 48 2018-09-20, draft 04
Auth 48 complete 2018-09-25
Published 2018-09-26

The goal of the draft was to document what the gnutls implementation was using for storing provably generated RSA keys. This is a short RFC that was published relatively quickly, although discussion between the author, the Independent Series Editor and the IESG lasted several months. In the initial conflict review, the IESG asked the
ISE to not publish this document before IETF working groups had an opportunity to pick up the work. The author met that requirement by a presentation to the SECDISPATCH WG in IETF 102. Since no WG was interested in pickup the work, the document progressed on the Independent Stream.

Very minor set of copy edit, moving some references from normative to informative.

The author is not aware of other implementations than gnutls relying on this RFC.

3.10.  8453

Framework for Abstraction and Control of TE Networks (ACTN) [RFC8453]

Informational, 42 pages.
3 personal drafts, first June 15, 2015. 16 WG drafts.
Out of WG 2018-01-26, draft 11
Expert review requested, 2018-02-13
Last call announced 2018-04-16, draft 13
IESG evaluation starts 2018-05-16, draft 14
Approved 2018-06-01, draft 15
Auth 48 2018-08-13
Auth 48 complete 2018-08-20
Published 2018-08-20
IANA Action, table rows added.

Minor copy editing.

3.11.  8429

Deprecate Triple-DES (3DES) and RC4 in Kerberos [RFC8429]

BCP, 10 pages.
6 WG drafts, first 5/1/2017.
Last call announced 7/16/2017, draft 03
IESG evaluation starts 8/18/2017, draft 04
Approved 5/25/2018, draft 05
Auth 48 7/24/2018
Auth 48 complete 10/31/2018
Published 10/31/2018
IANA Action, table rows added.

This RFC recommends to deprecate two encryption algorithms that are now considered obsolete and possibly broken. The document was sent back to the WG after the first last call, edited, and then there was a second last call. The delay from first draft to working group last
call was relatively short, but the number may be misleading. The initial draft was a replacement of a similar draft in the KITTEN working group, which stagnated for some time before the CURDLE working group took up the work. The deprecation of RC4 was somewhat contentious, but the WG had already debated this prior to the production of this draft, and the draft was not delayed by this debate.

Most of the 280 days between IETF LC and IESG approval was because the IESG had to talk about whether this document should obsolete or move to historic RFC 4757, and no one was really actively pushing that discussion for a while.

The 99 days in AUTH48 are mostly because one of the authors was a sitting AD, and those duties ended up taking precedence over reviewing this document.

Minor copy editing, for style.

The implementation of the draft would be the actual removal of support for 3DES and RC4 in major implementations. This is happening, but very slowly.

3.12. 8312

CUBIC for Fast Long-Distance Networks [RFC8312]

Informational, 18 pages.
2 personal drafts, first 9/1/2014. 8 WG drafts
Last call announced 9/18/2017, draft 06
IESG evaluation starts 2017-11-14
Approved 2017-10-04, draft 07
Auth 48 2018-01-08
Auth 48 complete 2018-02-07
Published 2018-02-07
IANA Action, table rows added.

Minor copy editing, for style.

The TCP congestion control algorithm Cubic was defined first in 2005, was implemented in Linux soon after, and was implemented in major OSes after that. After some debates from 2015 to 2015, the TCPM working group adopted the draft, with a goal of documenting Cubic in the RFC series. According to the authors, this was not a high priority effort, as Cubic was already implemented in multiple OSes and documented in research papers. At some point, only one of the authors was actively working on the draft. This may explain why
another two years was spent progressing the draft after adoption by the WG.

The RFC publication may or may not have triggered further implementations. On the other hand, several OSes picked up bug fixes from the draft and the RFC.

3.13. 8492

Secure Password Ciphersuites for Transport Layer Security (TLS)  
[:RFC8492]

Informational, 40 pages. (Independent Stream)  
10 personal drafts, first 9/2/2012. 8 WG drafts  
ISE review started 2017-05-10, draft 01  
IETF conflict review and IESG review started 2017-09-04  
Approved 2017-10-29, draft 04  
Auth 48 10/19/2018, draft 05  
Auth 48 complete 2/19/2019  
Published 2/21/2019  
IANA Action, table rows added.

This RFC has a complex history. The first individual draft was submitted to the TLS working group on September 7, 2012. It progressed there, and was adopted by the WG after 3 revisions. There were then 8 revisions in the TLS WG, until the WG decided to not progress it. The draft was parked in 2013 by the WG chairs after failing to get consensus in WG last call. The AD finally pulled the plug in 2016, and the draft was then resubmitted to the ISE.

