

Network Working Group	A. Silvas
Internet-Draft	GoDaddy
Intended status: Experimental	June TBD, 2016
Expires: December 7, 2016	

Push-Assets Header Field

draft-asilvas-http-push-assets-00

Abstract

Push-Assets is a header field that provides server the necessary client state, enabling servers to utilize HTTP/2 Server Push with confidence in knowing what resources SHOULD or SHOULD NOT be sent, reducing waste, and ultimately providing an improved user experience. This document will provide an overview of Push-Assets requirements, and describes any implementation concerns.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at <http://datatracker.ietf.org/drafts/current/>.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

This Internet-Draft will expire on December 7, 2016.

Copyright Notice

Copyright (c) 2016 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to BCP 78 and the IETF Trust's Legal Provisions Relating to IETF Documents (<http://trustee.ietf.org/license-info>) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must include Simplified BSD License text as described in Section 4.e of the Trust Legal Provisions and are provided without warranty as described in the Simplified BSD License.

Table of Contents

1. **Introduction**
 - 1.1. **Terminology**
 2. **Understanding The Problem**
 3. **Push Assets Use Cases**
 - 3.1. **First Load Experience**
 - 3.2. **Subsequent Load Experience**
 - 3.3. **Proxy Optimization**
 - 3.4. **Non-Browser Clients**
 - 3.5. **Alternative Content Types**
 4. **Push-Assets Header**
 - 4.1. **Caching Headers**
 - 4.2. **Empty Cache Request**
 5. **Push-Asset-Key Header**
 - 5.1. **Named Key**
 - 5.2. **Key from URI Path**
 6. **Push-Asset-Match Header**
 - 6.1. **Match Similar Requests**
 - 6.2. **Match All Requests**
 7. **Responsible Usage**
 - 7.1. **Frequently Changing Paths**
 - 7.2. **Excessive Matching**
 - 7.3. **Varying Content Types**
 8. **References**
 - 8.1. **Normative References**
 - 8.2. **Informative References**
- Author's Address**

1. Introduction

As described in [\[HighPerformance\]](#), transfer sizes and document requests continue to increase. While network conditions continue to improve, resulting in lower latencies and increased bandwidth, HTTP/1.1 ([\[RFC7230\]](#) and [\[RFC7231\]](#)) fails to address the underlying problem of document dependencies and the resulting "waterfall" of blocked requests.

HTTP/2 [\[RFC7540\]](#) aims to address some of these problems, by way of Streams and Multiplexing, combined with HTTP/2 Server Push [\[RFC7540\]](#). A ruthless combination, addressing "head-of-line blocking" through Multiplexing, and optimistic pre-loading by way of Server Push.

Where Server Push begins to fall short is around client state, leaving it up to servers to leverage existing HTTP State Management Mechanism [\[RFC6265\]](#) with Cookies, which are not purpose built to solve the problem of document dependency state. This lack of client state can result in HTTP/2 [\[RFC7540\]](#) RST_STREAM, where-in in-flight Server Push Streams will be cancelled, incurring client and server waste.

This document aims to address document dependency state by looking to Caching [\[RFC7234\]](#) familiar with existing HTTP/1.1 requests (see [\[RFC7230\]](#) and [\[RFC7231\]](#)). By pulling this state data into the parent request, servers are able to intelligently and responsibly Server Push only missing or outdated dependencies.

1.1. Terminology

In this document, the key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" are to be interpreted as described in BCP 14,

RFC 2119 [RFC2119] and indicate requirement levels for compliant implementations.

This document uses the Augmented BNF defined in [RFC5234].

2. Understanding The Problem

Here we can begin to see the problem with vanilla HTTP/2 [RFC7540] Server Push using one of many custom cookie-based implementations to manage client state.

