# Speed Kit

# A Polyglot & GDPR-Compliant Approach For Caching Personalized Content

## ICDE 2020, Dallas/USA

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Universität Hamburg
DER FORSCHUNG | DER LEHRE | DER BILDUNG

Baqend

Presentation is loading

# Nobody Wants It – Everybody Does It

Of **3.5 hours** you spend online each day...

...**20 minutes** are wasted waiting for pages to load.

In your life, you will waste **one whole year**.

Entwicklung der durchschnittlichen täglichen Nutzungsdauer des Internets in Deutschland in den Jahren 2000 bis 2018. Statista, 2020

# You Heard The Stories

amazon — **100 ms** slower → **-1%** Conversion Rate

zalando — **100 ms** faster → **+0.7%** Revenue Per Session

Walmart — **100 ms** faster → **+1%** Revenue


Greg Linden. Make Data Useful. Stanford Data Mining Class CS345A, 2006

Shuhei Kagawa, Jeff Cybulski, David Martin Jones, et. al.. Loading Time Matters. Zalando Tech Blog, 2018

C. Crocker, A. Kulick, B. Ram. Real-User Monitoring at Walmart, SF & SV Web Performance Group, 2012.

# Delay Psychology : Rules of Thumb

| Delay | User Perception |
|---|---|
| 0 – 100 ms | Instant |
| 100 – 300 ms | Small perceptible delay |
| 300 – 1000 ms | Machine is working |
| 1+ s | Mental context switch |
| 10+ s | Task is abandoned |

**Stay under 1000 ms to keep users' attention**

I. Grigorik, High performance browser networking, O'Reilly Media, 2013

Jakob Nielsen, Usability Engineering, Morgan Kaufmann, 1994

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**Page Speed = Money**

**Stay under 1000 ms to keep users' attention**

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# Global Pandemic: More Traffic, Reduced Speed

## United Kingdom

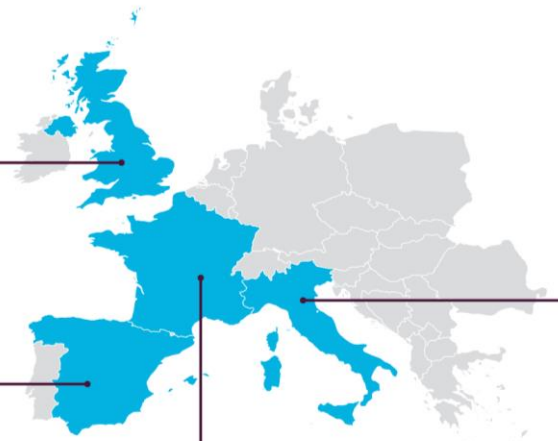
| Traffic | Download Speed |
|---|---|
| ↑78.6% | ↓30.3% |

Difference calculated between February 27th and March 31st.

## Italy

| Traffic | Download Speed |
|---|---|
| ↑109.3% | ↓35.4% |

Difference calculated between February 20th and March 31st.



## Spain

| Traffic | Download Speed |
|---|---|
| ↑39.4% | ↓8% |

Difference calculated between March 1st and March 31st.