At that point, the author was busy and was treating this RFC with a low priority because, in his words, it would not be a "real RFC". There were problems with the draft that only came up late. In particular, it had to wait for a change in registry policy that only came about with the publication of TLS 1.3, which caused the draft to only be published after RFC 8446, and also required adding references to TLS 1.3. The author also got a very late comment while in AUTH48 that caused some rewrite. Finally, there was some IANA issue with the extension registry where a similar extension was added by someone else. The draft was changed to just use it.

Changes in AUTH48 include added reference to TLS 1.3, copy-editing for style, some added requirements, added paragraphs, and changes in algorithms specification.
3.14. 8378

Signal-Free Locator/ID Separation Protocol (LISP) Multicast [RFC8378] is an experimental RFC, defining how to implement Multicast in the LISP architecture.

Experimental, 21 pages.
5 personal drafts, first 2/28/2014. 10 WG drafts
Last call announced 2018-02-13, draft 07
IESG evaluation starts 2018-02-28, draft 08
Approved 2018-03-12, draft 09
Auth 48 2018-04-23
Auth 48 complete 2018-05-02
Published 2018-05-02

Preparing the RFC took more than 4 years. According to the authors, they were not aggressive pushing it and just let the working group process decide to pace it. They also did implementations during that time.

Minor copy editing, for style.

The RFC was implemented by lispers.net and cisco, and was used in doing IPv6 multicast over IPv4 unicast/multicast at the Olympics in PyeungChang. The plan is to work on a proposed standard once the experiment concludes.

3.15. 8361

Transparent Interconnection of Lots of Links (TRILL): Centralized Replication for Active-Active Broadcast, Unknown Unicast, and Multicast (BUM) Traffic [RFC8361]

Proposed Standard, 17 pages.
3 personal drafts, first 11/12/2013. 14 WG drafts
Last call announced 2017-11-28, draft 10
IESG evaluation starts 2017-12-18, draft 11
Approved 2018-01-29, draft 13
Auth 48 2018-09-17
Auth 48 complete 4/9/2018
Published 2018-10-08

According to the authors, the long delays in producing this RFC was due to a slow uptake of the technology in the industry.

Minor copy editing, for style.

There was at least 1 partial implementation.
3.16. 8472

Transport Layer Security (TLS) Extension for Token Binding Protocol Negotiation [RFC8472]

Proposed Standard, 8 pages.
1 personal drafts, first 5/29/2015. 15 WG drafts
Last call announced 2017-11-13, draft 10
IESG evaluation starts 2018-03-19
Approved 2018-07-20, draft 14
Auth 48 2018-09-17
Auth 48 complete 2018-09-25
Published 2018-10-08

This is a pretty simple document, but it took over 3 years from individual draft to RFC. According to the authors, the biggest setbacks occurred at the start: it took a while to find a home for this draft. It was presented in the TLS WG (because it’s a TLS extension) and UTA WG (because it has to do with applications using TLS). Then the ADs determined that a new WG was needed, so the authors had to work through the WG creation process, including running a BOF.

Minor copy editing, for style, with the addition of a reference to TLS 1.3.

Perhaps partially due to the delays, some of the implementers lost interest in supporting this RFC.

3.17. 8466

A YANG Data Model for Layer 2 Virtual Private Network (L2VPN) Service Delivery [RFC8466]

Proposed Standard, 158 pages.
5 personal drafts, first 9/1/2016. 11 WG drafts
Last call announced 2018-02-21, draft 07
IESG evaluation starts 2018-03-14, draft 08
Approved 2018-06-25, draft 10
Auth 48 2018-09-17
Auth 48 complete 2018-10-09
Published 2018-10-12

Copy editing for style and clarity, with also corrections to the yang model.
3.18. 8362

OSPFv3 Link State Advertisement (LSA) Extensibility [RFC8362] is a major extension to the OSPF protocol. It makes OSPFv3 fully extensible.

Proposed Standard, 33 pages.
4 personal drafts, first February 17, 2013. 24 WG drafts
Last call announced 2017-12-19, draft 19
IESG evaluation starts 2018-01-18, draft 20
Approved 2018-01-29, draft 23
Auth 48 2018-03-19
Auth 48 complete 2018-03-30
Published 2018-04-03

The specification was first submitted as a personal draft in the IPv6 WG, then moved to the OSPF WG. The long delay of producing this RFC is due to the complexity of the problem, and the need to wait for implementations. It is a very important change to OSPF that makes OSPFv3 fully extensible. Since it was a non-backward compatible change, the developers started out with some very complex migration scenarios but ended up with either legacy or extended OSPFv3 LSAs within an OSPFv3 routing domain. The initial attempts to have a hybrid mode of operation with both legacy and extended LSAs also delayed implementation due to the complexity.

