What's Up With HTTP?

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Agenda

- HTTP in Theory: The Standards
- HTTP in Practice: The Implementations
- New Stuff: Fixing the Suck
Agenda

• Inform what HTTP (the protocol) can do
• Inform what HTTP implementations can't (yet) do
• Encourage implementers to close the gap
HTTP in Theory: The Standards

(and some history)
HTTP circa 1996

- HTTP/0.9 fading quickly
- HTTP/1.0 taking off
- HTTP/1.1 to contain the damage
  - virtual hosting
  - persistent connections
  - caching
- HTTP-NG discussions already underway
  - binary (i.e. length-delimited headers)
  - generic
  - ...


HTTP circa 1996

- Typical use
  - Browser client, static or CGI content
  - GET, POST
- WebDAV: Glimmer in Whitehead’s eye
- Services: huh?
2002: BCP56

- “On the use of HTTP as a Substrate”
- Brought about by new (ab)use; e.g., IPP
- Reasonable advice for the IETF community, but failed to foresee “services” and “Web 2.0”
- Codified distaste with non-browser uses
  - A new port for every app
  - Probably a new URI scheme too
- Currently being considered for deprecation
HTTP in 2009

- HTTP/2.0 didn’t happen
- WS-* debacle unfortunately did
  - PEP turned into SOAP
- “RESTful” APIs
- Pressure to extend
  - Bidirectional communication (AJAX, BOSH...)
  - New Web protocols (OAuth, CORS...)
- Explosion of implementations
  - new servers, clients
  - new frameworks, APIs
• Interop is OK for "traditional" usage, but...
• More implementations = more variance
• Use cases are getting more exotic
• Extensions are proliferating
• Underlying design is poorly documented
HTTPbis: Why

- IETF Working Group to
  - incorporate errata
  - clarify ambiguities
  - document extensibility
  - improve interoperability
- I.e., writing the recipe down more clearly
  - Specifications need to outlive their creators
  - Align theory with reality
  - NOT to extend HTTP (but wait...)
HTTPbis: Who

- “Core” Implementers
  - Apache (editing), Microsoft, Mozilla, Apple, Opera, Curl, Squid, WinGate, Serf

- Extension Authors
  - MetaLink, OAuth, WebDAV, PATCH

- Large Web Operators
  - PayPal, Google, Yahoo!

- Security Experts
  - Adam Barth, Amit Klein

- The “Old Guard”
  - W3C, HTTP authors, URI authors
HTTPbis: What

- Problem: RFC2616 is 176 pages of text/plain
- Solution: split it up
  - p1: messaging
  - p2: semantics
  - p3: payload
  - p4: conditional requests
  - p5: ranges
  - p6: caching
  - p7: authentication
HTTPbis: fixing...

- Currently ~200 issues, like
  - **editorial**: ABNF conversion (no implied LWS)
  - **procedural**: Registries for status, methods
  - **security**: WS between header name and colon
  - **i18n**: Header charset and folding
  - **html5**: Is Content Sniffing allowed?
  - **protocol**: Really, only two connections?
  - **semantic**: What is a PUT response w/ETag?
  - **caching**: Is the method part of the cache key?
HTTPbis: Status

• Editors: Roy Fielding, Julian Reschke, Yves Lafon, Mark Nottingham
• Currently on draft -08
• Major rewrites in progress
  • p1 messaging
  • p5 caching
• “six months”
• Also informal place for discussion of new extensions, liaison with HTML5 work, etc.
HTTP in Practice: The Implementations
Implementations

- **Clients**
  - IE, Mozilla, Opera, Safari, wget, curl, serf, Perl, Python, Ruby, Java
  - Abstractions: XMLHttpRequest, Prototype.js, Flash APIs

- **Servers**
  - Apache, IIS, Lighttpd, Tornado, your router, phone and fridge
  - Abstractions: filesystems, CGI, WSGI, Rack, Servlet

- **Intermediaries**
  - Squid, Traffic Server, Blue Coat, ISA, HAProxy, L7 load balancers, firewalls
  - Not many abstractions (yet)
  - 20%-30% of Web traffic goes through a proxy

- **Caches** in clients and intermediaries
  - starting to show up in Python, Ruby...
HTTP Versions

- Most everything these days is HTTP/1.1, except...
  - Squid (full 1.1 coming)
  - wget
  - a few libraries
  - very old browsers, servers, libraries
- That’s OK
Core Methods

• GET, POST - universally supported
• PUT, DELETE
  • A few clients can’t generate (e.g., Safari2 XHR)
  • Intermediaries can be configured to block, but usually aren’t (except the paranoid and mobile)
• Biggest limitation is W3C languages
  • XSLT, HTML forms
• Result: X-HTTP-Method header (Google) or query params (e.g., ?real-method=POST)
“Advanced” Methods

- **OPTIONS**
  - Hard to configure in servers
  - Isn’t cacheable... oops.
  - Result: only used for esoteric protocols (*DAV)

