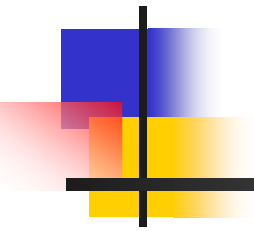# RFC Editor Tutorial

IETF 67

San Diego, California

5 November 2006

Overview of this Tutorial

1. Background: The RFC Series and the RFC Editor

2. The Publication Process

3. Contents of an RFC

4. How to Write an RFC

5. Conclusion

1. The RFC Series

- Earliest document series to be published online.

  - 1969 – today: 36 years old.

  - 4500+ documents.

- *An ARCHIVAL* series: RFCs are *forever*!

- A comprehensive record of Internet technical history

RFCs

- **RFC document series**
  - Begun by Steve Crocker [RFC 3] and Jon Postel in 1969.
  - Informal memos, technical specs, and much more.

- **Jon Postel quickly became *the* RFC Editor.**
  - 28 years: 1970 until his death in 1998.
  - He established and maintained the consistent style and editorial quality of the RFC series.
  - Jon was a 2-finger typist.

Jon Postel

- Postel had an enormous influence on the developing ARPAnet & Internet protocols – the "Protocol Czar" and the "Deputy Internet Architect" as well as the IANA and RFC Editor.
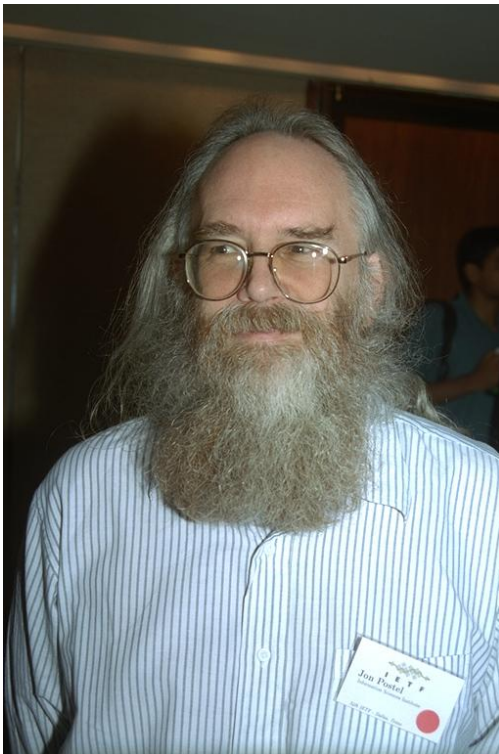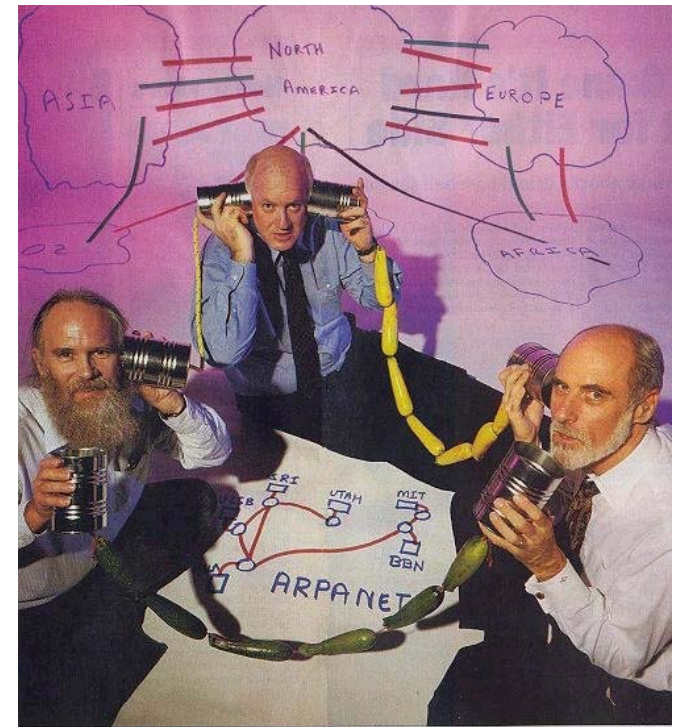

Photo by Peter Lothberg – IETF34 Aug 1995

Newsweek Aug 8, 1994

Historical Context of RFC Series

- 1969: Building ARPAnet   RFC 1
- 1975: TCP/IP research begun ~RFC 700
  - Recorded in separate IEN series
- 1983: Internet born 1 Jan   ~RFC 830
- 1985: IETF created   ~RFC 950
- 1993: Modern IESG/IAB org   ~RFC 1400
- 1998: Postel passed away   ~RFC 2430
- Today   ~RFC 4500