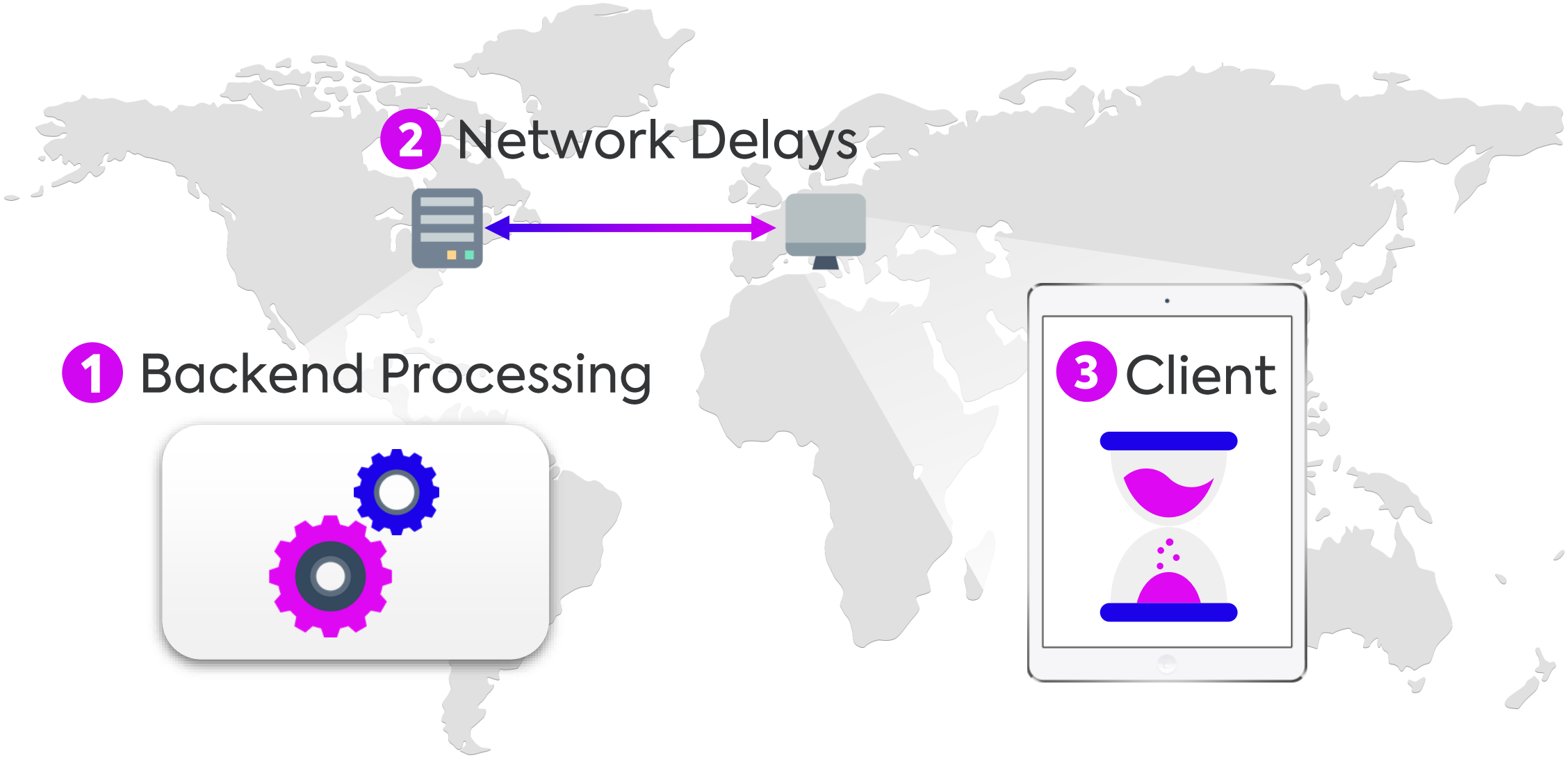
## France

| Traffic | Download Speed |
|---|---|
| ↑38.4% | ↓13.9% |

Difference calculated between February 26th and March 31st.

A. Bergman, J. Iyengar. How COVID-19 is Affecting Internet Performance. Fastly Blog, 2020

# 3 Things Make Your Website Slow

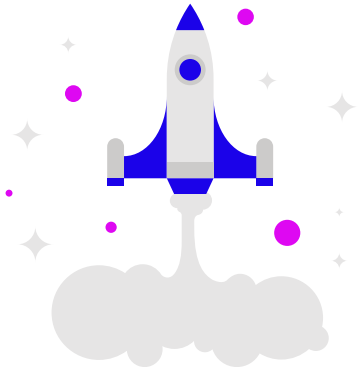


# We Are Baqend

We bring performance research to practice.

