Using XML in Internet Protocols

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Agenda

- Should you use XML?
- Should you invent a new XML language?
- If you’re inventing a new XML language, how do you maximize your chances of success?

Should You Use XML? Other options:

- Hardwired binary
- ASN.1
- Plain text
- JSON
- XML

Hardwired Binary: Issues

- Compact.
- (Potentially) high-performance parsing.
- Architecture-dependence.
- Severe debugging pain.

Example: IPV? packet headers

Use Hardwired Binary If:

- You're *way* down the protocol stack.
- But even then, be nervous.

ASN.1: Issues

- Compact.
- IETF tradition.
- Lousy tools.
- Debugging hell.
- No community outside the IETF & ITU.
- Only metadata is data type.

Example: SNMP

Use ASN.1 If:

- You have to talk to other IETF stuff that’s locked in.

Plain Text: Issues

- The simplest possible option is often the best.
- Pretty efficient.
- Fits well with server-side Internet (Unix) culture.
- Watch out for I18n.
- Watch out for extensibility.

Example: HTTP

Use Plain Text If:

- ... you possibly can.

JSON: Example vs. XML

```
{"menu": {
  "id": "file",
  "value": "File",
  "popup": {
    "menuitem": [
      {"value": "New", "onclick": "CreateNewDoc()"},
      {"value": "Open", "onclick": "OpenDoc()"},
      {"value": "Close", "onclick": "CloseDoc()"}
    ]
  }
}}
```

```
<menu id="file" value="File">
  <popup>
    <menuitem value="New" onclick="CreateNewDoc()" />
    <menuitem value="Open" onclick="OpenDoc()" />
    <menuitem value="Close" onclick="CloseDoc()" />
  </popup>
</menu>
```

JSON: Issues

- Superb browser integration.
- Knows about lists, tuples, hashes.
- Maps directly to programming-language structures.
- Hard-wired to UTF-8 (in theory).
- Awkward for deeply-nested or “document”-style structures.
- Watch out for extensibility.
- Browser security issues.

Example: Google Maps mashups

Use JSON If:

- You’re shipping structs and tuples around from program to program.
- You expect to implement client software in-browser.
- The expected lifetime of the data is short.
- It isn’t text-heavy.

XML: Issues

- Tons of excellent open-source tools.
- Programmers love XPath.
- Decent extensibility.
- I18n is nailed.
- Handles “document” structures well.
- Verbose & ugly.
- Doesn’t map naturally to programming-language structures.
- DOM API is programmer-hostile.

Use XML If:

- Your data is document-flavored.
- You’re worried about i18n.
- You’re worried about extensibility.
- You’re worried about reusability.

So, you’re going to use XML...

Inventing New XML Languages:

- Time-consuming.
- Bureaucratic.
- Difficult.
- Unpleasant.
- Includes complex software development as a sub-task.
- Usually fails.