RFC Publication Rate

Number of RFC documents Published per Year
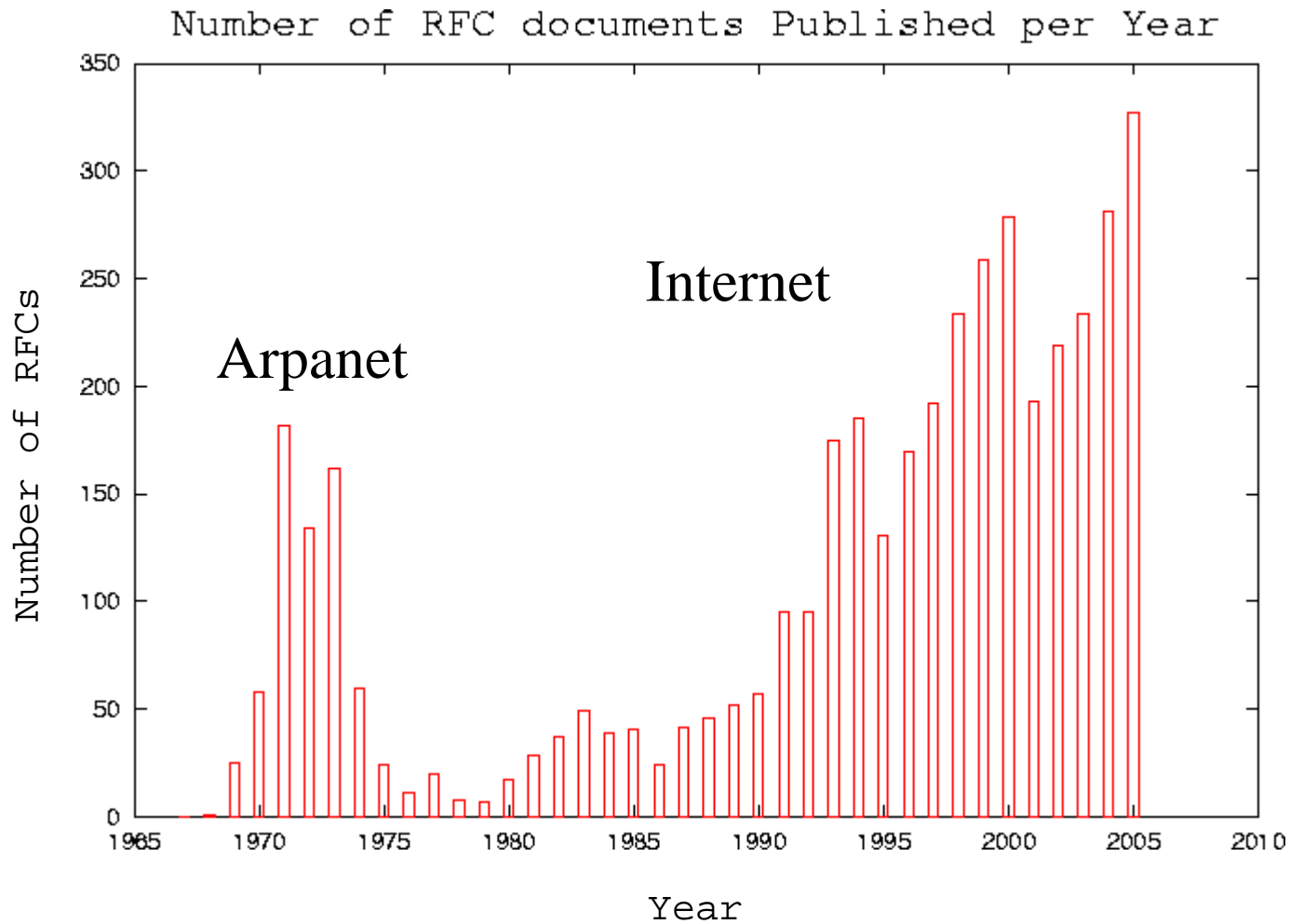
Jon Postel's Playful Side

- ## April 1 RFCs
  - A little humorous self-parody is a good thing…
  - Most, but not all, April 1 RFCs are satirical documents.
    - We expect you can tell the difference   ;-)

- ## April 1 submissions are reviewed for cleverness, humor, and topical relation to IETF themes.
  - Avian Carriers is famous [RFC 1149]
  - Evil Bit is a favorite [RFC 3514]

The RFC Editor today

- A small group at Jon's long-term home,
  - the Information Sciences Institute (ISI) of USC.
  - ~6 FTEs
- Under contract with ISOC/IASA
- Current leadership:
  - Bob Braden, colleague of Postel 1970-1998.
  - Sandy Ginoza, editor of RFCs for 7 years.
- RFC Editorial Board
  - Provides advice and counsel to the RFC Editor, particularly about independent submissions.

The RFC Editor Team

Bob Braden

Sandy Ginoza

Alice Hagens

Eric Nord

The RFC Editor Web site

http://www.rfc-editor.org

- Search engines for RFCs, Internet Drafts
- RFC publication queue
- Master index of RFCs
  - ftp://ftp.rfc-editor.org/in-notes/rfc-index.txt, .xml
- "Official Internet Protocols Standards" list
- Policy changes, news, FAQ, and more
- Errata (see next slide)

Errata Page

- **www.rfc-editor.org/errata.html**
  - A list of technical and editorial errors that have been reported to the RFC Editor.
  - Verified by the authors and/or the IESG.
  - The RFC Editor search engine results contain hyperlinks to errata, when present.
- Pending errata - a file of emails
  - Claimed errata that have been reported to the RFC Editor, but not verified or posted to errata.html.