Copy editing for style and clarity.

This specification either was or will be implemented by all the router vendors.

3.19. 8468

IPv4, IPv6, and IPv4-IPv6 Coexistence: Updates for the IP Performance Metrics (IPPM) Framework [rfc8468].

Informational, 15 pages.
3 personal drafts, first August 6, 2015. 7 WG drafts
Last call announced 2018-04-11, draft 04
IESG evaluation starts 2018-05-24, draft 05
Approved 2018-07-10, draft 06
Auth 48 2018-09-13
Auth 48 complete 2018-11-05
Published 2018-11-14

RFC8468 was somehow special in that there was not a technical reason/interest that triggered it, but rather a formal requirement. While writing RFC7312 the IP Performance Metrics working group (IPPM)
realized that RFC 2330, the IP Performance Metrics Framework supported IPv4 only and explicitly excluded support for IPv6. Nevertheless, people used the metrics that were defined on top of RFC 2330 (and, therefore, IPv4 only) for IPv6, too. Although the IPPM WG agreed that the work was needed, the interest of IPPM attendees in progressing (and reading/reviewing) the IPv6 draft was limited. Resolving the IPv6 technical part was straight-forward, but subsequently some people asked for a broader scope (topics like header compression, 6lo, etc.) and it took some time to figure out and later on convince people that these topics are out of scope. The group also had to resolve contentious topics, for example how to measure the processing of IPv6 extension headers, which is sometimes non-standard.

The Auth48 delay for this draft was longer than average. According to the authors, the main reasons include:

- Work-load and travel caused by busy-work-periods of all co-authors
- Time zone difference between co-authors and editor (at least US, Europe, India, not considering travel)
- Editor proposing and committing some unacceptable modifications that needed to be reverted
- Lengthy discussions on a new document title (required high effort and took a long time, in particular reaching consensus between co-authors and editor was time-consuming and involved the AD)
- Editor correctly identifying some nits (obsoleted personal websites of co-authors) and co-authors attempting to fix them.

The differences between the final draft and the publish RFC show copy editing for style and clarity, but do not account for the back and forth between authors and editors mentioned by the authors.

4. Analysis of process and delays

We examine the 20 RFC in the sample, measuring various characteristics such as delay and citation counts, in an attempt to identify patterns in the IETF processes.

4.1. Publication delays

We look at the distribution of delays between the submission of the first draft and the publication of the RFC. We break out the total delay in three components:
o The working group delay, from the first draft to the start of the IETF last call;

o The IETF delay, which lasts from the beginning of the IETF last call to the approval by the IESG, including the reviews by various directorates;

o The RFC production, from approval by the IESG to publication, including the Auth48 reviews.

For submissions to the independent stream, we don’t have a working group. We consider instead the progression of the individual draft until the adoption by the ISE as the equivalent of the "working group" period, and the delay from adoption by the ISE until submission to the RFC Editor as the equivalent of the IETF delay. The following table shows the delays for the 20 RFC in the sample:
The average delay from first draft to publication is about 3 years, but this varies widely. Excluding the independent stream.
submissions, the average delay from start to finish is 3 years and 4 months, of which on average 2 years and 10 months are spent getting consensus in the working group, and 3 to 4 months each for IETF consensus and for RFC production.

The longest delay is found for [RFC8492], 6.5 years from start to finish. This is however a very special case, a draft that was prepared for the TLS working group and failed to reach consensus. After that, it was resubmitted to the ISE, and incurred atypical production delays.

