The RFC Editor --

"How to Write an RFC"

A Tutorial

IETF-62

Minneapolis, MN, USA

March 2005

Goals of this Tutorial

- Introduction to the RFC process for newcomers
- Hints for old hands.
  - Improve quality of product
  - Hasten publication
- Overview of the process.
- Review some important editorial policies and formatting rules – Gotchas.

- Grateful acknowledgment: Avri Doria's slides from IETF 61 were our starting point.
- No time to explain everything in detail
- See references, especially: http://www.rfc-editor.org

Overview of this Tutorial

- Background: The RFC Series and the RFC Editor
- The Publication Process
- How to Write an RFC
- Some Persistent Issues

Background

- A (very short) history lesson
  - Jon Postel
- The RFC Editor today
- The RFC Series
  - Relation to the IETF
  - Independent submissions

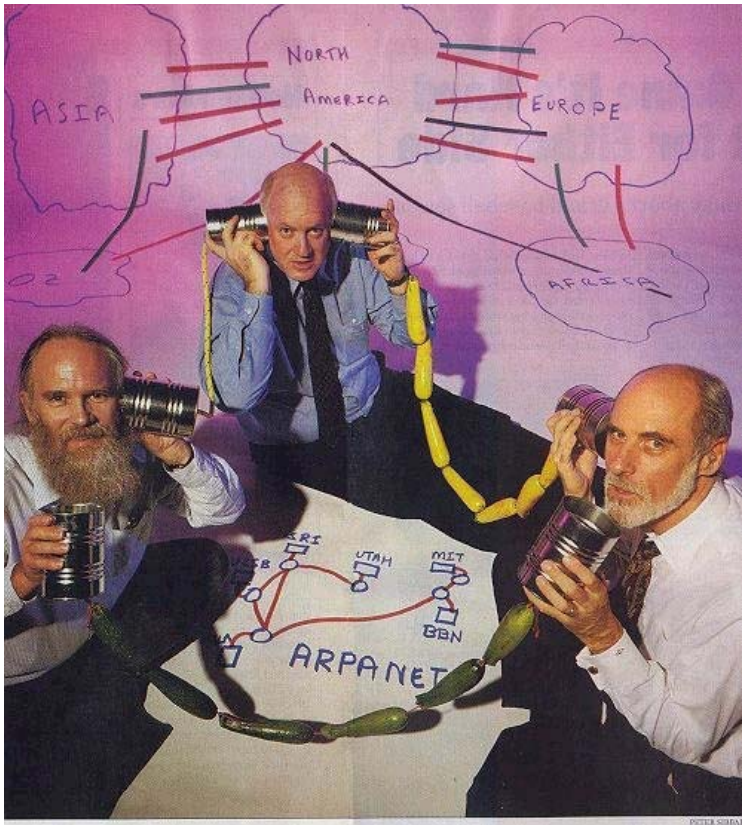
Historical Context

- Short chronology of Internet technology:
  - 1969-1983: ARPAnet protocol development
    - NCP, Telnet, FTP, SMTP
  - 1975-1985: Internet protocol development
    - IP, TCP, RIP, ARP, DNS, …
  - 1985-1990: NSFnet
  - 1991-today: Commercial Internet
    - HTTP protocol

RFCs

- RFC document series
  - Begun by Steve Crocker [RFC 3], 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.
  - Postel had an enormous influence on the developing ARPAnet & Internet protocols – known as the "Protocol Czar" and the "Deputy Internet Architect".
  - He established and maintained the consistent style and editorial quality of the RFC series.
  - Jon was a 2-finger typist.

