DoH Preference Hints

draft-schinazi-httpbis-doh-preference-hints

OARC 31 – Austin, TX – 2019-10

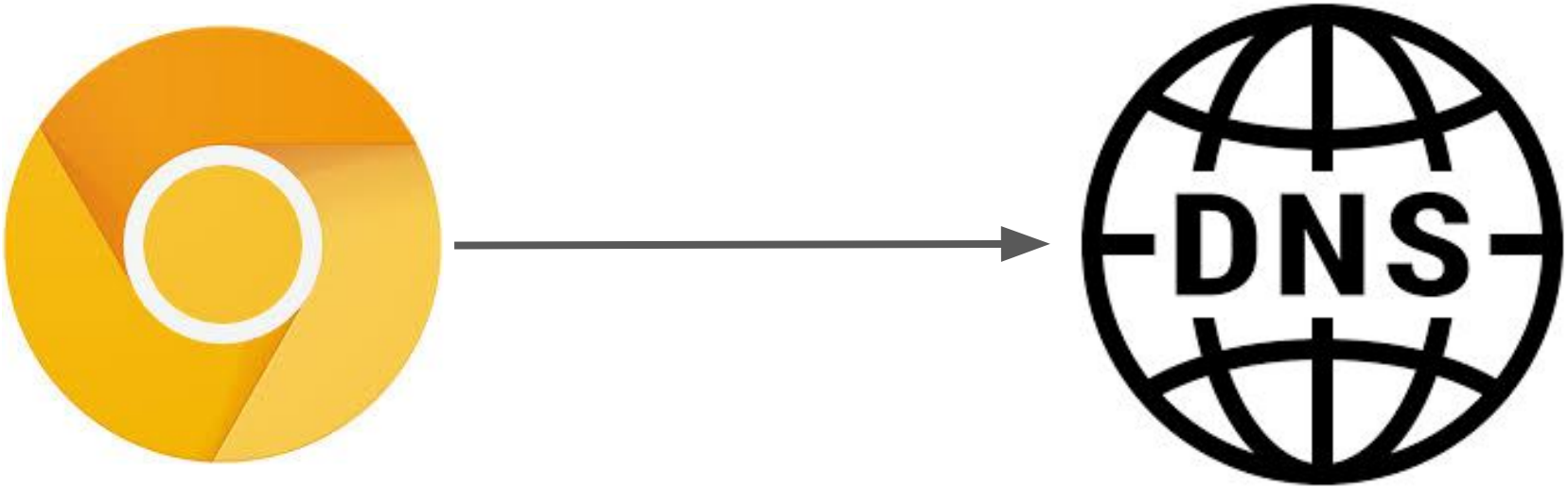
David Schinazi – dschinazi@google.com
Nick Sullivan – nick@cloudflare.com
Jesse Kipp – jkipp@cloudflare.com

DoH - Coming soon to a browser near you!