RFCs and the IETF

- It was natural to adapt the existing RFC series to publication of Internet standards specifications.

  - Informally: mid 1980s

  - Formally: RFC 1602 (1994), RFC 2026 (1996)

RFC Categories

- RFC 2026 defines specification maturity levels:
  - Standards track: Proposed, Draft, Standard.
  - Non-standards track: Experimental, Informational, Historic.
  - "Almost standard": Best Current Practice.
- Shown on RFC header as "Category:"
  - Except, one category "Standards Track" for PS, DS, S.
  - Often called "status".
- A published RFC can NEVER change, but its *category* can change (see rfc-index.txt).

Sources for RFCs

- **IETF submissions**
  - Mostly from Working Groups.
  - Rest are *individual submissions* via the IESG.
  - All are submitted to the RFC Editor by the IESG after approval process [RFC2026].

- **IAB submissions**
  - Submitted directly by IAB Chair
  - Informational category

More RFC Sources

- ## RFC Editor ("*independent*") submissions
  - Submitted directly to RFC Editor.
  - RFC Editor reviews and decides whether publication is appropriate.
  - IESG reviews for conflict with any WG, makes publish/do-not-publish recommendation.
  - RFC Editor has final decision, with advice from Editorial Board.
  - Only Experimental or Informational category.
- ## IRTF submissions: see *draft-irtf-rfcs-00.txt*

Review of Independent Submissions

- RFC Editor finds competent reviewer(s), with advice and aid from the Editorial Board.

- Possible conclusions:
    - Out of scope for RFC series.
    - Incompetent or redundant, not worth publication.
    - Important, but should go through IETF process first ("Throw it over the wall to the IESG!")
    - Serious flaws – report to author, reject for now.
    - Suggest changes to author, then OK to publish.
    - Great! Publish it.

RFC Sub-Series

- All RFCs are numbered sequentially.

- There was a desire to identify significant subsets of RFCs, so Postel invented "sub-series". An RFC may have a sub-series designator.

    - e.g., "RFC 2026, BCP 9"

- Sub-series designations:

    - BCP   Best Current Practice category

    - STD   Standard category

    - FYI   Informational category: user documentation

STD Sub-Series

- Originally: all protocol specs were expected to quickly reach (full) Standard category.
  - Then the STD sub-series would include all significant standards documents.
  - Of course, it did not work out that way; most standards-track documents do not get beyond Proposed Standard.
  - See "Official Internet Protocol Standards"
    - See: www.rfc-editor.org/rfcxx00.html (occasionally published as STD 1) for the REAL list of current relevant standards-track docs.

STD Sub-Series

- STDs were overloaded to represent "complete standards"; one STD # can contain multiple RFCs.

- Examples:
  - STD 5 = "IP", includes RFCs 791, 792, 919, 922, 950, 1112
  - STD 13 = "DNS", includes RFCs 1034, 1035
  - STD 12 = "Network Time Protocol", currently no RFCs.

STDs as Protocol Names

- Really, "RFCxxxx" is only a *document name.*
    - But, people often talk about "RFC 821" or "821" when they mean "SMTP".

- As protocols evolve, RFC numbers make confusing names for protocols. Postel hoped that STD numbers would function as protocol names.
    - But reality is too complicated for this to work well.
    - It HAS been working for BCPs.

- We need a better way to name protocols.
    - ISD (Internet Standards Document) proposal ??

2. RFC Publication Process

- Overview
- Queue states
- AUTH48 procedure

Publication Process: Overview (1)

- First published as an Internet Draft
  - A well-formed RFC starts with a well-formed I-D.
    - http://www.ietf.org/ID-Checklist.html
    - http://www.ietf.org/ietf/1id-guidelines.txt
  - Send us the `xml2rfc` or `nroff -ms` source, if available.

Publication Process: Overview (2)

- ## RFC Editor
  - Edits and formats the document
  - Makes many consistency checks

- ## IANA acts on IANA Considerations
  - Creates new registries and assigns numbers.
  - RFC Editor plugs assigned numbers into document.

Publication Process: Overview (3)

- An RFC # is assigned.

- Document and diff file sent to authors for final check
  - "AUTH48" state.
  - All named authors are responsible.

- Finished document added to archive and index.
  - Announcement on ietf-announce list.
  - Mirrored at IETF site, other sites.
  - Nroff, xml files archived, for later revisions.

Markup in Editing (1)

- When *xml2rfc* is not used:

- ASCII publication markup done using *nroff –ms*.