Jon Postel



Newsweek Aug 8, 1994

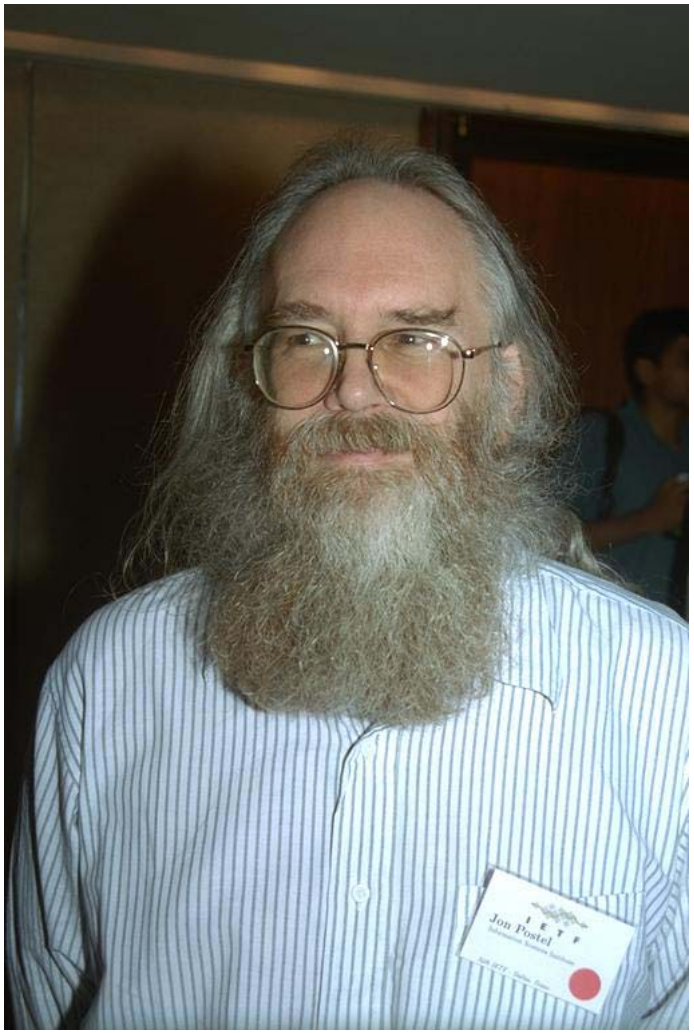


Photo by Peter Lothberg – IETF34 Aug 1995

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]
  - The Evil Bit is my favorite [RFC 3514]

- As the ARPAnet/Internet went from research to production to commercial, the technical community served by the RFC Editor morphed and grew.
  - The IAB created the IETF [1985]
  - The standards process crystalized, with occasional minor upheavals.
  - The IETF ate its parent and started over [Kobe 1992].
- Through these events, the RFC Editor kept right on publishing, adapting its rules to the changing environment but trying hard to maintain consistency, quality, and integrity of RFC series.

The RFC Editor today

- A small group at Jon's long-term home,
  - the Information Sciences Institute (ISI) of USC.
  - 4-5 FTEs
- Funded by ISOC.
- Current leadership:
  - Joyce Reynolds, Postel's chief editorial assistant 83-98.
  - Bob Braden, colleague of Postel 70-98.
  - Aaron Falk, newcomer.

The RFC Editor Web site

http://www.rfc-editor.org

- Search engines for RFCs, Internet Drafts
- Publication queue
- Master index to RFCs: rfc-index.html, .xml
- "Official Internet Protocols Standards" list
- Errata
- Policy changes, news, …