- Browsers are starting to use DoH
- Multiple deployment proposals

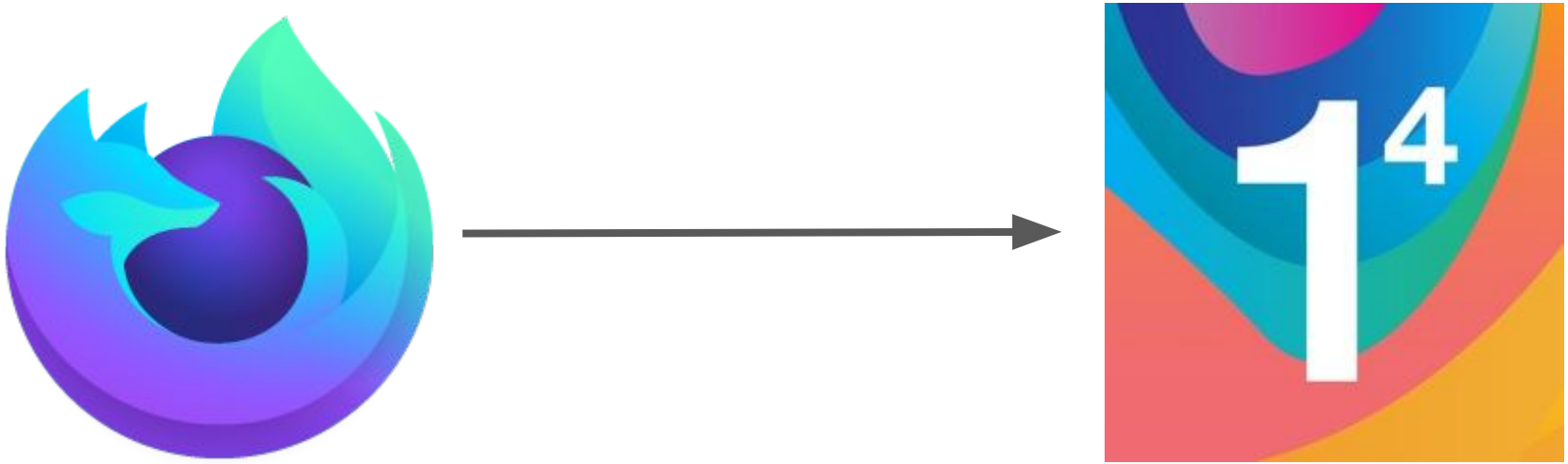
Proposed Deployment Models

- Chrome: opportunistic encryption
- If the system-configured resolver is DoH, capable, use DoH



Proposed Deployment Models

- Firefox: single privacy-preserving DoH server



New model: multiple simultaneous DNS servers

- Picking a single, fixed resolver can have downsides
  - Performance
  - Privacy
  - Security
  - Commercial considerations

Performance

- A large network/CDN/Cloud provider may be able to perform fast resolution for a given website (e.g. because the authoritative servers are on its network)

Privacy

- Spreading DNS queries out across multiple resolvers conceals full browsing history from a single provider

Security

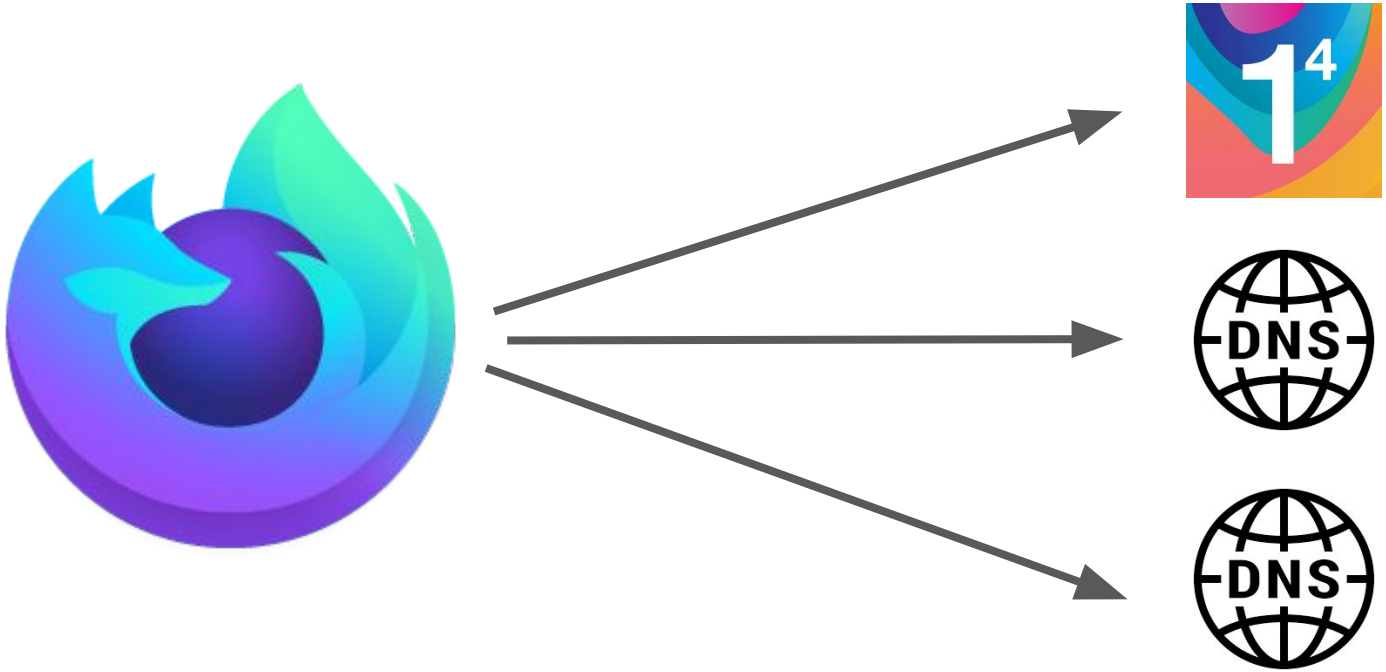
- Sites may want to specify that users should use a resolver that meets specific requirements for security or functionality

Commercial Considerations

- There may be real or perceived pressure for resolvers operating by entities that have other commercial interests to slow resolution for sites hosted on competing platform