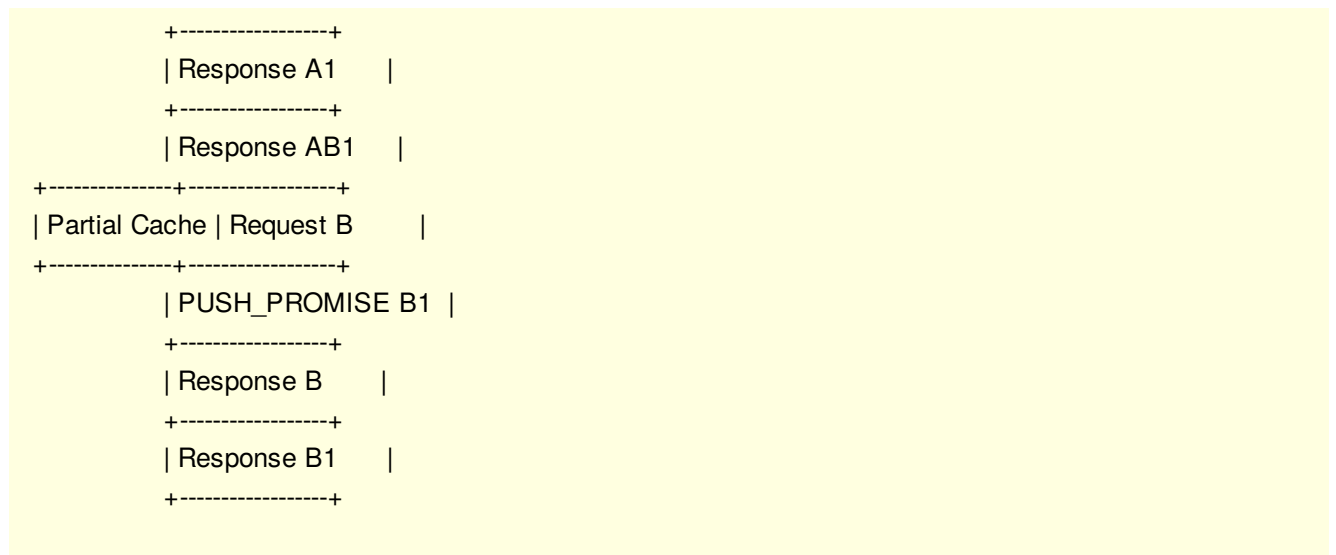
```
+-----+-----+
| Empty Cache | Request A      |
+-----+-----+
      | PUSH_PROMISE A1 |
      +-----+
      | PUSH_PROMISE AB1 |
      +-----+
      | Response A      |
      +-----+
      | Response A1     |
      +-----+
      | Response AB1    |
+-----+-----+
| Partial Cache | Request B      |
+-----+-----+
      | PUSH_PROMISE B1 |
      +-----+
      | PUSH_PROMISE AB1 | <== EVIL
      +-----+
      | Response B      |
      +-----+
      | Response B1     |
      +-----+
      | Response AB1    | <== EVIL
      +-----+
      | RST_STREAM AB1  | <== EVIL
      +-----+
```

While in some situations cookie-based management will address the above, ultimately it'll vary depending on the complexity of the origin, including but not limited to the number of assets and the frequency of change.

Figure 1

With Push-Assets enabled both client and server adhere to a strict dependency state contract.

```
+-----+-----+
| Empty Cache | Request A      |
+-----+-----+
      | PUSH_PROMISE A1 |
      +-----+
      | PUSH_PROMISE AB1 |
      +-----+
      | Response A      |
```



Avoiding needless waste, the benefits of Push-Assets far outweighs the additional header data needed to track client state.

Figure 2

3. Push Assets Use Cases

3.1. First Load Experience

Often the most import visit to a site is the first. Push-Assets provides the necessary client state for the server to confidently know which resources are missing or outdated.

3.2. Subsequent Load Experience

As users navigate to previously visited pages, or new pages where some shared resources have been cached, Push-Assets provides ample client state to continue making efficient use of Server Push, only sending what resources the client does not already have.

3.3. Proxy Optimization

On one end of the spectrum of proxies lies your server proxies, with CDN's on the other end.