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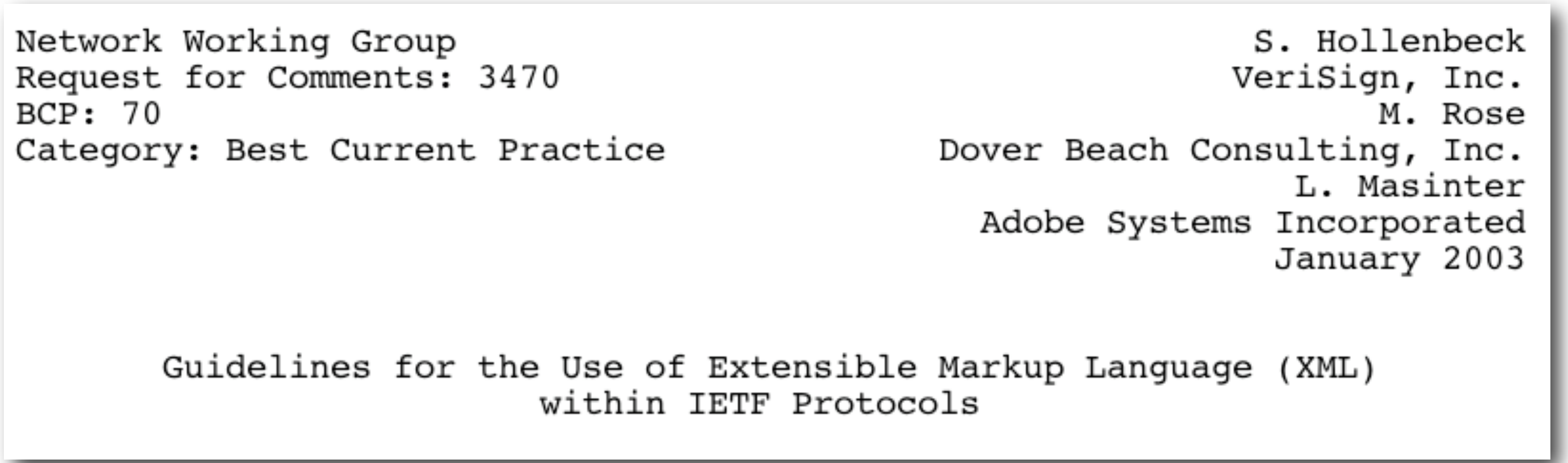
... so try not to!

Some Good XML Languages

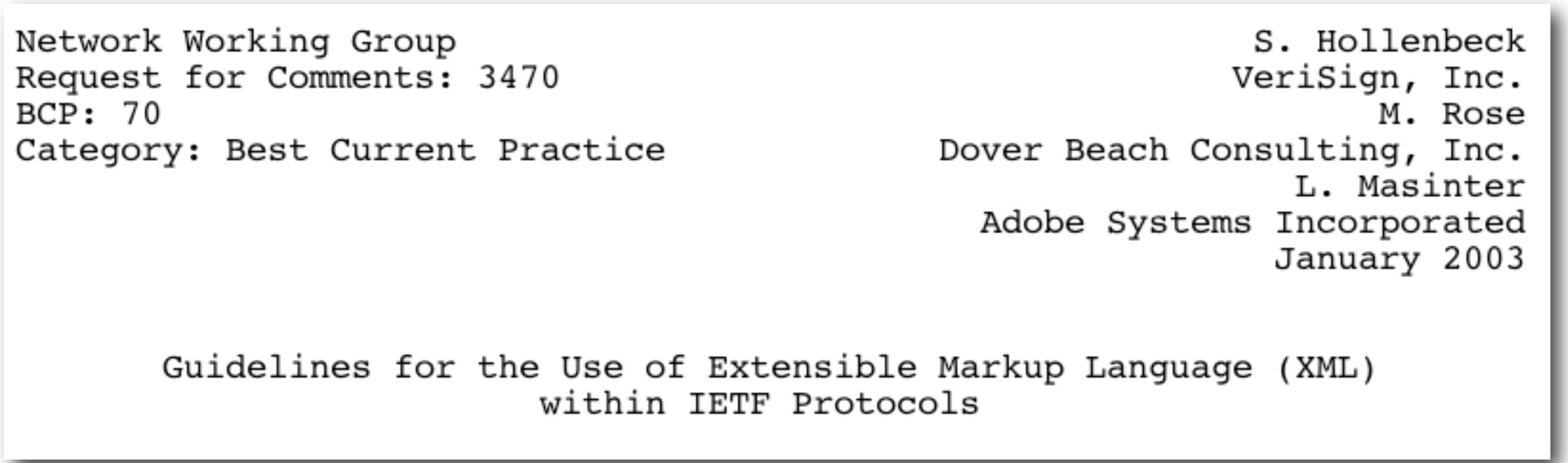
- XHTML
- DocBook
- ODF
- Atom
- XMPP
- UBL
- RDF