On average, we see that 80% of the delay is incurred in WG processing, 10% in IETF review, and 10% for edition and publication. We can compare these delays to those observed 10 years ago and 20 years ago:
<table>
<thead>
<tr>
<th>RFC (2008)</th>
<th>Status</th>
<th>Pages</th>
<th>Delay</th>
</tr>
</thead>
<tbody>
<tr>
<td>5326</td>
<td>Exp</td>
<td>54</td>
<td>1584</td>
</tr>
<tr>
<td>5348</td>
<td>PS</td>
<td>58</td>
<td>823</td>
</tr>
<tr>
<td>5281</td>
<td>Info</td>
<td>51</td>
<td>1308</td>
</tr>
<tr>
<td>5354</td>
<td>Exp</td>
<td>23</td>
<td>2315</td>
</tr>
<tr>
<td>5227</td>
<td>PS</td>
<td>21</td>
<td>2434</td>
</tr>
<tr>
<td>5329</td>
<td>PS</td>
<td>12</td>
<td>1980</td>
</tr>
<tr>
<td>5277</td>
<td>PS</td>
<td>35</td>
<td>912</td>
</tr>
<tr>
<td>5236</td>
<td>ISE</td>
<td>26</td>
<td>1947</td>
</tr>
<tr>
<td>5358</td>
<td>BCP</td>
<td>7</td>
<td>884</td>
</tr>
<tr>
<td>5271</td>
<td>Info</td>
<td>22</td>
<td>1066</td>
</tr>
<tr>
<td>5195</td>
<td>PS</td>
<td>10</td>
<td>974</td>
</tr>
<tr>
<td>5283</td>
<td>PS</td>
<td>12</td>
<td>1096</td>
</tr>
<tr>
<td>5186</td>
<td>Info</td>
<td>6</td>
<td>2253</td>
</tr>
<tr>
<td>5142</td>
<td>PS</td>
<td>13</td>
<td>1005</td>
</tr>
<tr>
<td>5373</td>
<td>PS</td>
<td>24</td>
<td>1249</td>
</tr>
<tr>
<td>5404</td>
<td>PS</td>
<td>27</td>
<td>214</td>
</tr>
<tr>
<td>5172</td>
<td>PS</td>
<td>7</td>
<td>305</td>
</tr>
<tr>
<td>5349</td>
<td>Info</td>
<td>10</td>
<td>1096</td>
</tr>
<tr>
<td>5301</td>
<td>PS</td>
<td>6</td>
<td>396</td>
</tr>
<tr>
<td>5174</td>
<td>Info</td>
<td>8</td>
<td>427</td>
</tr>
<tr>
<td>RFC (1998)</td>
<td>Status</td>
<td>Pages</td>
<td>Delay</td>
</tr>
<tr>
<td>------------</td>
<td>--------</td>
<td>-------</td>
<td>--------</td>
</tr>
<tr>
<td>2289</td>
<td>PS</td>
<td>25</td>
<td>396</td>
</tr>
<tr>
<td>2267</td>
<td>Info</td>
<td>10</td>
<td>unknown</td>
</tr>
<tr>
<td>2317</td>
<td>BCP</td>
<td>10</td>
<td>485</td>
</tr>
<tr>
<td>2404</td>
<td>PS</td>
<td>7</td>
<td>488</td>
</tr>
<tr>
<td>2374</td>
<td>PS</td>
<td>12</td>
<td>289</td>
</tr>
<tr>
<td>2449</td>
<td>PS</td>
<td>19</td>
<td>273</td>
</tr>
<tr>
<td>2283</td>
<td>PS</td>
<td>9</td>
<td>153</td>
</tr>
<tr>
<td>2394</td>
<td>Info</td>
<td>6</td>
<td>365</td>
</tr>
<tr>
<td>2348</td>
<td>DS</td>
<td>5</td>
<td>699</td>
</tr>
<tr>
<td>2382</td>
<td>Info</td>
<td>30</td>
<td>396</td>
</tr>
<tr>
<td>2297</td>
<td>ISE</td>
<td>109</td>
<td>28</td>
</tr>
<tr>
<td>2381</td>
<td>PS</td>
<td>43</td>
<td>699</td>
</tr>
<tr>
<td>2312</td>
<td>Info</td>
<td>20</td>
<td>365</td>
</tr>
<tr>
<td>2387</td>
<td>PS</td>
<td>10</td>
<td>122</td>
</tr>
<tr>
<td>2398</td>
<td>Info</td>
<td>15</td>
<td>396</td>
</tr>
<tr>
<td>2391</td>
<td>PS</td>
<td>10</td>
<td>122</td>
</tr>
<tr>
<td>2431</td>
<td>PS</td>
<td>10</td>
<td>457</td>
</tr>
<tr>
<td>2282</td>
<td>Info</td>
<td>14</td>
<td>215</td>
</tr>
<tr>
<td>2323</td>
<td>ISE</td>
<td>5</td>
<td>unknown</td>
</tr>
<tr>
<td>2448</td>
<td>ISE</td>
<td>7</td>
<td>92</td>
</tr>
</tbody>
</table>

We can compare the median delay, and the delays observed by the fastest and slowest quartiles in the three years:
The IETF takes three to four times more times to produce an RFC in 2018 than it did in 1998, but about the same time as it did in 2008. The increased delay does not mean increased work per RFC. The number of RFC published per year remained between 200 and 300 all those years, and the number of participants is not greater now than in 1998. If we estimated the "level of attention" by dividing the number of participants by the number of RFC produced, we would see a number that remains stable. People are probably not working much more on each RFC now than they were 20 years ago, but the same amount of work is stretched over a much longer period.