- **Extension methods - FOO**
  - A number of clients don’t allow (e.g., XHR)
  - Intermediaries often block (e.g., Squid, L4 balancers)
  - Result: This probably isn’t so horrible
URIs

- Mobile clients limit to as small as 256
- Browsers
  - IE: ~2k
  - The rest: really really big
- Intermediaries are OK up to about 4k; some go higher
- Servers can be configured (or replaced)
- Result: people putting queries in POSTs
  - application-specific and frameworks
  - frameworks doing this leads to gratuitous tunnelling
  - HTTPbis recommendation: 8k
Headers

- Some length limits (e.g. 20k total in Squid)
- Almost no-one handles line continuations
  - Result: effectively profiled out
- Disallowed by latest HTTPbis changes
- Connection header control: not great
  - Result: extending protocol difficult
- Trailers aren’t well-supported at all
  - Result: debug, status more difficult
Partial Content

• Content-Range / 206
• Biggest use: PDF
• Some caches don’t store partial content
  • e.g., Squid
• Flash URL API can access ranges, but VideoPlayer, etc. don’t use it

• Result:
  $vidID = $_GET["vidID"];
  $vidPosition = $_GET["vidPosition"];

Redirection

• Most* current browsers will preserve POST when they get a 307 Temporary Redirect
  • ... but not PUT or DELETE
  • ... and not a 301 or 302
  • * except Safari - it doesn’t even do 307

• HTTPbis redefining 301, 302 to reflect reality
Connection Handling

- Browsers limited to two concurrent connections to each server
  - ouch!
  - Result: BATCH, hosting on multiple names, etc.
- Being fixed in HTTPbis
  - no particular limit
  - IE8 already running with this
Pipelining

• Clients
  • Only Opera does by default (lots of heuristics)
  • The brave can turn it on in Mozilla
  • A few libraries allow (e.g., Serf)
• Most intermediaries will be OK with it, but won’t forward
• Many servers handle it just fine; a few don’t
• Risks: interleaved or out-of-order responses
• Predominant use today: SVN (thanks to Serf)
• Result: “waterfall” of requests; CSS spriting
Cookies

- There is no cookie specification.
- Netscape isn’t complete
- RFC2109 doesn’t reflect current practice
- Opera only major implementation of RFC2965

- Parsing raw dates is painful
  - Set-Cookie: a=1; Expires=Thu, 24 July 2008 00:00:00
  - requires special case handling

- Result: libraries required.
- New IETF Working Group contemplated
New Stuff
(a.k.a. fixing the suck)
Authentication

- Basic is interoperable, but not secure
- Digest is more secure, but not terribly interoperable
- Many newer requirements not addressed
  - Phishing
  - Delegated auth
- OAuth IETF Working Group
- "two-legged"
  - Other efforts still coalescing
Security Model

- Origin Header
- Strict Transport Security (STS)
- Content Security Policy (CSP)
- Cross-Origin Resource Sharing (CORS)
- Server auth without SSL?
- W3C may be starting a WG.
PATCH

• “Restful” APIs are starting to abuse PUT
• “update that with this...”
• PATCH allows you to apply a diff to a resource
• Currently in IETF Last Call
Prefer Header

- Lets a client state what it wants;
  - Full content in response body
  - Status message in response body
  - No response body
- E.g., POST /order-handler
- Currently a (quiet) Internet-Draft
Link Header

- Under-developed part of the Web arch: typed links
- Advertise/discover links in HTTP headers
  - “this invalidates <foo>”
  - “the previous one is <bar>”
  - “edit this over at <baz>”
- In RFC2068, taken out of RFC2616
- In IETF Last Call
HyBi: Bidirectional HTTP

- "Short-Term" Solution: Comet
  - Long polling optimisations
  - Connection use hints
  - Intermediary coordination
- "Long term": WebSockets
  - New, very low-level protocol
  - Already in browsers
  - Likely to be an IETF WG very soon
Better Transport

- head-of-line blocking STILL an issue
  - Pipelining isn’t well-supported, and doesn’t completely solve the problem
- HTTP doesn’t guarantee integrity
  - except with Content-MD5 (which no one does)
- HTTP over TCP sucks
  - on lossy links
  - on high latency links
  - on low bandwidth links
HTTP/2.0?

- Re-framing HTTP semantics onto better transport
- HTTP-over-SCTP (uDel, Cisco)
  - Better over long-distance / lossy nets
- WAKA (Roy Fielding)
  - Still probably TCP
  - Allow new message patterns, more efficient implementation and network use
Take-Aways

- Implementations are (obviously) usable, but
  - They sometimes impose arbitrary limits
  - They don’t expose some important controls
- HTTPbis is an opportunity to
  - get implementers together
  - clarify ambiguities
  - improve interop
  - make HTTP a more stable basis for the next 10+ years
- We need to start thinking about HTTP evolution NOW.