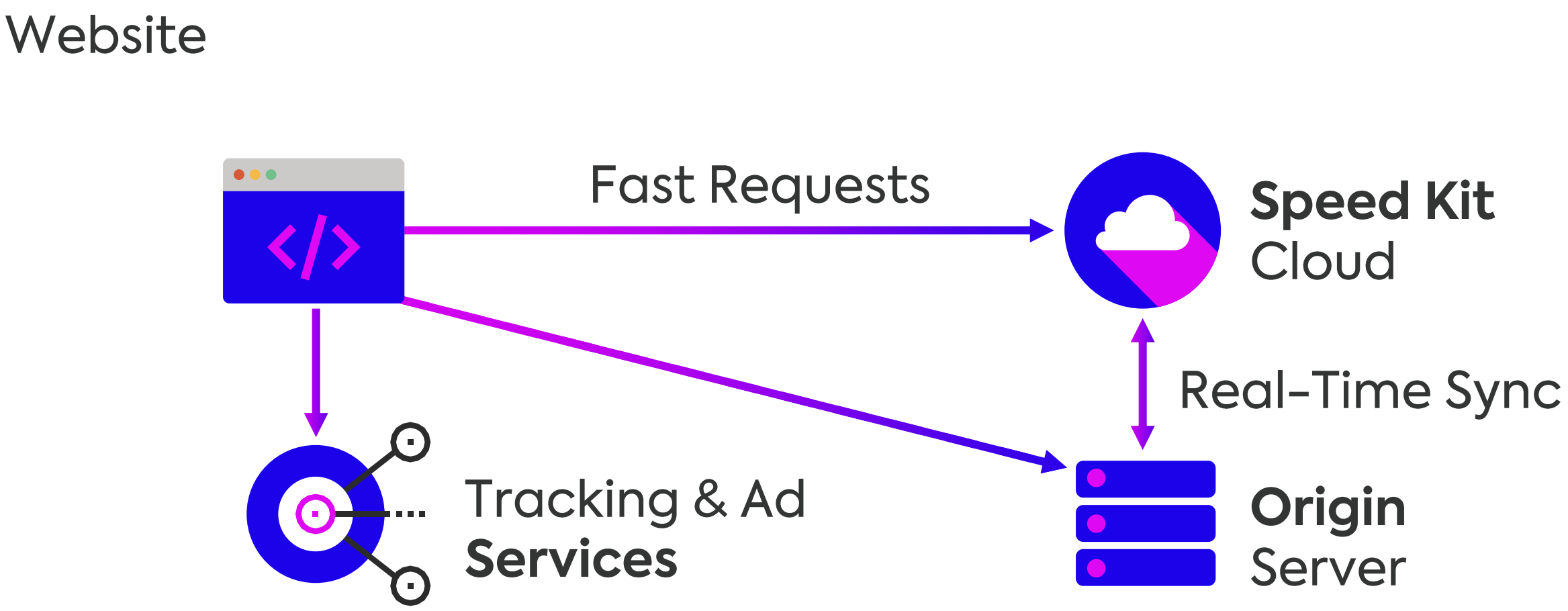
40+ man-years of **web performance research**