4.2. Preparation and Publication delays

The preparation and publication delays include three components:

- the delay from submission to the RFC Editor to beginning of Auth48, during which the document is prepared;
- the AUTH48 delay, during which authors review and eventually approve the changes proposed by the editors;
- the publication delay, from final agreement by authors and editors to actual publication.

The breakdown of the publication delays for each RFC is shown in the following table.
<table>
<thead>
<tr>
<th>RFC</th>
<th>Status</th>
<th>Pages</th>
<th>RFC edit</th>
<th>Auth 48</th>
<th>RFC Pub</th>
<th>Edit (total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8411</td>
<td>Info</td>
<td>5</td>
<td>53</td>
<td>88</td>
<td>20</td>
<td>161</td>
</tr>
<tr>
<td>8456</td>
<td>Info</td>
<td>64</td>
<td>98</td>
<td>46</td>
<td>14</td>
<td>158</td>
</tr>
<tr>
<td>8446</td>
<td>PS</td>
<td>160</td>
<td>85</td>
<td>57</td>
<td>0</td>
<td>142</td>
</tr>
<tr>
<td>8355</td>
<td>Info</td>
<td>13</td>
<td>83</td>
<td>15</td>
<td>1</td>
<td>99</td>
</tr>
<tr>
<td>8441</td>
<td>PS</td>
<td>8</td>
<td>67</td>
<td>33</td>
<td>6</td>
<td>106</td>
</tr>
<tr>
<td>8324</td>
<td>ISE</td>
<td>29</td>
<td>42</td>
<td>28</td>
<td>1</td>
<td>71</td>
</tr>
<tr>
<td>8377</td>
<td>PS</td>
<td>8</td>
<td>39</td>
<td>102</td>
<td>0</td>
<td>141</td>
</tr>
<tr>
<td>8498</td>
<td>Info</td>
<td>15</td>
<td>49</td>
<td>16</td>
<td>2</td>
<td>67</td>
</tr>
<tr>
<td>8479</td>
<td>ISE</td>
<td>8</td>
<td>31</td>
<td>5</td>
<td>1</td>
<td>37</td>
</tr>
<tr>
<td>8453</td>
<td>Info</td>
<td>42</td>
<td>73</td>
<td>7</td>
<td>0</td>
<td>80</td>
</tr>
<tr>
<td>8429</td>
<td>BCP</td>
<td>10</td>
<td>60</td>
<td>99</td>
<td>0</td>
<td>159</td>
</tr>
<tr>
<td>8312</td>
<td>Info</td>
<td>18</td>
<td>96</td>
<td>30</td>
<td>0</td>
<td>126</td>
</tr>
<tr>
<td>8492</td>
<td>ISE</td>
<td>40</td>
<td>355</td>
<td>123</td>
<td>2</td>
<td>480</td>
</tr>
<tr>
<td>8378</td>
<td>Exp</td>
<td>21</td>
<td>42</td>
<td>9</td>
<td>0</td>
<td>51</td>
</tr>
<tr>
<td>8361</td>
<td>PS</td>
<td>17</td>
<td>39</td>
<td>31</td>
<td>3</td>
<td>73</td>
</tr>
<tr>
<td>8472</td>
<td>PS</td>
<td>8</td>
<td>59</td>
<td>8</td>
<td>13</td>
<td>80</td>
</tr>
<tr>
<td>8466</td>
<td>PS</td>
<td>158</td>
<td>84</td>
<td>22</td>
<td>3</td>
<td>109</td>
</tr>
<tr>
<td>8362</td>
<td>PS</td>
<td>33</td>
<td>49</td>
<td>11</td>
<td>4</td>
<td>64</td>
</tr>
<tr>
<td>8468</td>
<td>Info</td>
<td>15</td>
<td>65</td>
<td>53</td>
<td>9</td>
<td>127</td>
</tr>
<tr>
<td>-8492</td>
<td>Average</td>
<td>62</td>
<td>37</td>
<td>4</td>
<td>103</td>
<td></td>
</tr>
</tbody>
</table>
On average, the total delay appears to be a bit more than four month, but the average is skewed by the extreme values encountered for [RFC8492]. If we exclude that RFC from the computations, the average delay drops to just a bit more than 3 months: about 2 months for the preparation, a bit more than one month for the Auth48 phase, and 4 days for the publishing.