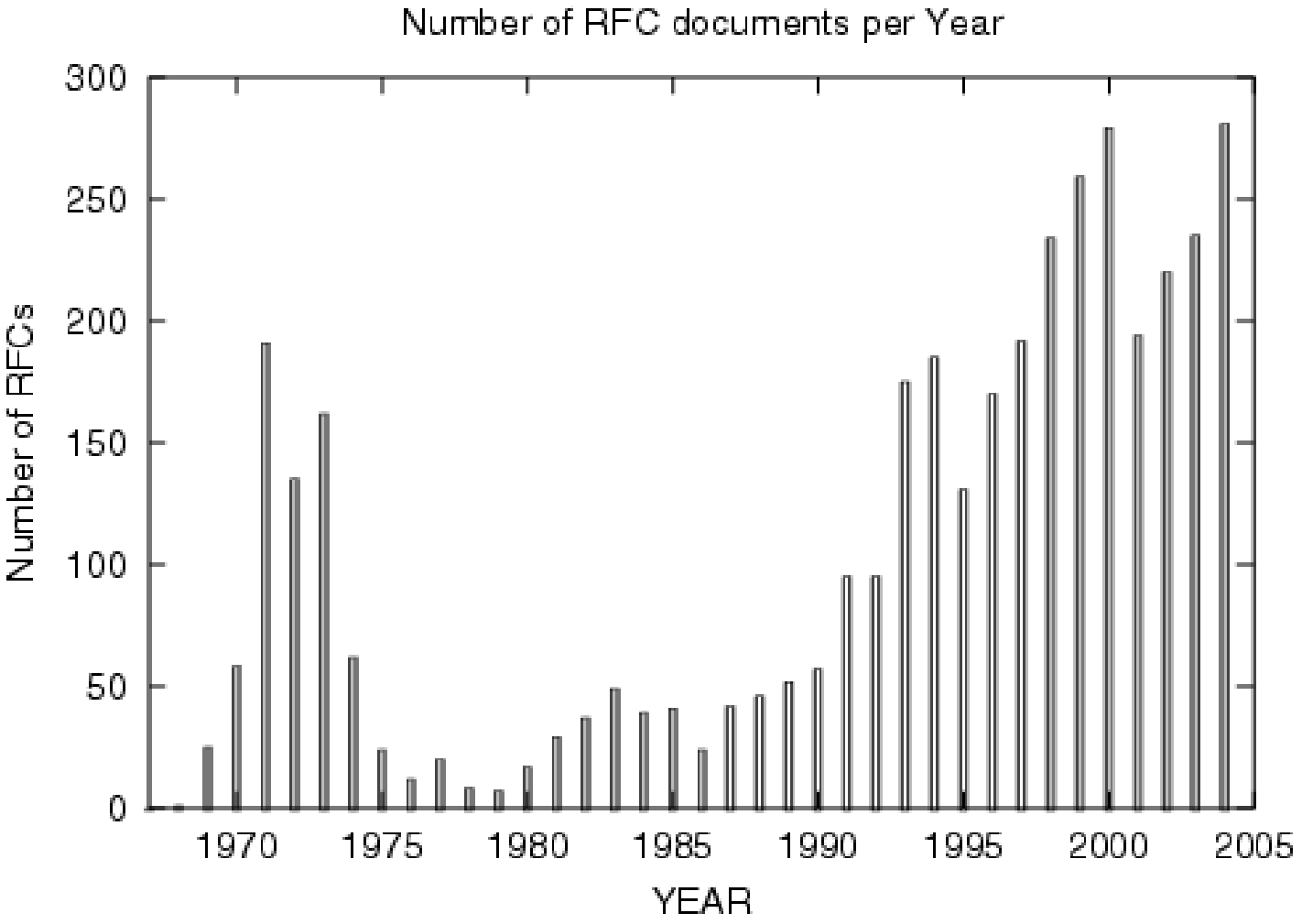
Errata Page

- 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.

The RFC Series

- Earliest document series to be published online.
- 1969 – today: 36 years old.
- 3900+ documents.
- *An ARCHIVAL* series: RFCs are *forever*!
- A nearly-complete record of Internet technical history
  - Early RFCs: a treasure trove of technical history.
  - Many "wheels" that we repeatedly re-invent.

RFC Publication Rate



RFCs and the IETF

- RFCs have always been the archival series for Internet standards documents.
- The RFC Editor is therefore one component of the standards process, under IAB supervision.[RFC 2026]
- An RFC Editorial Board drawn from IETF community provides advice and counsel to the RFC Editor, particularly about independent submissions.
- The RFC Editor has a dual loyalty: to the IETF process, and to the RFC series.

Two Kinds of RFCs

- IETF submissions
  - Most come from Working Groups.
  - A few are *individual* submissions to IESG.
  - All are submitted to the RFC Editor by the IESG, after approval and with announcement to community.
- RFC Editor ("*independent*") submissions
  - Submitted directly to RFC Editor.
  - IESG reviews for conflict with IETF activity, makes publish/do-not-publish recommendation. RFC Editor has final decision, with advice from Editorial Board.
  - Only Experimental or Informational category.

Why Independent Submissions (1)?

- Document proprietary protocols
  - Encourage companies to publish their protocol designs
  - Socially desirable behavior…
- Republish output of other standards bodies, to make it easily available to Internet community.
  - More socially-desirable behavior

Why Independent Submissions (2)?

- Repository of technical history
  - To record important new ideas, including perhaps controversial ideas.
  - To help counter possible ossification of the IETF technical discourse.
- Document minority views in WG discussions
  - This may be, but will not always be, a BAD reason.
  - RFC Editor listens carefully to what WG chairs and IESG say. IESG can say "[Please] Do Not Publish Now", providing up to 1.5 years delay.

Some Common Questions

- Why does every RFC say "Network Working Group" at the top?
  - A reminder of our history [RFC 3] (1969).
- "I want to read RFC 219, but the index says "not online".
  - The early archive (RFCs 1-800) did not survive the changeover from TOPS20 to Unix around 1983.
  - Volunteers have been retyping early RFCs.
  - There are still about 80 that have not been typed and proof-read.

Common Question

- Why do Internet Drafts expire after 6 months?
  - Experience with RFCs in the early days showed the value of having ONE archival series, the RFC series. To avoid accidentally creating a competing archival series, the early IAB made I-Ds expire.
  - There has been much heated discussion about whether this is still a good idea.

The Internet Standards process

- RFC 2026 rules.
- It defines document maturity levels:
  - Standards track: Proposed, Draft, Standard.
  - Non-standards track: Experimental, Informational, Historical.
  - Not quite either: Best Current Practice.
- Shown on RFC header as "Category:"
  - Except, one category "Standards Track"
- A published RFC can NEVER change, but its *category* can change (see rfc_index.txt).