[Client] <==[CDN]<===== [Proxy]<==[Origin]

Figure 3

With Push-Assets providing efficient communication between two points, this may lend to potential benefits between Proxies and their Origin server as well. While the Proxy nearest your Client SHOULD support Push-Assets for best results, it MAY elect not to also leverage Push-Assets between the Proxy and Origin.

For proxies with caching nearest to Client (namely CDN's), they may further benefit from Push-Assets for an efficient utilization of Server Push.

3.4. Non-Browser Clients

Leveraging the benefits of Push-Assets allows for more efficient communication with compatible servers. The more complex the data, the greater the potential benefits.

3.5. Alternative Content Types

With Push-Assets being nothing more than an HTTP Header, extending the benefits to other Content Type's [\[RFC2045\]](#) is entirely up to the Client and Server. Consider circumstances where you retrieve a JSON document, which signals relationships with other documents. Push-Assets reduces waste and enables better user experiences regardless of the Content-Type.

4. Push-Assets Header

```
Push-Assets = [*][Asset-Key=Caching-Headers][;Asset-Key=Caching-Headers]
```

A request header field SHALL be sent by the client when requesting the server to support Push-Assets.

Comprised of zero or more Assets addressed by their Asset-Key.

An Asset-Key is the name of the asset uniquely identifiable by the document or matching documents.

4.1. Caching Headers

```
Push-Assets = Asset-Key=[etag(etag-value),][last-modified(date)][no-push]
```

Caching MAY include an etag, and/or last-modified, or no-push. This provides necessary client state of dependencies to server.

4.2. Empty Cache Request

```
Push-Assets = *
```

Where * informs server to Server Push all push-enabled dependencies, if Push-Assets is enabled. Servers are NOT required to push any or all dependencies, but MUST push all missing or outdated push-enabled assets.

5. Push-Asset-Key Header

```
Push-Asset-Key = Asset-Key
```

A PUSH_PROMISE response Header field MAY be sent to inform the client that the asset should be tracked as a Push-Asset.

The Asset-Key MUST be stored in the header field as an MD5 representation of the desired Key.

Unlike the Asset-Key in a request, the Push-Asset-Key header field corresponds to the Key of the PUSH_PROMISE response.

5.1. Named Key

```
Push-Asset-Key = core-bundle.js
```

By naming an asset, you MAY share that asset across multiple documents, and MAY change the URI [\[RFC3986\]](#) as necessary.

5.2. Key from URI Path

```
Push-Asset-Key = $
```

Where \$ is reserved as a short-hand for the client to recognize the key as the URI Path [\[RFC3986\]](#), and MUST NOT include the query string.

Example URI Path [\[RFC3986\]](#) of /my/document?some=thing would be keyed as /my/document.

If there are more than one cached documents on the client for a given Push-Asset-Key, the client MUST treat the most recent Key as the current version.

6. Push-Asset-Match Header

```
Push-Asset-Match = Asset-Path[;Asset-Path]
```

An OPTIONAL PUSH_PROMISE response header field.

An Asset-Match supports the lexical matching of the URI Path [\[RFC3986\]](#), and MAY end with reserved wildcard * to indicate matching all requests "equal or greater than" the URI Path. While one or more Asset-Path's may be provided, they SHOULD be consistent between requests to avoid any caching proxies from serving varying responses. Usage of Vary header field (Section 7.1.4 of [\[RFC3986\]](#)) MAY be applied with Push-Asset-Match to permit varying responses, but SHOULD NOT be used in most scenarios to avoid unnecessary complexity.

6.1. Match Similar Requests

```
Push-Asset-Match = /some-path/*
```

Where all requests with URI Path [\[RFC3986\]](#) greater than or equal to /some-path/ will be matched.

6.2. Match All Requests

```
Push-Asset-Match = *
```

* by itself corresponds to "match all requests". This is the equivalent of /*.

7. Responsible Usage

State management can be simple for simple origins, but complex for complex origins. Following is a set of usage scenarios and suggested tactics to combat unnecessary waste.