  - *Nroff* provides direct, explicit format control

- Final products -- files created and archived:

  - rfcxxxx.txt: ASCII file of RFC

 - rfcxxxx.nroff: markup that produces rfcxxxx.txt

Markup in Editing (2)

- When *xml2rfc* is used and .xml is submitted:
  - We edit the .xml as much as possible, then
  - use *xml2rfc* to convert .xml to .nroff.
  - We make final formatting changes by editing .nroff.

- Then we also archive:
  - rfcxxxx.xml: Partially edited version.

- Ideal: edit only .xml, make final .txt using *xml2rfc*.
  - Working with *xml2rfc* developers to make this possible.

Normative References

- Set of RFCs linked by normative refs must be published simultaneously.

- Two hold points:

  - MISSREF state: a doc with norm. ref to a doc not yet received by RFC Editor.

  - REF state: a doc that is edited but waiting for dependent docs to be edited.

Publication Process
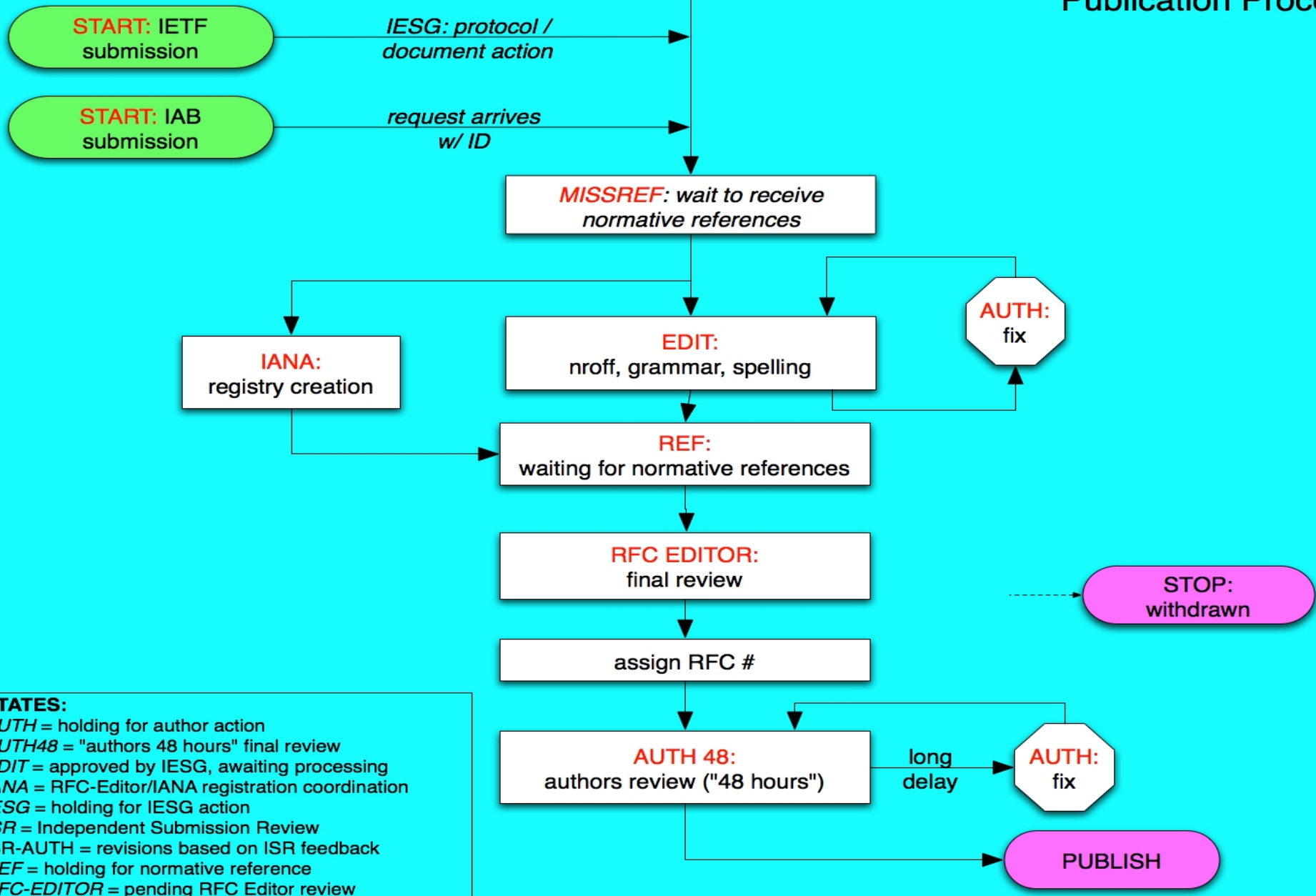
STATES:
AUTH = holding for author action
AUTH48 = "authors 48 hours" final review
EDIT = approved by IESG, awaiting processing
IANA = RFC-Editor/IANA registration coordination
IESG = holding for IESG action
ISR = Independent Submission Review
ISR-AUTH = revisions based on ISR feedback
REF = holding for normative reference
RFC-EDITOR = pending RFC Editor review

Aaron Falk November 1, 2005, v.15

AUTH48 State: Final Author Review

- Last-minute editorial changes allowed – But should not be substantive or too extensive.
  - Else, must get OK from AD, WG chair.
- This process can involve a fair amount of work & time
  - AT LEAST 48 hours!
  - All listed authors must sign off on final document
  - Authors should take it seriously - review the entire document, not just the diffs.
  - Your last chance to avoid enrollment in the *Errata Hall of Infamy*!