RFC Publication Process

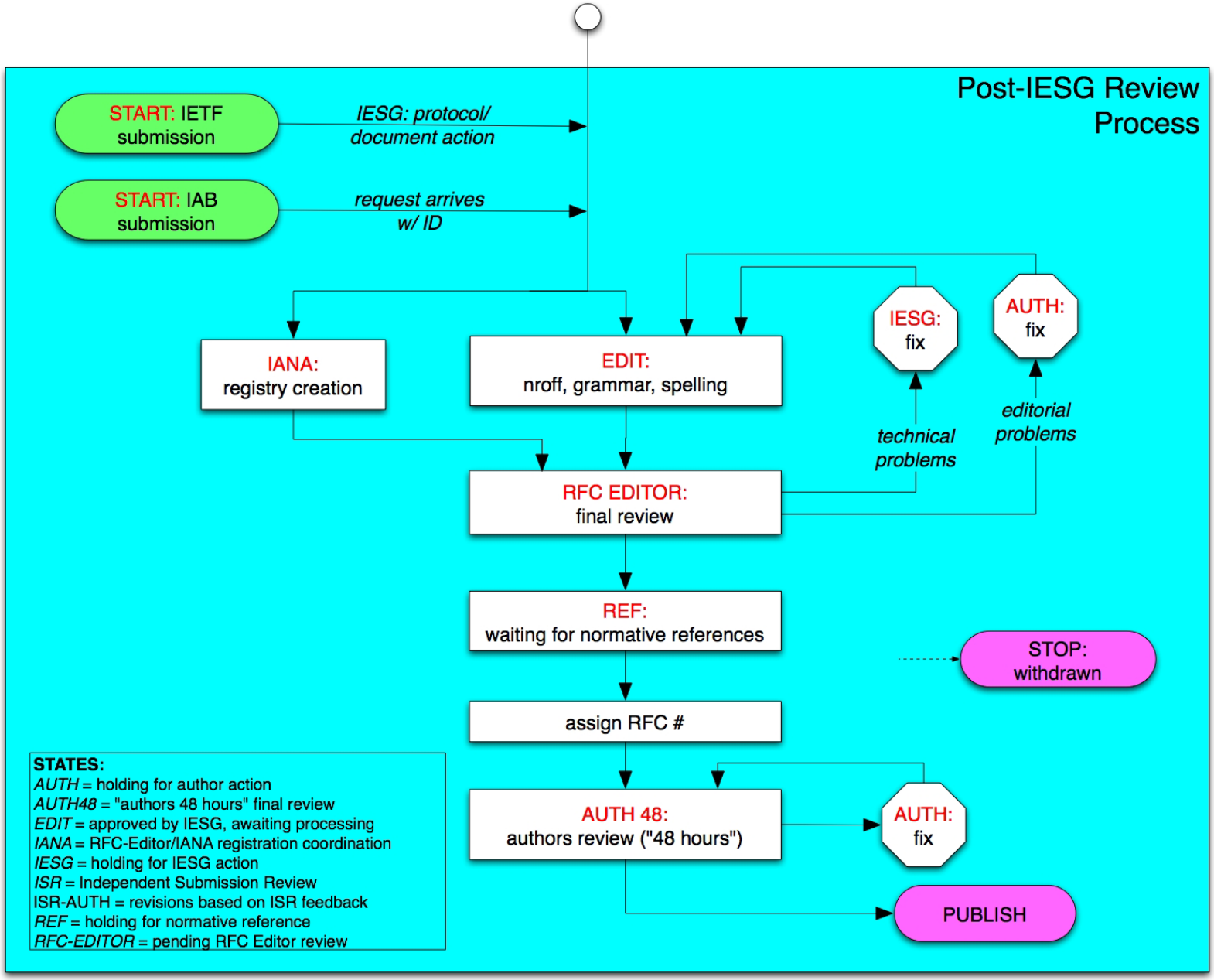
- Overview
- Queue states
- AUTH48 procedure
- Contents of an RFC