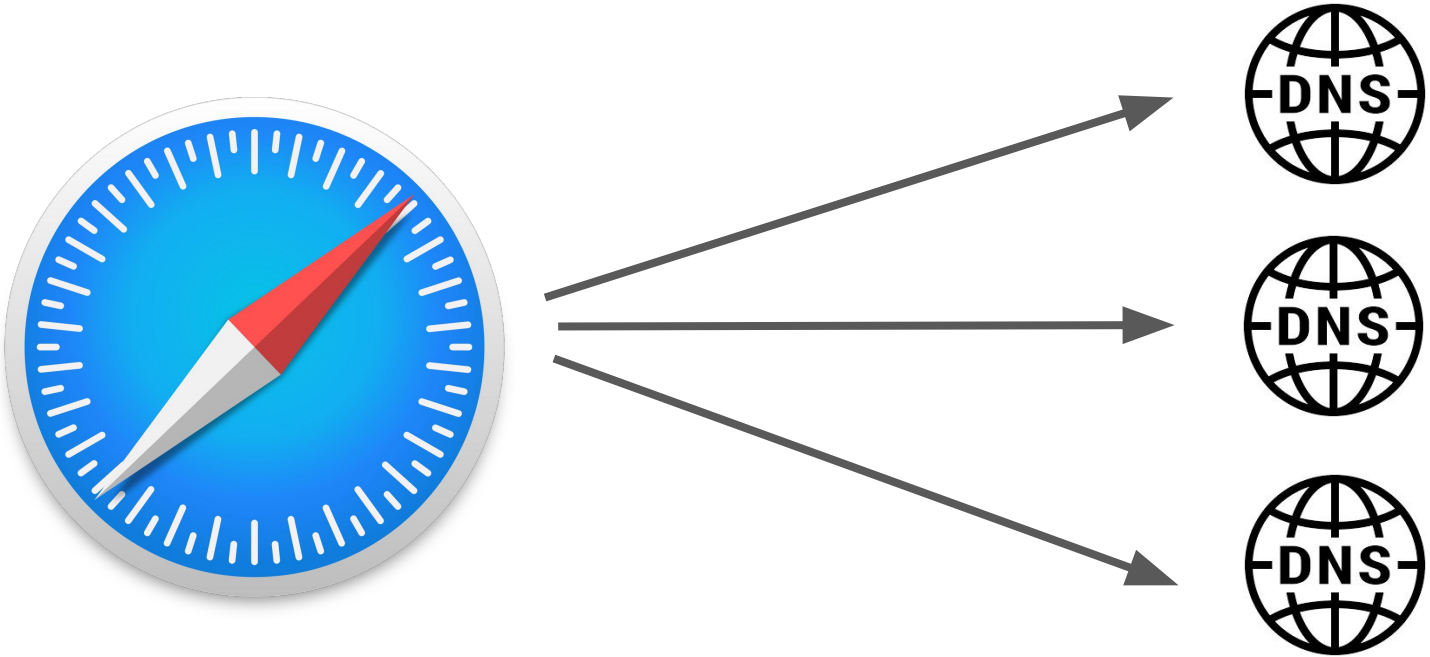
Proposed Deployment Models

- Firefox’s future(?): curated list of DoH servers



Proposed Deployment Models

- Future(?): Discovery of designated DoH providers



New model: multiple DoH servers

- Which set of DNS resolvers to use?
  - Pre-set list
  - Discovery

- How to choose which DNS resolver for a given query?
  - Round-robin
  - Sticky associations

Downsides of pre-set list + round-robin

- Performance
  - Less-than optimal selection
- Privacy
  - Some DoH servers are co-located with authoritative servers

Proposed solution: DoH-Preference Header

Let users and the site have a say in how future DNS resolutions are performed.