Novel technology for caching **dynamic data**



**Speed Kit –** SaaS for e-commerce speed

# Speed Kit Makes Websites Fast



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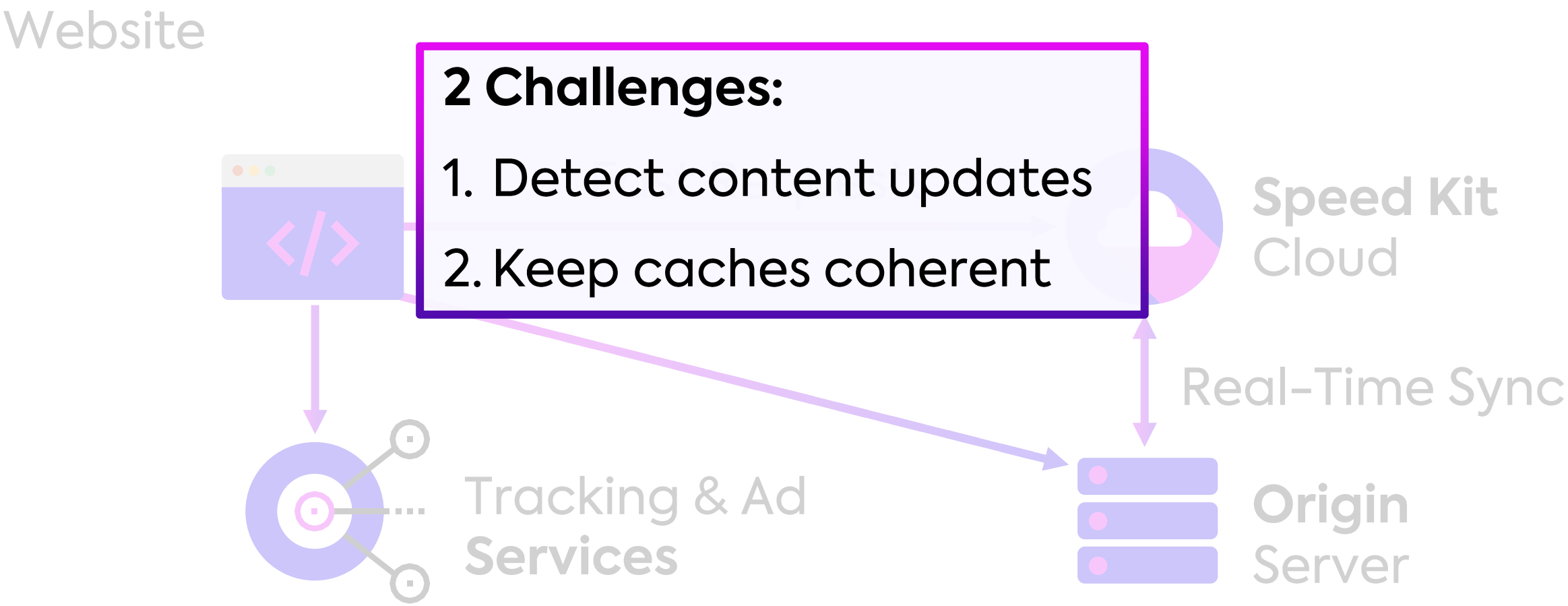
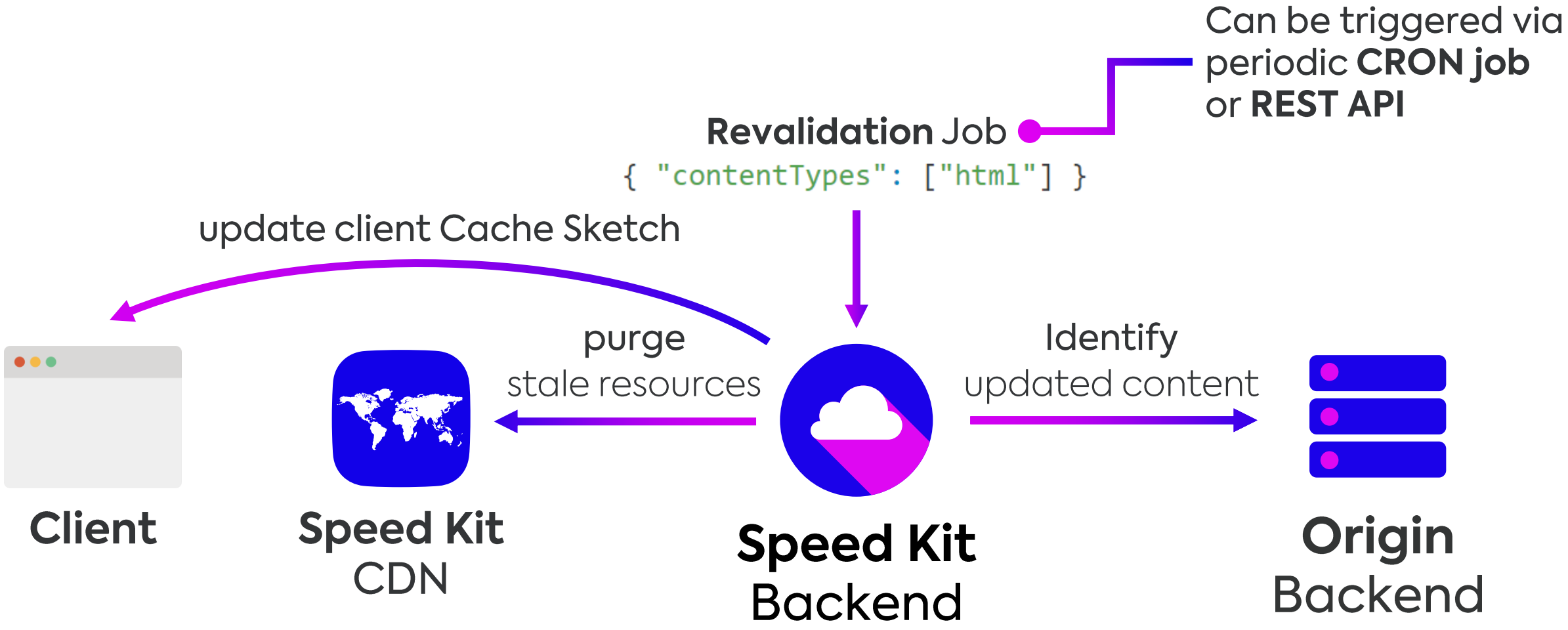