So, you’re making your own language...



```
Network Working Group                                      S. Hollenbeck
Request for Comments: 3470                                VeriSign, Inc.
BCP: 70                                                          M. Rose
Category: Best Current Practice             Dover Beach Consulting, Inc.
                                                             L. Masinter
                                               Adobe Systems Incorporated
                                                             January 2003


       Guidelines for the Use of Extensible Markup Language (XML)
                          within IETF Protocols
```



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Design Issue: Semantics

- What does “Age” mean?
- What does “Version” mean?
- What does “Person” mean?
- What does “Update” mean?
- What does “Creator” mean?

Design Issue: Model vs. Syntax

“What matters is getting the data model right. The syntax is ephemeral.”

“The bits on the wire are the only reality.”

Design Issue: Minimalism vs. Completeness

"Let's solve the whole problem."

"Minimum progress required to declare victory."

Design Issue: Specification Tools

- Human-readable prose.
- Examples.
- Validator.
- Schema.

But, first: Know Your Audience

Why specs matter

Most developers are morons, and the rest are assholes. I have at various times counted myself in both groups, so I can say this with the utmost confidence.

-Mark Pilgrim: http://diveintomark.org/archives/2004/08/16/specs

Design Issue: Specification Tools

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Design Issue: Specification Tools

- Human-readable prose. ← Most important
- Examples. ← Very important
- Validator. ← Very important
- Schema. ← Nice to have

XML Schema Language Options

- DTD
- XSD (W3C XML Schemas)
- RelaxNG
- Schematron

Document Type Definitions (DTDs)

- Constrain only what elements/attributes can appear, and where.
- Don’t say much about content.
- Allow the definition use of “Entities”, macros of zero arguments. Don’t use them!
- Past their sell-by date.

W3C XML Schemas (XSD)

- Hard to understand, hard to implement, hard to interoperate.
- No underlying formalism.
- Limited in the set of markup idioms they can define.
- Includes (in “Part 2”) a usable set of primitive data types: Integers, floats, dates, URIs, and so on.
- One of the reasons why the SOA/WS-* project is sinking.

RelaxNG

- Based on the hedge-automaton formalism.
- Written in XML, or a non-XML Compact Syntax.
- Good human-readability.
- Can specify a very wide range of markup idioms.
- Can use XSD Part 2 base datatypes.
- Validators only available in Java and C.
- For a good example, see RFC4287.
- ISO 19757-2.

Schematron

- Based on XPath.
- Assertions with associated error/success messages.
- Excellent for checking for specific error conditions or anomalies.
- Not really a language-specification tool.
- Several implementations.
- ISO 19757-3.

XML Extensibility: Three Options

- No changes.
- Must-Understand policy (e.g. as in SOAP).
- Must-Ignore policy (e.g. as in Atom).

XML Internationalization

- “An XML document knows what encoding it’s in.” -Larry Wall
- In an ideal world, everything would be in UTF-8.
- In the real world, people don’t understand this stuff and probably shouldn’t have to.
- XML makes this survivable in many circumstances... with most tools, they can suck up their Shift-JIS or Big5 or whatever and it’ll quite possibly Just Work.

XML Security and Signatures

```
<a b="1" c="1"/> <a
                   c='1'
                   b='1'></a>
```

- Shouldn’t these two have the same signature?
- XML Canonicalization is the solution.
- Unfortunately, it’s also a problem.
- XML DigSig says how to apply a signature to c14n-ized XML.
- Or, you could just sign the bag-o’-bits.

The Semantic Web

- The RDF view: Everything’s a graph of 3-tuple assertions: Resource/Property/Value.
- R, P, and V can each be a URI. Value can be a URI or a literal.
- Assertions can be resources.
- The RDF/XML serialization is ugly and annoying.
- Semantic Web project sees a bright future of operations on the Universal graph, once it’s built, so they’d like to use RDF/XML for everything.

Thank You!

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tbray.org/ongoing/