3. Contents

- **Header**
- **Title**
- **Header boilerplate (Short copyright, Status of Memo)**
- **IESG Note (when requested by IESG)**
- **Abstract**
- **Table of Contents (not req'd for short docs)**
- **Body**
- **Authors' Addresses**
- **IPR boilerplate**
  - See RFC 3667/BCP 78, RFC 3668/BCP 79.

RFC Header

```
Network Working Group                    T. Berners-Lee
Request for Comments: 3986                      W3C/MIT
STD: 66                                      R. Fielding
Updates: 1738                              Day Software
Obsoletes: 2732, 2396, 1808                 L. Masinter
Category: Standards Track                  Adobe Systems
                                           January 2005
```

- ## STD sub-series number 66

- ## Updates, Obsoletes: relation to earlier RFCs.
  - Please note this information in a prominent place in your Internet-Draft; preferably the header.

RFC Header: Another Example

```
Network Working Group                          T. Berners-Lee
Request for Comments: 2396                           MIT/LCS
Updates: 1808, 1738                              R. Fielding
Category: Standards Track                       U. C. Irvine
                                                  L. Masinter
                                             Xerox Corporation
                                                  August 1998
```

Corresponding RFC Index entry (search on "2396")

RFC2396	T. Berners-Lee, R. Fielding, L. Masinter	August 1998	ASCII	Obsoleted by RFC3986, Updates RFC1808, RFC1738, Updated by RFC2732 Errata	DRAFT STANDARD

Red fields were not known when RFC was published

Authors in Header

- Limited to lead authors, document editors.
- There must be very good reason to list more than 5.
- Each author in the header must give approval during AUTH48 review.
- Each author in the header should provide unambiguous contact information in the Authors' Addresses section.
- Other names can be included in Contributors and/or Acknowledgments sections.

Titles

- Should be thoughtfully chosen
- No un-expanded abbreviations - except for very well-known ones (e.g., IP, TCP, HTTP, MIME, MPLS)
- We like short, snappy titles, but sometimes we get titles like:
    - *"An alternative to XML Configuration Access Protocol (XCAP) for manipulating resource lists and authorization lists, Using HTTP extensions for Distributed Authoring and Versioning (DAV)"*

Abstracts

- Carefully written for clarity (*HARD* to write!)

- No un-expanded abbreviations (again, except well-known)

- No citations

    - Use "RFC xxxx", not "[RFCxxxx]" or "[5]"

- Less than 20 lines! Shorter is good.

- Not a substitute for the Introduction; redundancy is OK.

- We recommend starting with "This document…"

Body of RFC

- **First section should generally be "1. Introduction".**
- **Special sections that may appear:**
    - References
    - Contributors, Acknowledgments
    - Internationalization Considerations
        - When needed -- see Section 6, RFC 2277/BCP 18.
- **Sections that MUST appear:**
    - Security Considerations
    - IANA Considerations

References

- Normative vs. Informative
  - Normative refs can hold up publication.
  - [RFC Editor opinion: Normative gets over-used]
- We STRONGLY recommend against numeric citations "[37]".
- Citations and references must match.
- Handy file of RFC reference text:
  - ftp://ftp.rfc-editor.org/in-notes/rfc-ref.txt
- Include draft strings of any I-Ds.

Copyrights and Patents

- **Copyright Issues**
  - Specified in RFC 3977/BCP 77 "IETF Rights in Contributions"
  - Independent submissions: generally follow IETF rules
- **Patent ("IPR") issues**
  - RFC boilerplate specified in RFC 3978/BCP 78 "Intellectual Property Rights in IETF Technology"
  - Recently updated by RFC 4748/BCP 78.
- **Generally, you supply the correct boilerplate in the Internet Draft, and the RFC Editor will supply the correct boilerplate in the RFC.**

Security Considerations Section

- Security Considerations section required in every RFC.

- See RFC 3552: "Guidelines for Writing RFC Text on Security Considerations"

- Important!

