

HTTP/3's Extensible Prioritization Scheme in the Wild

Joris Herbots, Robin Marx, Maarten Wijnants, Peter Quax, Wim Lamotte
Expertise Center for Digital Media – Hasselt University

IETF 120 – Heads-up talk



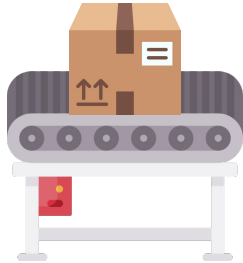
Mixed Augmented and Extended Reality Media Pipeline



The HTTP Trilogy

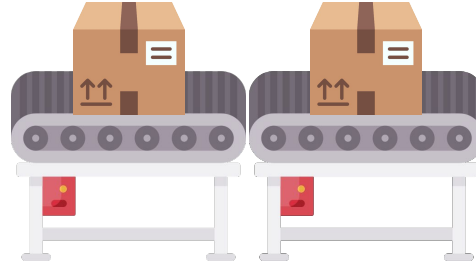
HTTP/1.1 (TCP) - 1997

1 resource/connection



HTTP/2 (TCP) - 2015

≥1 resources/connection



HTTP/3 (QUIC) - 2022

≥1 resources/connection



Extensible Prioritization Scheme

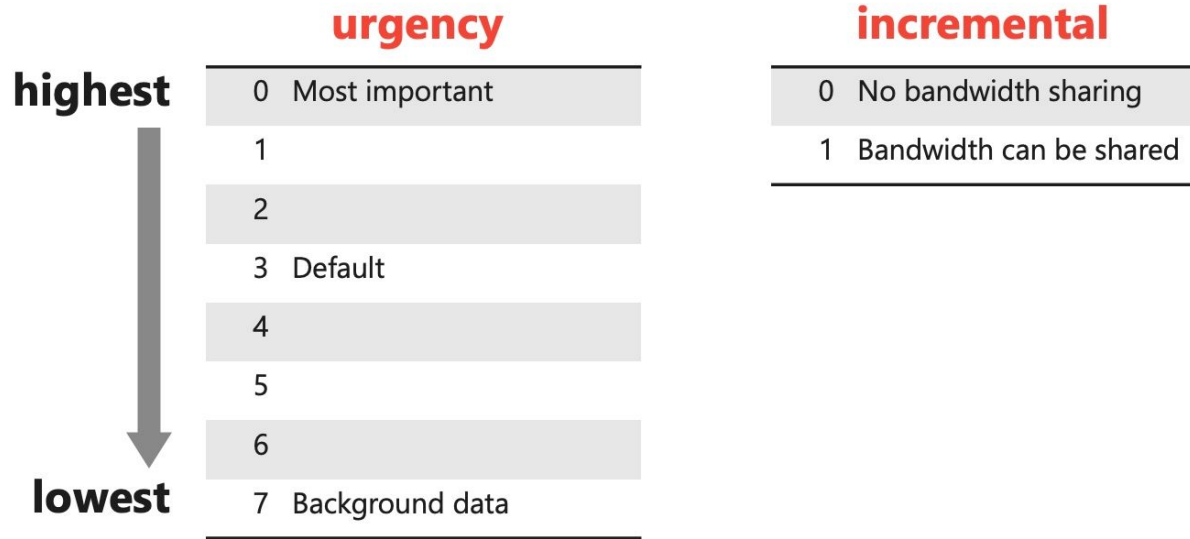
EXPECTATION



REALITY






EPS Parameters



HTTP header and/or binary frame

Browsers - Parameter Usage & Signalling

Experiment: Multiple HTML pages with a variety of resource types

↓ Browser / EPS Feature →	Approach	Incremental usage
	Fine grained	Partial
	Medium grained	Always on
	Coarse grained	Never

! A lot of heterogeneity











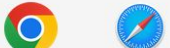
Browsers - Fetchpriority

```

```

```
<link rel="preload" href="/defer.js" as="script" fetchpriority="low">
```

Browsers - Fetchpriority

↓ Type / Priority →	Highest	High	Medium	Low	Lowest
JS (head)					
JS (head fp@high)					
JS (head fp@low)					
JS (async)					
JS (async fp@high)					
JS (async fp@low)					