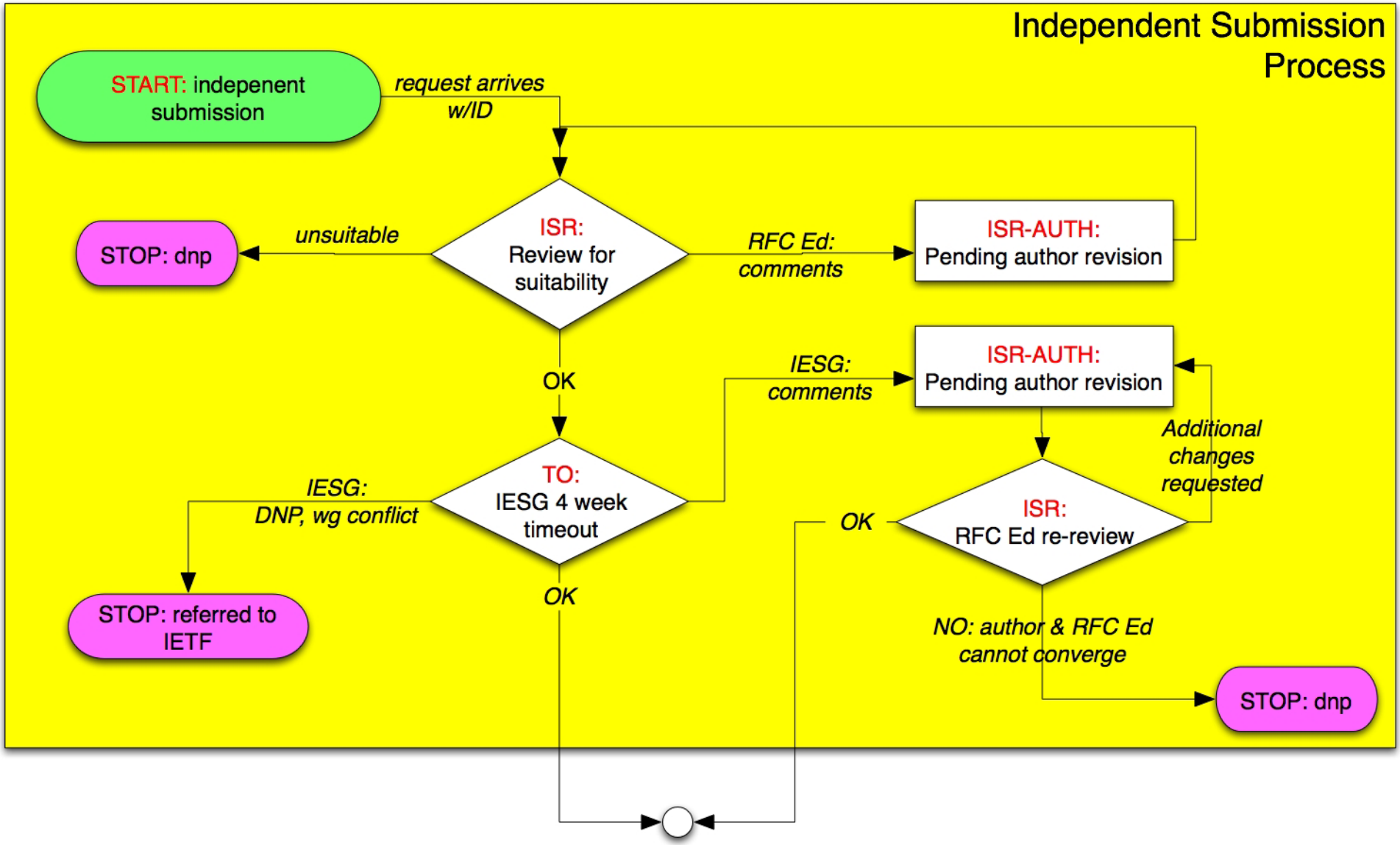
Publication Process: Overview (1)

- First published as an Internet Draft
  - Send us the `nroff` or `xml2rfc` source, if available.
- RFC Editor
  - Copy-edits for clarity, syntax, punctuation, …
  - Creates official nroff source containing editorial changes
  - Makes many consistency checks
- IANA acts on IANA Considerations
  - Creates new registries, assign numbers, informs RFC Editor
  - RFC Editor plugs assigned numbers into document.

Publication Process: Overview (2)

- Publication may be held up by other RFCs.
  - "REF" state: doc set linked by Normative refs must be published simultaneously.
- 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.
  - .nroff files archived, for later revision.


Post-IESG Review Process
START: IETF submission
IESG: protocol/ document action
START: IAB submission
request arrives w/ ID
IANA: registry creation
EDIT: nroff, grammar, spelling
IESG: fix
AUTH: fix
technical problems
editorial problems
RFC EDITOR: final review
REF: waiting for normative references
STOP: withdrawn
assign RFC #
AUTH 48: authors review ("48 hours")
AUTH: fix
PUBLISH
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


Independent Submission Process
START: indepenent submission
request arrives w/ID
ISR: Review for suitability
unsuitable
STOP: dnp
RFC Ed: comments
ISR-AUTH: Pending author revision
OK
IESG: comments
ISR-AUTH: Pending author revision
Additional changes requested
TO: IESG 4 week timeout
IESG: DNP, wg conflict
STOP: referred to IETF
OK
ISR: RFC Ed re-review
OK
NO: author & RFC Ed cannot converge
STOP: dnp

The RFC Editor *Does Edit* …

- At least, for correct syntax and punctuation.
- Ideally, to improve clarity, consistency, and quality of the prose.
- To maintain consistent format and style.
  - Using the format and style that many, many years of experience have been found to work well.