IANA Considerations Section

- **Primary input to IANA**
- **Defines:**
  - Individual code points, in one place
  - New registries (number spaces), with future assignment rules.
- **Section is required in draft**
  - But "No IANA Considerations" section will be removed by RFC Editor.
- **See RFC 2434, "Guidelines for Writing an IANA Considerations Section in RFCs"**

Current Internet Standards

- *"What are the current Internet standards?"*
  - See STD 1: "Official Internet Protocol Standards"
  - In practice, reality is so complex that this is probably not even a valid question.
    - "Roadmaps" are desirable
    - ISDs might be better

4. How to Write an RFC

- Some editorial guidelines
- Improving your writing
- Preparation tools
- MIBs and formal languages

"Instructions to Request for Comments (RFC) Authors". draft-rfc-editor-rfc2223bis-08.txt aka

ftp.rfc-editor.org/in-notes/rfceditor/instructions2authors.txt

General Editorial Guidelines

- **Immutability – once published, never change**
- **Not all RFCs are standards**
- **All RFCs in English**
  - RFC 2026 allows translations
  - British English is allowed in principle, but there is some preference for American English.
- **Consistent Publication Format**
  - ASCII (also .txt.pdf for Windows victims)
  - Also .ps or .pdf (special process for handling)

RFC Formatting Rules

- ASCII, 72 char/line.

- 58 lines per page, followed by FF (^L).

- No overstriking or underlining.

- No "filling" or (added) hyphenation across a line.

- <.><sp><sp> between sentences.

- No footnotes.

RFC Editing

- For correct syntax, spelling, punctuation: always.

    - Sometimes exposes ambiguities

- To improve clarity and consistency: sometimes.

    - e.g., expand each abbreviation when first used.

- To improve quality of the technical prose: occasionally.

- By general publication standards, we edit lightly.

    - Balance: author preferences against consistency and accepted standards of technical English.

Preserving the Meaning

- A comment that does not faze us:

  "How dare you change my perfect prose?"

  - Just doing our job as editors!

- A comment that concerns us very much:
  "You have changed the meaning of what I wrote".

  - Often, because we misunderstood what you meant.

  - That implies that your prose is ambiguous.

  - You should recast the sentence/paragraph to make it clear and unambiguous, so even the RFC Editor cannot mistake the meaning. ;-)

The RFC Editor checks many things

- Header format and content
- Title format
- Abstract length and format
- Table of Contents
- Presence of required sections
- No uncaught IANA actions
- Spelling checked
- ABNF/MIB/XML OK, using algorithmic checker
- Citations match references
- Most recent RFC/I-D cited
- Pure ASCII, max 72 char lines, hyphens, etc.
- Header and footer formats
- Page breaks do not create "orphans"
- References split into Normative, Informative
- Boilerplate OK

Writing RFCs

- Simple fact: writing clear, unambiguous technical prose is very ***HARD*** !!

- Not *literary* English, but *comprehensibility* would be nice!

  - Avoid ambiguity.
  - Use consistent terminology and notation.
    - If you choose "4-bit", then use it throughout (not "four-bit").
  - Define each term and abbreviation at first use.
  - Expand every abbreviation at first use.

Style

- **Primary goal:** clear, unambiguous technical prose.

- The RFC Editor staff generally follows two sources for style advice:
  - Strunk & White (4th Ed., 2000)
  - "A Pocket Style Manual" by Diana Hacker (4th Ed., 2004)

- In any case, internally consistent usage is objective.

Sentence Structure

- Simple declarative sentences are good.
    - Flowery, literary language is not good.
    - Goal: Simple descriptions of complex ideas.
- Avoid long, involuted sentences. You are not James Joyce.
    - Use ";" │ ", and" │ ", or" sparingly to glue successive sentences together.
- Make parallel clauses parallel in syntax.
    - Bad: "… whether the name should be of fixed length or whether it is variable length".

Grammar Tips

- **Avoid passive voice (backwards sentences).**
  - "The nail was hit on the head by you."
  - "In this section, the network interface is described."

    vs. "This section describes the network interface."

- **"which" vs. "that"**
  - "which" is used parenthetically and follows a comma.
  - "The interface which the users see is too complex."

    that /

  - Or better: "The user interface is too complex."

- **Some Protocol Engineers over-capitalize Nouns.**

Punctuation Conventions

- A comma before the last item of a series:

    - "TCP service is reliable, ordered, and full-duplex"

    - Avoids ambiguities, clearly shows parallelism.

- Punctuation outside quote marks:
  "This is a sentence"{.|?|!}

    - To avoid computer language ambiguities.

Lean and Mean

- You often improve your writing by simply crossing out extraneous ~~extra~~ words.

  - Look at each sentence and ask yourself,
    "Do I need every word to make my meaning clear and unambiguous?"

  - English professors call it the "Lard Factor" (LF) [Lanham79]

  - *"If you've not paid attention to your own writing before, think of a LF of ⅓ to ½ as normal and don't stop revising until you've removed it."* [Lanham79]

[Lanham79] Richard Lanham, "Revising Prose", Scribner's, New York, 1979.