Of course, these delays vary from RFC to RFC. To try explain the causes of the delay, we compute the correlation factor between the observed delays and 4 plausible explanation factors:

- The number of pages in the document,
- The amount of copy edit, as discussed in (#copy-editing),
- Whether or not an IANA action was required.

We find the following values:

<table>
<thead>
<tr>
<th>Correlation</th>
<th>RFC edit</th>
<th>Auth 48</th>
<th>Edit(total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nb pages</td>
<td>0.50</td>
<td>-0.04</td>
<td>0.21</td>
</tr>
<tr>
<td>Copy-Edit</td>
<td>0.42</td>
<td>0.24</td>
<td>0.45</td>
</tr>
<tr>
<td>IANA</td>
<td>-0.13</td>
<td>0.26</td>
<td>0.15</td>
</tr>
</tbody>
</table>

None of these indicate strong correlations. The greater number of pages will tend to increase the preparation delay, but it does not appear to impact the Auth48 delay at all. The amount of copy editing also tend to increase the the preparation delay somewhat and the Auth48 delay a little. The presence or absence of IANA action has very ittle correlation with the delays.

We also observe that the Auth48 delay varies much more than the preparation delay, with a standard deviation of 20 days for Auth48 versus 10 days for the preparation delay. In theory, Auth48 is just a final verification: the authors receive the document prepared by the RFC production center, and just have to give their approval, or maybe request a last minute correction. The name indicates that this is expected to last just two days, but in average it lasts more than a month.

We tested a variety of hypotheses that might explain the duration of AUTH48 by computing the correlation coefficients between various
properties of the RFC and the production delays. The results are listed in the following table:

<table>
<thead>
<tr>
<th>Correlation</th>
<th>RFC production</th>
<th>Auth 48</th>
<th>RFC Edit(total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nb drafts</td>
<td>0.19</td>
<td>-0.30</td>
<td>-0.17</td>
</tr>
<tr>
<td>Nb Authors</td>
<td>0.40</td>
<td>-0.04</td>
<td>0.16</td>
</tr>
<tr>
<td>WG delay</td>
<td>0.03</td>
<td>-0.16</td>
<td>-0.15</td>
</tr>
</tbody>
</table>

The results show that there is no simple answer. The number of pages, the required amount of copy editing and to a very small extent the number of drafts can help predict the production delay, but there is no obvious predictor for the Auth 48 delay. In particular, there is no numerical evidence that the number of authors influences the Auth48 delay, or that authors who have spent a long time working on the document in the working group somehow spend even longer to answer questions during Auth48 - if anything, the numerical results point in the opposite direction.

After asking the authors of the RFC in the sample why the AUTH48 phase took a long time, and we got three explanations:

1- Some RFC have multiple authors in multiple time zones. This slows down the coordination required for approving changes.

2- Some authors found some of the proposed changes unnecessary or undesirable, and asked that they be reversed. This required long exchanges between authors and editors.

3- Some authors were not giving high priority to AUTH48 responses.

As mentioned above, we were not able to verify these hypotheses by looking at the data.

4.3. Copy editing

We can assess the amount of copy editing applied to each published RFC by comparing the text of the draft approved for publication and the text of the RFC. We do expect differences in the "boilerplate" and in the IANA section, but we will also see differences due to copy editing. Assessing the amount of copy editing is subjective, and we do it using a scale of 1 to 4:

1- Minor editing
2- Editing for style, such as capitalization, hyphens, that versus which, and expending all acronyms at least one.

3- Editing for clarity in addition to style, such as rewriting ambiguous sentences and clarifying use of internal references. For Yang models, that may include model corrections suggested by the verifier.

4- Extensive editing.

