How many years can a tiny unbalanced parenthesis go unnoticed on a widely accessed Internet document, older than the World Wide Web itself?

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Abstract

1 Introduction

Reading the RFC Index\(^1\) we noticed a syntax error: a tiny unbalanced parenthesis on one of the first paragraphs, as reported on table 1 on the following page. For example, the file available at https://www.ietf.org/rfc/rfc-index.txt still has this issue, as of today.

The error is clearly a minor one, but we realized it was present also in older releases of the same document, for example looking at the Wayback machine of https://web.archive.org we checked that the error is already present on the first occurrence, dated 15 June 2007. Also, on the same IETF site, there is a PDF file\(^2\) dating back to 2012-04-06 10:17 that shows the same issue — the PDF, by the way, reports “CREATED ON: 04/04/2012.” so it is probably really sitting on that web folder since April 2012.

The RFCs are a fundamental part of the Internet documents, the oldest of all: RFC 1, titled “Host Software”, was written by Steve Crocker and published on 7 April 1969. We may assume that, since there was a list of RFCs, there was also a document with the list of the citations to the published RFCs and that a document like the rfc-index.txt file (maybe by another name) surely existed since the ’70s. Because of the relevance of the RFCs we may also assume that the RFC index has been downloaded a lot of times — but probably not read in detail many times, as the present investigation suggests.

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\(^1\)As everybody does on their Christmas holidays, at least in civilized lands.

\(^2\)https://www.ietf.org/rfc/rfc-index.txt.pdf
2 The quest for the RFC indexes

| Wrong | Obsoletes xxxx refers to other RFCs that this one replaces; Obsoleted by xxxx refers to RFCs that have replaced this one. Updates xxxx refers to other RFCs that this one merely updates but does not replace; Updated by xxxx refers to RFCs that have updated (but not replaced) this one. Generally, only immediately succeeding and/or preceding RFCs are indicated, not the entire history of each related earlier or later RFC in a related series. |
| Right | Obsoletes xxxx refers to other RFCs that this one replaces; Obsoleted by xxxx refers to RFCs that have replaced this one. Updates xxxx refers to other RFCs that this one merely updates (but does not replace); Updated by xxxx refers to RFCs that have updated (but not replaced) this one. Generally, only immediately succeeding and/or preceding RFCs are indicated, not the entire history of each related earlier or later RFC in a related series. |

Table 1: The sentence is italic in the first block and bold in the second.

This brings to the question that gives the title to the paper: “How many years can a tiny unbalanced parenthesis go unnoticed on a widely accessed Internet document, older than WWW itself?” (probably much older than the WWW.)

2 The quest for the RFC indexes

We began our quest for ancient RFC indexes: we wanted to find the precise date where the error was introduced, or the best estimate we could determine.

The main issue is that, while a web search for a rfc-index.txt file returns millions of hits, what we really need are some of the very few archived versions, not one of the many recent ones.

An help came by noticing that the rfc-index.txt has some “brother and sisters” documents, as stated in RFC2648: the For Your Information fyi-index.txt, the Standards std-index.txt and the Best Common Practices bcp-index.txt. Moreover, and more important for our investigation, current releases of those files show the same mistake, with the exception of the std-index.txt files, because they do not have that paragraph. Besides, these three indexes (RFC, FYI and BCP) show a very similar structure, and in particular the sentence “Obsoletes xxxx (...) in a related series.” is the most conserved region of the header — clearly they differ in the second part of the file, where the proper citations list begins. So, it
3 Analysis

Table 2: Metadata of index files downloaded from TU Clausthal’s FTP server.

| Filename   | Bytes   | Date - ISO 8601 format         |
|------------|---------|-------------------------------|
| fyi-index.txt | 186821  | 1994-07-15 20:58:34.000000000 +0200 |
| rfc-index.txt | 222733  | 1994-07-15 21:32:32.000000000 +0200 |
| std-index.txt | 186821  | 1994-07-15 21:38:13.000000000 +0200 |

seems reasonable to infer that they are generated by some software\textsuperscript{3} that makes the same mistake whenever it builds the indexes, and that we could use dates and references of either index to pin down the time of change.

To cut a long story short, we believe that there is good evidence that the change happened between the 14 and the 15 of July 1994: the key finding was the FTP server of the Clausthal University of Technology (see the Resources section 5 on page 5 for the URLs), which contains some indexes that seems to mark exactly the threshold between the latest occurrence of a correct text and the earliest occurrence of the mistake.

3 Analysis

We downloaded the files at the following URLs and analyzed their content and metadata (for readability, the path is relative to ftp://ftp.tu-clausthal.de/pub/docs/rfc/):

- rfc-index.txt /other_indexes/rfc-index.txt
- fyi-index.txt /other_indexes/fyi-index.txt
- std-index.txt /other_indexes/std-index.txt which is in fact a symbolic link for the file /standards/std-index.txt

Table 2 shows the file size and the ISO 8601 date format of the three files. The reader may notice a strange thing, namely that the fyi-index.txt and the std-index.txt have exactly the same size, and this is very suspicious since their content should be quite different. Looking at the content the mystery unveils: all the indexes are in fact RFC indexes, despite the file name says otherwise.

An MD5 comparison of fyi-index.txt and std-index.txt shows that the files are indeed different. An inspection of the files shows that they are the same until line 271: after that the fyi-index.txt has a sequence of `^@` characters, as if it was corrupted (it is worth to mention that also the rfc-index.txt file is similarly corrupted, beginning from line 232).

\textsuperscript{3}We have not been able to track the source.
There seems to be two different RFC index files: the first is properly named `rfc-index.txt` while the second is referred by two different misleading names. Reading and comparing the file content we see that the properly named RFC index has these characteristics:

1. an embedded date at line 4, 7/14/1994,
2. the right sentence,
3. the list of citations reverse sorted, from the newest to the oldest.