The RFC Editor checks many things

- Header format and content
- Title format
- Abstract length and format
- Table of Contents
- Required sections are present
- No uncaught IANA actions
- Spell check
- ABNF/MIB/XML passes mechanical checker
- Citations match references
- Most recent RFC/I-D cited
- Pure ASCII, max 72 char lines, hyphens, etc.
- Headers and footer
- Remove “widows”
- References split into Normative, Informative
- Boilerplate

AUTH48 State: Final Author Review

- Authors given rfcxxxx.txt file and diff file (.html)
- Last-minute editorial changes allowed – But should not be technically 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
  - Critical that editors take it seriously - review the entire document, not just the diffs.
  - Your last chance to avoid enrollment in the Errata Hall of Infamy!

General RFC Policies

- Immutability
- Not all RFC's are standards
- Language - all RFCs in English
  - RFC2026 allows translations
    - British English is allowed in principle, but…
- 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.

Parsing an RFC

- 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 number: labels a *standard* (as opposed to a document)
  - One STD may include a set of related RFCs.
  - An STD number will be re-assigned to replacement RFC(s)
  - IETF considering elaboration of STD idea into an “Internet Standards Document (ISD)”
- Updates, Obsoletes: relation to earlier RFCs..

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**

Note fields that were not known when RFC was published

More First-Page Stuff

Title

Uniform Resource Identifier (URI): Generic Syntax

Status of This Memo

This document specifies an Internet standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "Internet Official Protocol Standards" (STD 1) for the standardization state and status of this protocol. Distribution of this memo is unlimited.

Copyright Notice

Copyright (C) The Internet Society (2005).

Abstract

Authors in Header

- Limited to lead authors, document editors.
- There must be very good reason to list more than 5.
- All authors in header responsible for 48 hours review.
- Authors section should provide unambiguous contact points.
- Others can be included in Contributors and/or Acknowledgments sections.

Title and Abstracts

- Titles
  - Should be thoughtfully chosen
  - No unexpanded abbreviations - except for very well known (eg, IP, TCP, HTTP, MIME, MPLS…)
- Abstracts
  - Carefully written for clarity (*HARD* to write!)
  - No unexpanded abbreviations (again, except well-known)
  - No citations
  - Less than 20 lines! Shorter is good.
  - Not a substitute for the Introduction; redundancy is OK.

Body of RFC

- First section should generally be “1. Introduction”.
- Following special sections may appear:
  - Contributions, Acknowledgments
  - Internationalization Considerations
    - When needed -- see Sect 6, RFC 2277/BCP 18.
  - References
- Sections that MUST appear:
  - Security Considerations
  - IANA Considerations

References

- Normative vs. Informative
  - Normative refs in stds track documents can hold up pub.
  - [Normative gets over-used]
- 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

Copyrights and Patents

- Copyright Issues
  - Specified in RFC 3977/BCP 77 "IETF Rights in Contributions"
  - Independent submissions: RFC Editor rules, but generally follows IETF rules.
  - Differences should be of interest only to lawyers.
- Patent ("IPR") issues
  - RFC boilerplate specified in RFC 3978/BCP 78 "Intellectual Property Rights in IETF Technology"

Security Considerations

- Security Considerations section required in every RFC.
- IESG is (rightfully!) suspicious of "There are no security considerations in this document."
  - There are security considerations in nearly everything that we do.
  - The IESG is increasingly asking for in-depth, meaningful SC sections!
- See: RFC 3552: "Guidelines for Writing RFC Text on Security Considerations"

IANA Considerations

- Primary input to IANA
- Defines:
  - Individual code points, in one place
  - New registries (number spaces), with instructions on 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"

How to Write an RFC

- Some editorial guidelines
- Improving your writing
- Tools
- MIBs and formal languages

Writing an RFC

- Primary goal is clear, unambiguous technical prose
  - Some preference for American English style
- The RFC Editor staff generally follows two sources for style advice:
  - Strunk & White (4th Edition, 2000)
  - "A Pocket Style Manual" by Diana Hacker (4th Ed., 2004).
- In any case, internally consistent usage is required.