The following table shows that with about half of the RFC required editing for style, and the other half at least some editing for clarity.
<table>
<thead>
<tr>
<th>RFC</th>
<th>Status</th>
<th>Copy Edit</th>
</tr>
</thead>
<tbody>
<tr>
<td>8411</td>
<td>Info</td>
<td>2</td>
</tr>
<tr>
<td>8456</td>
<td>Info</td>
<td>4</td>
</tr>
<tr>
<td>8446</td>
<td>PS</td>
<td>3</td>
</tr>
<tr>
<td>8355</td>
<td>Info</td>
<td>2</td>
</tr>
<tr>
<td>8441</td>
<td>PS</td>
<td>2</td>
</tr>
<tr>
<td>8324</td>
<td>ISE</td>
<td>2</td>
</tr>
<tr>
<td>8377</td>
<td>PS</td>
<td>3</td>
</tr>
<tr>
<td>8498</td>
<td>Info</td>
<td>3</td>
</tr>
<tr>
<td>8479</td>
<td>ISE</td>
<td>1</td>
</tr>
<tr>
<td>8453</td>
<td>Info</td>
<td>2</td>
</tr>
<tr>
<td>8429</td>
<td>BCP</td>
<td>2</td>
</tr>
<tr>
<td>8312</td>
<td>Info</td>
<td>2</td>
</tr>
<tr>
<td>8492</td>
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<td>8378</td>
<td>Exp</td>
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<td>8361</td>
<td>PS</td>
<td>2</td>
</tr>
<tr>
<td>8472</td>
<td>PS</td>
<td>2</td>
</tr>
<tr>
<td>8466</td>
<td>PS</td>
<td>3</td>
</tr>
<tr>
<td>8362</td>
<td>PS</td>
<td>3</td>
</tr>
<tr>
<td>8468</td>
<td>Info</td>
<td>3</td>
</tr>
</tbody>
</table>

This method of assessment does not take into account the number of changes proposed by the editors and eventually rejected by the authors, since these changes are not present in either the final draft or the published RFC. It might be possible to get an evaluation of these "phantom changes" from the RFC Production Center.
4.4. Independent Series

Out of 20 randomly selected RFC, 3 were published through the "independent series". One is an independent opinion, another a description of a non-IETF protocol format, and the third was [RFC8492], which is a special case. Apart from this special case, the publication delays were significantly shorter for the Independent Stream than for the IETF stream. This seems to indicate that the Independent Series is functioning as expected.

The authors of these 3 RFC are regular IETF contributors. This observation motivated a secondary analysis of all the RFC published in the "independent" stream in 2018. There are 14 such RFC: 8507, 8494, 8493, 8492, 8483, 8479, 8433, 8409, 8374, 8369, 8367, 8351, 8328 and 8324. (RFC 8367 and 8369 were published on 1 April 2018.) We can ask whether the authors of these RFC are these outsiders, part of a "wider community" or are people who are also contributing to the IETF. The overwhelming response is, "insiders". Pretty much all the authors are or were involved in the IETF, many of them with a prominent track record. There are just 2 exceptions, a single RFC in which only 3 of the 5 authors are well associated with the IETF.

5. Citation Counts

In this exploration, we want to assess whether citation counts provide a meaningful assessment of the popularity of RFC. We obtain the citation counts through the Semantic Scholar API, using queries of the form: ~~~ http://api.semanticscholar.org/v1/paper/10.17487/rfc8446?include_unknown_references=true ~~~ In these queries, the RFC is uniquely identified by its DOI reference, which is composed of the RFC Series prefix 10.17487 and the rfc identifier. The queries return a series of properties, including a list of citations for the RFC. Based on that list of citations, we compute three numbers:

- The total number of citations
- The number of citations in the year of publication and the year after that
- For the RFC published in 1998 or 2008 that we use for comparison, the number of citations in the years 2018 and 2019.

All the numbers were retrieved on October 6, 2019.
5.1. Citation Numbers

As measured on October 6, 2019, the citation counts for the RFC in our sample set were:

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The results indicate that [RFC8446] is by far the most cited of the 20 RFC in our sample. This is not surprising, since TLS is a key Internet Protocol. The TLS 1.3 protocol was also the subject of extensive studies by researchers, and thus was mentioned in a number of published papers. Surprisingly, the Semantic Scholar mentions a number of citations that predate the publication date. These are probably citations of the various draft versions of the protocol.

The next most cited RFC in the sample is [RFC8312] which describes the Cubic congestion control algorithm for TCP. That protocol was also the target of a large number of academic publications. The other RFC in the sample only have a small number of citations.

5.2. Comparison to 1998 and 2008

In order to get a baseline, we can look at the number of references for the RFC published in 2008 and 1998. However, we need to take time into account. Documents published a long time ago are expected to have accrued more references. We try to address this by looking at three counts for each document: the overall number of references over the document’s lifetime, the number of references obtained in the year following publication, and the number of references observed since 2018:
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</table>

We can compare the median number of citations and the numbers of citations for the least and most popular quartiles in the three years:
The total numbers show new documents with fewer citations than the older ones. This can be explained to some degree by the passage of time. If we restrict the analysis to the number of citations accrued in the year of publishing and the year after that, we still see about the same distribution for the three samples.