Instead, the misnamed RFC indexes have:

1. the wrong sentence,
2. the list of citations sorted from the oldest to the newest.

The above findings suggests that the `rfc-index.txt` file was probably created on 14 July 1994, as the embedded date suggests, and copied on the FTP server the day after; it could be useful if the list of citations showed further evidence of the above, but this can not happen, since the file begins with RFC0001 and then it is corrupted well before it reaches RFCs issued by July 1994.

We assume that the bug was then introduced and the RFC files generated afterwards show the unbalanced parenthesis.

To support this deduction, we see that the wrong files have a date on the FTP server that is 15 July 1994, as it is reported in table 2 on the previous page; even assuming that the date was changed for some reason the last RFC shown on `std-index.txt` — the only file that is not corrupted — is RFC1653, that was issued on July 1994. So, in any case, the `std-index.txt` file could not have been generated before the begin of July 1994. To summarize:

1. it is highly probable that a correct RFC index was generated on 14 July 1994,
2. a mistaken file, that had been necessarily created on July 1994 or later, is present on the FTP server of the Clausthal University of Technology with a timestamp of 15 July 1994.

In our opinion the most plausible scenario is that the `rfc-index.txt` files generated before 14 July 1994 had no error, that the mistake was introduced that day and thereafter the answer to the question posed at the beginning of this paper is: *an unbalanced parenthesis may go unnoticed for more that twenty-six years.*

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4We have further evidence that on December 1993 the RFC index was correct, so there is support that before 1994 the mistake was not present.
4 Discussion

There is an empirical law — dubbed Linus’ law — that states that “given enough eyeballs, all bugs are shallow”. It was formulated by Eric S. Raymond in the book “The Cathedral and the Bazaar” and so named in honour of Linus Torvalds, Linux creator.

The law applies to software, not to documentation, and it has been criticized so there is no clear evidence either of its validity or its falsity.

Our little investigation would like to bring some evidence towards a better understanding of the idea behind the Linus’ law: is it true that simply having a content under a wide public scrutiny ensures for its quality? If we compare syntax errors on documentation to software bugs in computer code — which is a not too-far stretched analogy, in our opinion — then the present paper gives a negative answer.

We have tried to understand if there is some other reason behind the fact that the error went unfixed for so long, and among the issues we noticed that:

• it is not easy to provide a proper feedback for this kind of error: it is possible to provide a RFC errata\(^5\), but it is limited to RFCs and the last resort is emailing the mailto:rfc-editor@rfc-editor.org address — we did that on 10 of January 2021;

• it is not explained how the indexes are created: we have not been able to find the repository of the software that generates them and file a bug report.

In our opinion the main enabler is not the “number of eyeballs”, to quote the law statement, but how easy it is to contribute changes. Clearly open source and free software have this property, the same does not necessarily hold for documentation, even if it is freely available (legally speaking, the RFCs licenses are very permissive) and freely distributable.

5 Resources

5.1 Links

TU Clausthal’s FTP server The anonymous FTP server is reachable at the address: ftp://ftp.tu-clausthal.de/pub/docs/rfc/

rfc-index.txt ftp://ftp.tu-clausthal.de/pub/docs/rfc/other_indexes/rfc-index.txt

fyi-index.txt ftp://ftp.tu-clausthal.de/pub/docs/rfc/other_indexes/fyi-index.txt

std-index.txt ftp://ftp.tu-clausthal.de/pub/docs/rfc/standards/std-index.txt

\(^5\)https://www.rfc-editor.org/errata.php
5.2 Indexes

Excerpt of the header of the index files analyzed in this paper.

**rfc-index.txt**

```
# RFC INDEX #
-----------
7/14/1994

This file contains citations for all RFCs in reverse numeric order. RFC
 citations appear in this format:

NUM STD  Author 1, ... Author 5., "Title of RFC", Issue date.
         (Pages=##) (Format=.txt or .ps) (FYI ##) (STD ##) (RTR ##)
         (Obsoletes RFC####) (Updates RFC####)

Key to citations:

#### is the RFC number; ## p. is the total number of pages.

The format and byte information follows the page information in
 parenthesis. The format, either ASCII text (TXT) or PostScript (PS) or
 both, is noted, followed by an equals sign and the number of bytes for
 that version (Post Script is a registered trademark of Adobe Systems
 Incorporated). The example (Format: PS=xxx TXT=zzz bytes) shows that
 the PostScript version of the RFC is xxx bytes and the ASCII text version
 is zzz bytes.

The (Also FYI ##) phrase gives the equivalent FYI number if the RFC was
 also issued as an FYI document.

"Obsoletes xxx" refers to other RFCs that this one replaces; "Obsoleted
 by xxx" refers to RFCs that have replaced this one. "Updates xxx" refers
 to other RFCs that this one merely updates (but does not replace);
 "Updated by xxx" refers to RFCs that have been updated by this one (but
 not replaced). Only immediately succeeding and/or preceding RFCs are
 indicated, not the entire history of each related earlier or later RFC
 in a related series.
```

**fyi-index.txt**

```
-----------------------------------------------
RFC INDEX
---------
-----------------------------------------------

This file contains citations for all RFCs in numeric order.

RFC citations appear in this format:

#### Title of RFC. Author 1, Author 2, Author 3. Issue date.
     (Format: ASCII) (Obsoletes xxx) (Obsoleted by xxx) (Updates xxx)
     (Updated by xxx) (Also FYI ####)

Key to citations:

#### is the RFC number.

Following the number are the title (terminated with a period), the
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6 Acknowledgments

piece of the old Internet.