Writing RFCs

- Simple fact: writing clear, unambiguous technical prose is ***HARD*** !!
  - Reread RFC 793 for inspiration and example.
- Not *literary* English, but comprehensibility would be nice!
  - Avoid ambiguity
  - Use consistent terminology and notation
  - Define each term and abbreviation at first use.
  - Expand every abbreviation at first use.

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 1/3 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)

- A. “We can avoid new administrative overhead by allowing individuals to generate statistically unique names.” (14, LF = .30)

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

- How about:
  "New administrative overhead can be avoided by allowing individuals to generate statistically-unique names."
- Compare to:
  "The nail has been hit on the head by you!"
- Passive voice: generally a bad idea…

Another (reality-based) Example

- Original: “This is the kind of situation in which the receiver is the acknowledger and the sender gets the acknowedgments.” (19)
- “We observe that an acknowledgment action is taking place from the receiver and the sender.” (15, LF=.21)
- “The receiver returns acknowledgments to the sender.” (7, LF=.63)

Writing Hints

- Simple declarative sentences are good.
  - Flowery, literary language is not good.
  - Say enough, but not more than enough
- Avoid long, involuted sentences. You are not James Joyce.
  - Use ";" | ", and" | ", or" sparingly to glue successive sentences together.
- Make parallel clauses parallel in syntax.

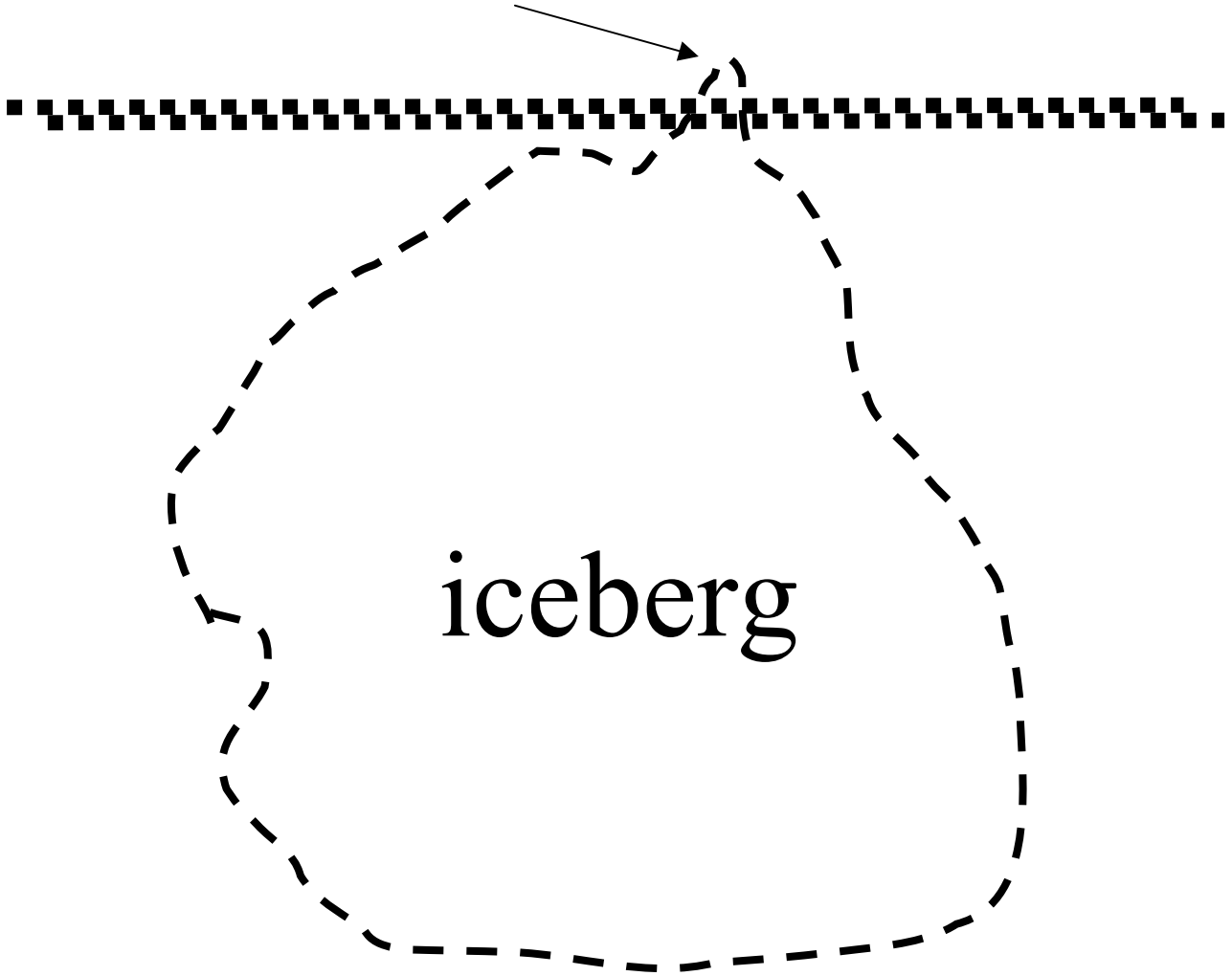
  Bad: "... whether the name should be of fixed length or whether it is variable length".