We also see that the number of references to RFC fades over time. Only the most popular of the RFC produced in 1998 are still cited in 2019.

### 5.3. Citations versus deployments

The following table shows side by side the number of citations as measured in (#citation-numbers) and the estimation of deployment as indicated in (#sample/rfc-analysis).
From looking at these results, it is fairly obvious that citation counts cannot be used as proxies for the "value" of an RFC. In our sample, the two RFC that have high citation counts were both widely deployed, and can certainly be described as successful, but we also see many RFC that saw significant deployment without garnering a high level of citations.
Citation counts are driven by academic interest, but are only loosely correlated with actual deployment. We saw that RFC8446 was widely cited in part because the standardization process involved many researchers, and that the high citation count of RFC8312 is largely due to the academic interest in evaluating congestion control protocols. If we look at previous years, the most cited RFC in the 2008 sample is RFC5326, an experimental RFC defining security extensions to an experimental delay tolerant transport protocol. This protocol does not carry a significant proportion of Internet traffic, but has been the object of a fair number of academic studies.

The citation process tends to privilege the first expression of a concept. We see that with the most cited RFC in the 1998 set is RFC2267, an informational RFC defining Network Ingress Filtering that was obsoleted in May 2000 by RFC2827. It is still cited frequently in 2018 and 2019, regardless of its formal status in the RFC series. We see the same effect at work with RFC8441, which garners very few citations although it obsoletes RFC6455 that has a large number of citations. The same goes for RFC8468, which is sparsely cited while the RFC2330 is widely cited. Just counting citations will not indicate whether developers still use an old specification or have adopted the revised RFC.

6. Observations and Next Steps

The goal of this study was to evaluate how the IETF produces standards, from working group processing to RFC production. As shown in (#process-analysis), the average RFC was produced in 3 years and 4 months, which is similar to what was found in the 2008 sample, but more than three times larger than the delays for the 1998 sample.

The Working group process appears to be the main source of delays. Efforts to diminish delays should probably focus there, instead of on the IETF and IESG reviews of the RFC production. For the RFC production phase, most of the variability originates in the AUTH48 process, which is influenced by a variety of factors such as number of authors or level of engagement of these authors.

The Independent Submission stream operates as expected. The authors of the independent RFC appear to be mostly IETF insiders.

The analysis of citations in (#citation-numbers) shows that citation numbers are a very poor indication of the "value" of an RFC. Citation numbers measure the engagement of academic researchers with specific topics, but have little correlation with the level of adoption and deployment of a specific RFC.
This document analyses a small sample of RFC "in depth". This allowed gathering of detailed feedback on the process and the deployments. On the other hand, much of the data on delays is available from the data tracker. It may be worth considering adding an automated reporting of delay metrics in the data tracker.

This document only considers the RFC that were published in a given year. This approach can be criticized as introducing a form of "survivor bias". There are many drafts proposed to the IETF, and only a fraction of them end up being published as RFC. On one hand this is expected, because part of the process is to triage between ideas that can gather consensus and those that don’t. On the other hand, we don’t know whether that triage is too drastic and discouraged progress on good ideas.

One way to evaluate the triage process would be to look at publication attempts that were abandoned, for example drafts that expired without progressing or being replaced. The sampling methodology could also be used for that purpose. Pick maybe 20 drafts at random, among those abandoned in a target year, and investigate why they were abandoned. Was it because better solutions emerged in the working group? Or maybe because the authors discovered a flaw in their proposal? Or was it because some factional struggle blocked a good idea? Was the idea pursued in a different venue? Hopefully, someone will try this kind of investigation.

7. Security considerations

This draft does not specify any protocol.

We might want to analyze whether security issues were discovered after publication of specific standards.

8. IANA Considerations

This draft does not require any IANA action.

Peliminary analysis does not indicate that IANA is causing any particular delay in the RFC publication process.

9. Acknowledgements

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Mavrogiannopoulos, Patrick McManus, Victor Moreno, Al Morton, Andrei Popov, Eric Rescorla, Michiko Short, Bhuvaneswaran Vengainathan, Lao Weiguo, and Li Yizhou. Many thanks to Adrian Farrel for his useful advice, and to Stephen Farrel and Colin Perkins for their guidance on the use of citations.

10. Informative References


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