Inspired by HSTS

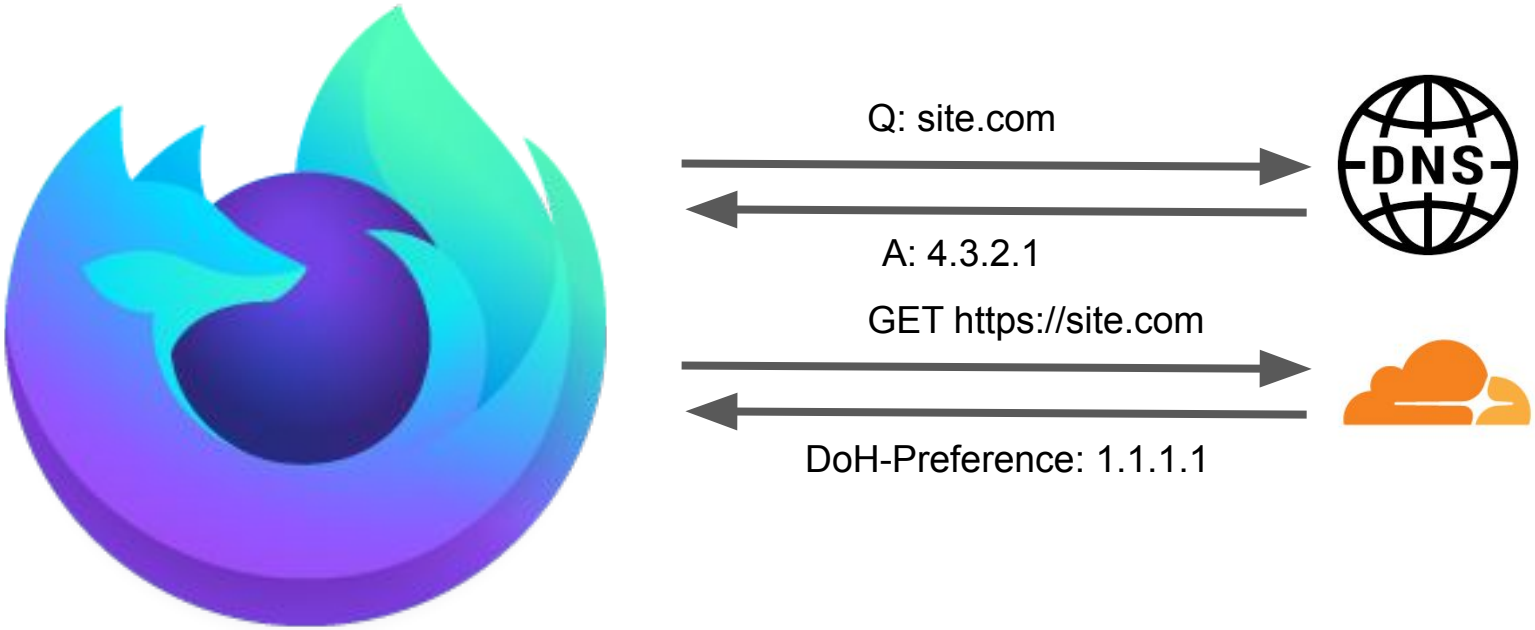
Completely optional, user agent is free to decide

```
DoH-Preference: "https://dnsserver.example.net/dns-query{?dns}";
       max-age=15768000
```

Intended Deployment

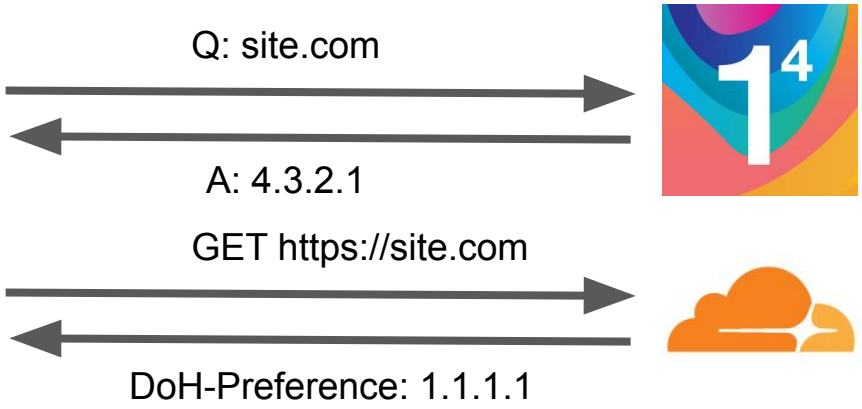
- Browsers ship with
  - a vetted list of servers or
  - a discovery mechanism for trustworthy resolvers
- Content providers can supply a hint, if the hint is in the vetted list, the browser may use that resolver in the future

First request



Second request

site.com : 1.1.1.1



Solving the single resolver issues

- Performance
  - Origin knows fastest DoH resolver for its host
- Privacy
  - Origin knows best which resolvers to be trusted with queries
- Security
  - Origin can choose resolvers with high security (e.g. DNSSEC-validating)
- Commercial considerations
  - Origin can choose resolver that does not conflict commercially with HTTP service provider

Fallback

- *Unlike* HSTS, fallback is always to the default DNS resolution mechanism, any failure results in fallback

Preventing tracking

- In order to be useful, preference must survive longer than DNS cache, preferably until next time user visits the site
- Could be a vector for tracking users
- Hint is only accepted if it matches a vetted list of DoH templates.
- Needs to be properly double-keyed
    - Proposal avoids leaking information by keying to both first party domain and the domain sending the header
    - Prevents tracking across site visits

DoH Preference Hints

draft-schinazi-httpbis-doh-preference-hints

OARC 31 – Austin, TX – 2019-10

David Schinazi – dschinazi@google.com
Nick Sullivan – nick@cloudflare.com
Jesse Kipp – jkipp@cloudflare.com