Cache Digests for HTTP/2

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To push, or not to push

- a server *should not* push a resource already cached
  - reason: minimize consumed bandwidth
- but how to determine (at the point colored in red)?
Cache Digests for HTTP/2

- client sends a *digest* of resources cached
- a digest is:
  - a Golomb-coded set containing the hashes of fresh resources being cached
  - scope is the origin
- authors: me, Mark Nottingham
Size of the digest

- uses Golomb-coded sets
  - compressed form of bloom filter
  - has false positives, no false negatives
    - i.e. non-cached resources marked as cached, but not the reverse
  - roughly \((1.x + \log_2(P)) \times \text{number_of_urls}\) bits
    - i.e. 1 byte-per-URL if false positive rate is set to 1/128 (P=128)
  - small P (e.g. P=2) would still be useful
    - since some of the resources can be detected as non-cached and be pushed
CACHE_DIGEST frame

- CACHE_DIGEST frame
  - stream_id is fixed to 0
  - contains digest covering resources belonging to the origin of the previous HEADERS frame
    - reason: don't delay the arrival of the request
- client typically sends CACHE_DIGEST only once per connection, per origin
  - server can memoize what it has sent over the connection to avoid resend
Example sequence

```
01 08 11 0e ff
(digest of /main.js & /main.css, with false positive rate of 1/256)

<body>
... generated response ...
```
Security Considerations

- cache-based fingerprinting becomes passive
  - possible mitigation: alter the cache state when other tracking identifiers (e.g. Cookie) is cleared
Implementation Status

■ server-side:
  - H2O
    • variant of the draft (uses Cookie)
  - mod_h2 (Apache)
    • variant of the draft (uses H1 header)

■ client-side:
  - https://github.com/Jxck/dispenser.js (WIP)
    • ServiceWorker; modifies the cookie recognized by H2O
Discussion after submission

- why not use HTTP header?
  - send digests using ServiceWorker
- customizable scope?
  - when connecting to a server possessing a wild-card certificate
- digest of stale resources as well?
  - need to formalize how to push validation info.
- partial vs. complete digest
  - define a flag to distinguish them, so that the server can change the push strategy
Comments?