A Real Example

"When the nature of a name is decided one must decide whether the name should be of fixed length or whether it is variable length." (25 words)

A. "One must decide whether the length of a name should be fixed or variable." (14 words, LF = .44)

B. "We may choose fixed or variable length for a particular class of name." (13 words)

C. "A name may have fixed or variable length."
   (7 words, LF = .72)

Another Real Example

"One way to avoid a new administrative overhead would be for individuals to be able to generate statistically unique names." (20 words)

A. "New administrative overhead can be avoided by allowing individuals to generate statistically unique names."
(14 words, LF = .30)

B. "Allowing individuals to generate statistically unique names will avoid new administrative overhead."
(12 words, LF = .40)

Another (reality-based) Example

"This is the kind of situation in which the receiver is the acknowledger and the sender gets the acknowledgments." (19 words)

A. "An acknowledgment action is taking place from the receiver and the sender." (11, LF=.42)

B. "The receiver returns acknowledgments to the sender." (7, LF=.63)

Another Real Example

"Also outside the scope are all aspects of network security which are independent of whether a network is a PPVPN network or a private network (for example, attacks from the Internet to a web-server inside a given PPVPN will not be considered here, unless the way the PPVPN network is provisioned could make a difference to the security of this server)."

- Two sentences!!
- "make a difference to" -> "affect"

iceberg
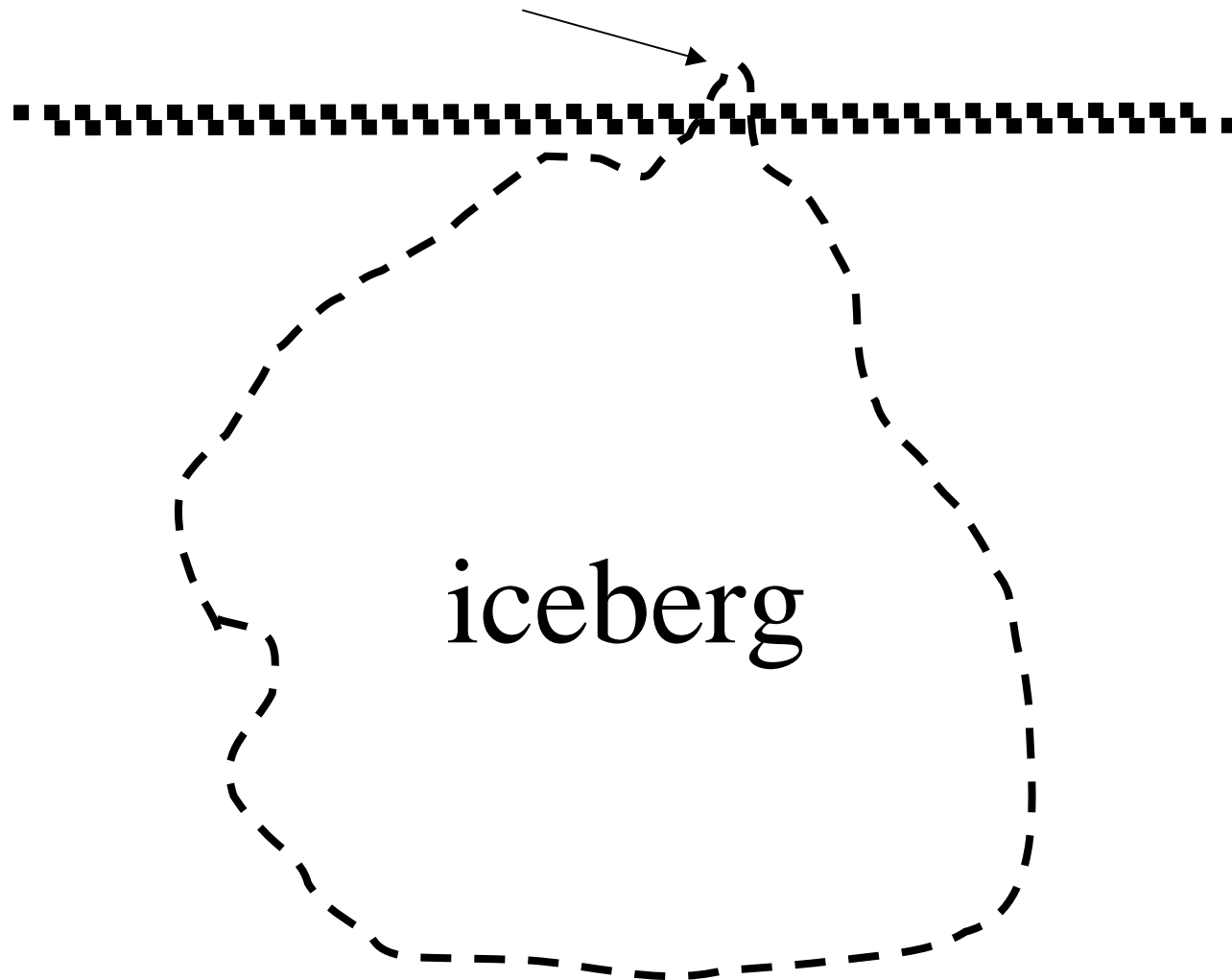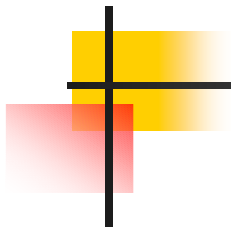
Format for Readability

- Careful use of indentation and line spacing can greatly improve readability.
    - Goes a long way to compensate for single font.
    - Bullets often help.
    - High density on a page may be the enemy of clarity and readability.
- The RFC Editor will format your document according to these guidelines, but it is helpful if you can do it in the I-D.