7.1. Frequently Changing Paths

Not uncommon amongst websites are changes to the URI Path [\[RFC3986\]](#) of a document when the contents change. For these assets, utilizing the default Push-Asset-Key of \$ MAY result in excessive waste by way of the client sending state of matched assets that are no longer applicable.

An effective measure is to leverage a uniquely named Push-Asset-Key, enabling the client and server to understand that the asset has effectively been renamed.

7.2. Excessive Matching

Leveraging the power of the Push-Asset-Match header field MAY greatly improve the efficiency of assets shared amongst many documents. However used excessively where-in many matching documents do not depend on the matched asset MAY lead to waste, as the state of this matching asset is still sent via Push-Assets header field.

The server MAY improve effectiveness by way of highly specific Push-Asset-Match definition, breaking an origin into multiple sub-paths to permit parts an Origin to operate without negative effect from other parts of

an Origin. For example, /some-path/ does NOT need to use the same shared assets as /some-other-path/, as they MAY NOT know about one another.

In cases where even with highly specific Push-Asset-Match does not address excessive matching, the client MAY track historical false positives where-in matching assets are not served from requested documents, and MAY determine a threshold from which the client MAY elect NOT to send alongside Push-Assets requests.

7.3. Varying Content Types

With Push-Assets not being specific to html documents, clients MUST NOT match assets across documents with varying Content Type's [\[RFC2045\]](#).

If a server has enabled Push-Assets for more than one Content Type, the client MUST only notify the server of matching assets that were from the same Content Type of the parent document.

As an example, "/home.html" with a dependent asset that matches all URI Paths, MUST NOT be sent via Push-Assets when making a request for "/file.js" as the parent documents differ in Content Type.

8. References

8.1. Normative References

- [RFC2119] Bradner, S., "[Key words for use in RFCs to Indicate Requirement Levels](#)", BCP 14, RFC 2119, DOI 10.17487/RFC2119, March 1997.
- [RFC3986] Berners-Lee, T., Fielding, R. and L. Masinter, "[Uniform Resource Identifier \(URI\): Generic Syntax](#)", STD 66, RFC 3986, DOI 10.17487/RFC3986, January 2005.
- [RFC5234] Crocker, D. and P. Overell, "[Augmented BNF for Syntax Specifications: ABNF](#)", STD 68, RFC 5234, DOI 10.17487/RFC5234, January 2008.
- [RFC7230] Fielding, R. and J. Reschke, "[Hypertext Transfer Protocol \(HTTP/1.1\): Message Syntax and Routing](#)", RFC 7230, DOI 10.17487/RFC7230, June 2014.
- [RFC7231] Fielding, R. and J. Reschke, "[Hypertext Transfer Protocol \(HTTP/1.1\): Semantics and Content](#)", RFC 7231, DOI 10.17487/RFC7231, June 2014.
- [RFC7234] Fielding, R., Nottingham, M. and J. Reschke, "[Hypertext Transfer Protocol \(HTTP/1.1\): Caching](#)", RFC 7234, DOI 10.17487/RFC7234, June 2014.
- [RFC7540] Belshe, M., Peon, R. and M. Thomson, "[Hypertext Transfer Protocol Version 2 \(HTTP/2\)](#)", RFC 7540, DOI 10.17487/RFC7540, May 2015.

8.2. Informative References

- [HighPerformance] Grigorik, I., "High Performance Browser Networking", September 2013.
- [RFC2045] Freed, N. and N. Borenstein, "[Multipurpose Internet Mail Extensions \(MIME\) Part One: Format of Internet Message Bodies](#)", RFC 2045, DOI 10.17487/RFC2045, November 1996.
- [RFC6265] Barth, A., "[HTTP State Management Mechanism](#)", RFC 6265, DOI 10.17487/RFC6265, April 2011.

Author's Address

Aaron Silvas

GoDaddy

EMail: asilvas@godaddy.com