A Few Common Errors

- "which"s that should be "that"s.
  - "Which" is used parenthetically and follows a comma.
  - "The interface ~~which~~ that the users sees is too complex."
  - Or better: "The user interface is too complex."
- Should be comma before last item of series:
  - "TCP service is reliable, ordered, and full-duplex"
  - Avoids ambiguity, clearly shows parallelism.

A Few Common Errors

- RFC Editor convention: punctuation outside quote marks:
  "This is a sentence"{.|?|!}
  - To avoid computer language ambiguities.
- Some Protocol Engineers over-capitalize Nouns.
- Keep your sentences short and direct.
  - Don't make simple things complex


iceberg

Format for Readabilty

- Careful use of indentation and line spacing can make huge improvement in readability.
  - Goes a long way to make up lack of fancy fonts.
  - Bullets can often help.
- High density on the page may be the enemy of clarity and readability

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.

Easier to Read

3.1 Message Formats

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

Preserving the Meaning

- A comment that does not faze us:

  "How dare you change my perfect prose…"?
  - Sorry… we are just doing our job. See earlier.
- 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 dumb RFC Editor cannot mistake the meaning. ;-)

Internet Drafts

- A well-formed RFC starts with a well-formed I-D
- Surviving IESG review:
  - http://www.ietf.org/ID-Checklist.html
  - http://www.ietf.org/ietf/1id-guidelines.txt

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 production
- Engine to convert `.xml` to `.txt` or to `.nroff` available online at: http://xml.resource.org/
  - If you use xml2rfc, give the .xml file to the RFC Editor! It saves us doing the markup on your document.
- Xml2rfc resources at: http://xml.resource.org/

nroff, groff

- Handy templates for authors using nroff:
  - ftp.rfc-editor.org/in-notes/rfc-editor/2-nroff.template
    - Published in 1991 - J. Postel
    - 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.

Microsoft word templates

- 2-word-template.doc
  - Published in 2002 - T. Hain
  - Using Microsoft Word to create Internet Drafts and RFCs www.ietf.org/rfc/rfc3285.txt
- Template can be found at:
  - ftp.rfc-editor.org/in-notes/rfc-editor/2-Word.template.rtf
  - ftp.rfc-editor.org/in-notes/rfc-editor/crlf.exe
  - And at the IETF web site.
  - Updated version: www.isi.edu/touch/tools (J. Touch)

LaTeX

- Mostly private templates and methods
- Sometimes causes difficulty when documents are inherited by new authors.
- Tool for conversion of LaTeX to text:
  - www.cs.columbia.edu/IRT/software/l2x/
- There are private tools to convert LaTeX subset to nroff.

MIB RFCs – Important 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: draft-ietf-ops-mib-review-guidelines
- 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/

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 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

Persistent Issues

- Normative references
  - Practical effect: can hold up publication
  - Some disagreement on what should be Normative
- MUST/MAY/SHOULD/… applicability words
  - Do they belong in Informative documents at all?
  - Tend to overuse – makes it sound important.
  - Worse, often inconsistent use
- URLs in RFCs
  - Some are more stable than others…

Persistent Issues

- Author contact information
  - Seems important, but hard to keep it current
  - RFC Editor gets many queries from newbies.
  - Ideal: maintain database of current email addresses; daunting job.
- Update and Obsolete relationships
  - Some disagreement on what they mean
  - At best, only high-order bit of complex relationship
  - RFC Editor supports ISD (Internet Standard Document) [Newtrk] as a more systematic and complete definition.

Persistent Issues

- *"What are the current Internet standards?"*
  - STD sub-series is supposed to define this.
- In practice, reality is so complex that this is probably not even a valid question.
  - Again, ISDs would be better than STDs (but more work)
- What is meaning of Historic category?
  - "Really Bad", or just "well, not very current…"?

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/rfceditor/instructions2authors.txt

Thank you

Questions? Comments?

mailto:edu-discuss@ietf.org

mailto:rfc-editor@rfc-editor.org