Hard to read

3.1 RSVP Message Formats

3.1.1 Common Header

The fields in the common header are as follows:

Flags: 4 bits

   0x01-0x08: Reserved

   No flag bits are defined yet.

 Send_TTL: 8 bits

   The IP TTL value with which the message is sent. See Section 3.8.

Formatted for Easier Reading

```
3.1.   Message Formats

3.1.1.   Common Header

   The fields in the common header are as
   follows:

      Flags: 4 bits

         0x01-0x08: Reserved

         No flag bits are defined yet.

      Send_TTL: 8 bits

         The IP TTL value with which the message is
         sent. See Section 3.8.
```

Text Formatting Tools

- Author tools: www.rfc-editor.org/formatting.html
  - xml2rfc
  - nroff
  - Microsoft word templates
  - LaTeX

- RFC Editor does final RFC formatting using venerable Unix tool nroff –ms.

xml2rfc

- Read RFC2629.txt - Marshall Rose
  - Writing I-Ds and RFCs using XML
  - Explains use of DTD for RFC publication
- Engine to convert xml to txt or nroff. Available online at: http://xml.resource.org/
  - If you use xml2rfc, send the xml file to the RFC Editor. It will save us work on your document.
- "An XML2RFC Template for Documents Containing a MIB module"
  - draft-harrington-xml2rfc-mib-doc-template-00.txt

nroff, groff

- Handy templates for authors using nroff:
  - ftp.rfc-editor.org/in-notes/rfc-editor/2-nroff.template
    - Published in 1991 by J. Postel. Updated October 2006.
    - Gives instructions on using macros for creating RFCs.
  - www.1-4-5.net/~dmm/generic_draft.tar.gz
    - Updated nroff template maintained by David Meyer.
- If you use nroff –ms (without a private `make` file), give the nroff source to the RFC Editor.

MIB RFCs: A Special Case

- MIB references
    - O&M Web Site at www.ops.ietf.org/
    - MIB doctors at www.ops.ietf.org/mib-doctors.html
    - MIB Review: See RFC 4181, BCP 111: "Guidelines for Authors and Reviewers of MIB Documents"
- Tools
    - http://www.ops.ietf.org/mib-review-tools.html
    - smilint at www.ibr.cs.tu-bs.de/projects/libsmi/
    - SMICng at www.snmpinfo.com/
- MIB boilerplate
    - The Internet-Standard Management Framework:
      www.ops.ietf.org/mib-boilerplate.html
    - Security Considerations: www.ops.ietf.org/mib-security.html

Use of Formal Languages

- Formal languages and pseudo-code can be useful as an aid in explanations, although English remains the primary method of describing protocols.

- Pseudo-code judged on the basis of clarity.

- Formal Languages (e.g., ABNF, XML, ASN.1 (MIBs))
  - Requires a normative reference to language specification
  - RFC Editor will run verifier program.

- www.ietf.org/IESG/STATEMENTS/pseudo-code-in-specs.txt

- ftp.rfc-editor.org/in-notes/rfc-editor/UsingPseudoCode.txt

5. Conclusion: Problem Areas (1)

- **Normative references**
  - Practical effect: can hold up publication
- **MUST/MAY/SHOULD/... requirement words**
  - Do they belong in Informative documents at all?
  - Tend to overuse – makes it sound important.
  - Worse, often inconsistent use

Problem Areas (2)

- ## URLs in RFCs
  - Some are more stable than others...

- ## *Updates* and *Obsoletes* relationships
  - Some disagreement on what they mean
  - At best, only high-order bit of complex relationship
  - RFC Editor hopes ISD (Internet Standard Document) [Newtrk] will be more systematic and complete.

Hints to Authors

- Respond promptly to all messages from RFC Ed.

- Read your I-D carefully before submission, as you would read the final document in AUTH48!

- If your I-D is in the queue, and you see typos or have a new email address, send us an email.

- DON'T use numeric citations.

- Avoid gratuitous use of requirement words (MUST, etc.)

- Craft title and abstract carefully.

- Remember that your document should be understandable by people who are not deep experts in the subject matter.

A Common Question from Authors

Q: Why is my document not published yet?

A: You can check the state of your document online at www.rfc-editor.org/queue.html

- "IANA" indicates waiting on IANA considerations
- "REF" indicates there are normative references
- "AUTH48" indicates each author must send final approval of the document

Authoritative References

- Overview of RFC publication:

  www.rfc-editor.org/howtopub.html

- "Instructions to Request for Comments (RFC) Authors". draft-rfc-editor-rfc2223bis-08.txt aka

  ftp.rfc-editor.org/in-notes/rfc-editor/instructions2authors.txt

Thank you ...

- Questions? Comments?
- mailto:rfc-editor@rfc-editor.org
- mailto: rfc-interest@rfc-editor.org