Servers

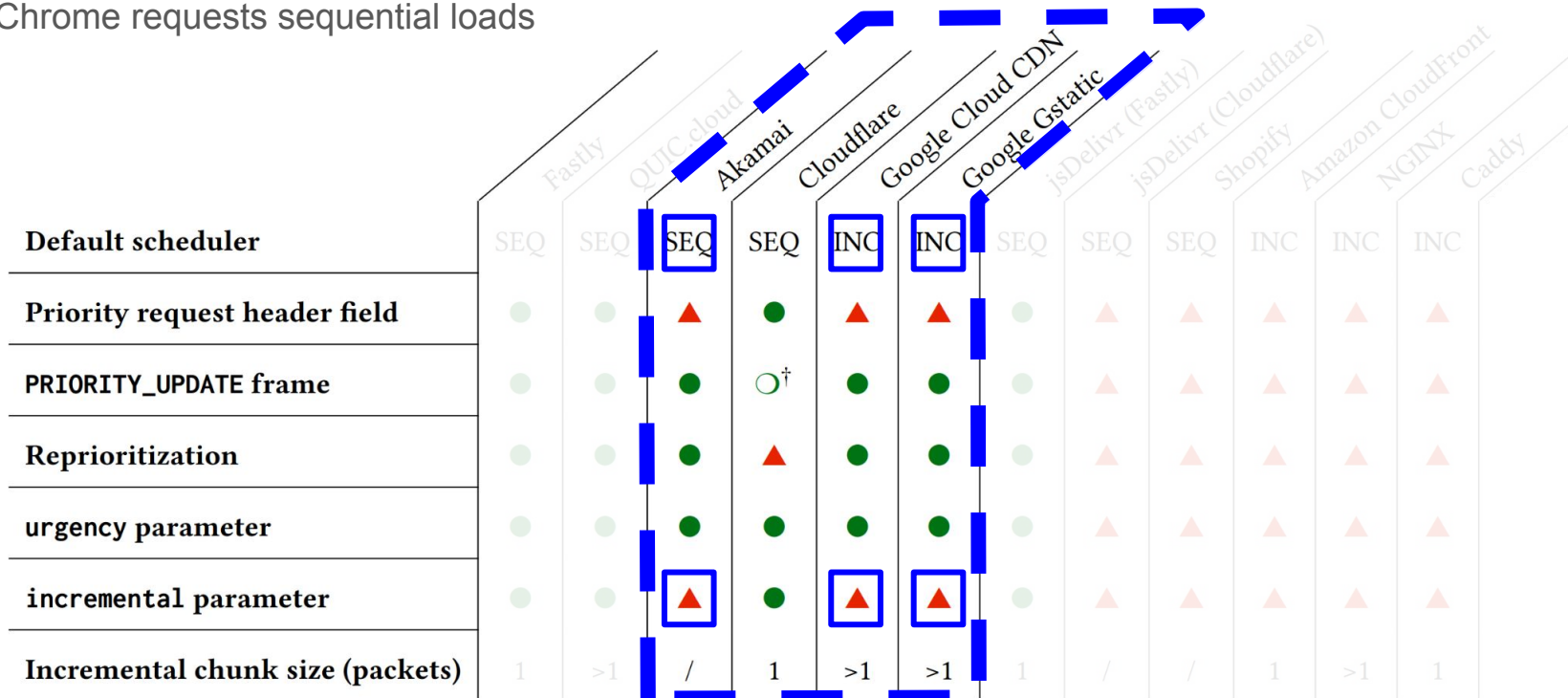
Experiment: Request multiple resources in a wide variety of ways

	Fastly	QUIC.cloud	Akamai	Cloudflare	Google Cloud CDN	Google Gstatic	jsDelivr (Fastly)	jsDelivr (Cloudflare)	Shopify	Amazon CloudFront	NGINX	Caddy
Default scheduler	SEQ	SEQ	SEQ	SEQ	INC	INC	SEQ	SEQ	SEQ	INC	INC	INC
Priority request header field	●	●	▲	●	▲	▲	●	▲	▲	▲	▲	▲
PRIORITY_UPDATE frame	●	●	●	○ ⁺	●	●	●	▲	▲	▲	▲	▲
Reprioritization	●	●	●	▲	●	●	●	▲	▲	▲	▲	▲
urgency parameter	●	●	●	●	●	●	●	▲	▲	▲	▲	▲
incremental parameter	●	●	▲	●	▲	▲	●	▲	▲	▲	▲	▲
Incremental chunk size (packets)	1	>1	/	1	>1	>1	1	/	/	1	>1	1

Servers - Partial Support

Akamai and Google have no support for the incremental flag

- ! Google has no sequential support
- ! Chrome requests sequential loads



Considerable heterogeneity

Behavior unpredictable between browsers and servers

- ! fetchpriority ineffective
- ! Optimize for one browser, worsen experience in others
⇒ Worst case!

Priorities impact Web performance

- ! Websites/web developers care a lot about this



imgflip.com

JAKE-CLARK.TUMBLR

Key Recommendations

1. Full support for EPS by major deployments
 - Inconsistent without basic features!
 - Extensibility at risk
 - Space for future extensions
 - No basic support == no extensibility

2. Better manual control through developer APIs
 - Work around browser heuristics
 - E.g., change incremental through fetchpriority
 - Enable complex Web applications (e.g., video streaming)

Feel free to peruse our findings (paper)