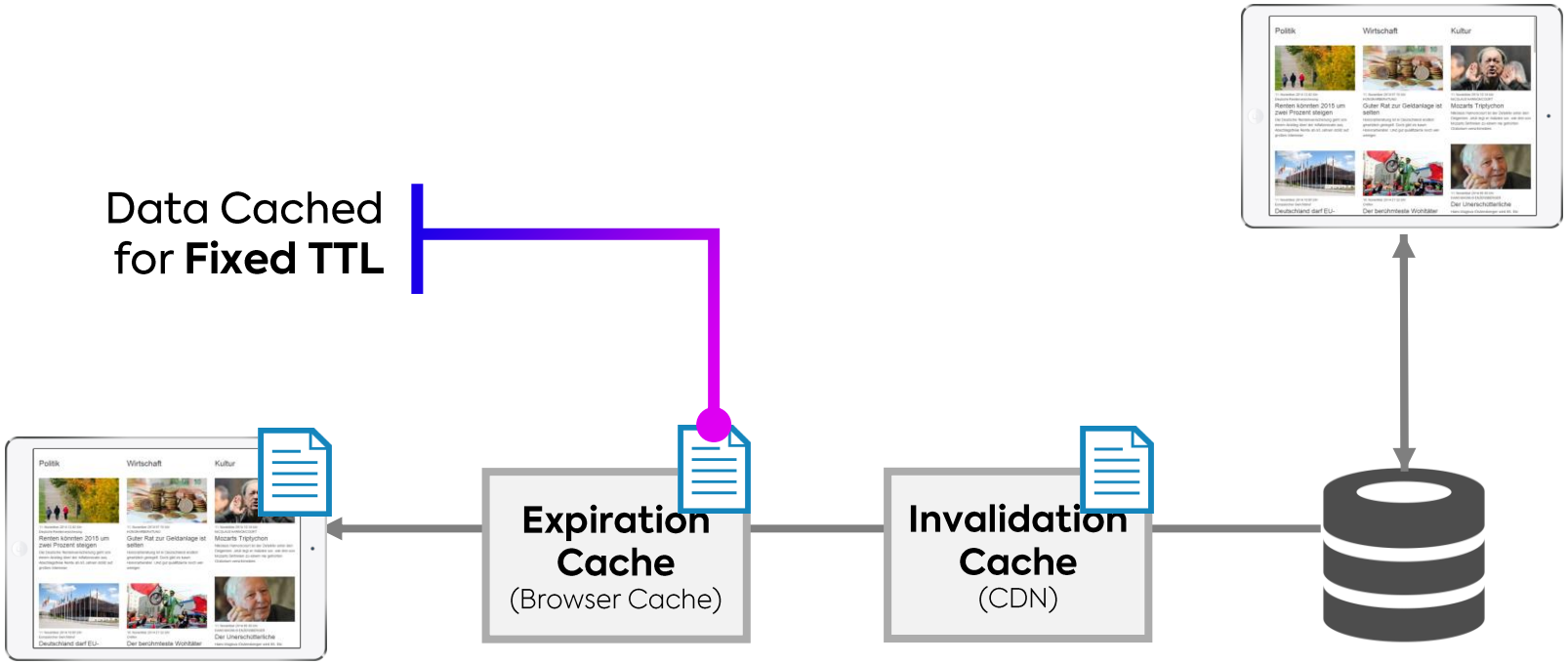

**2 Challenges:**

1. Detect content updates
2. Keep caches coherent

# Challenge I: Detect Content Updates



# Challenge II: How We Solved Cache Coherence



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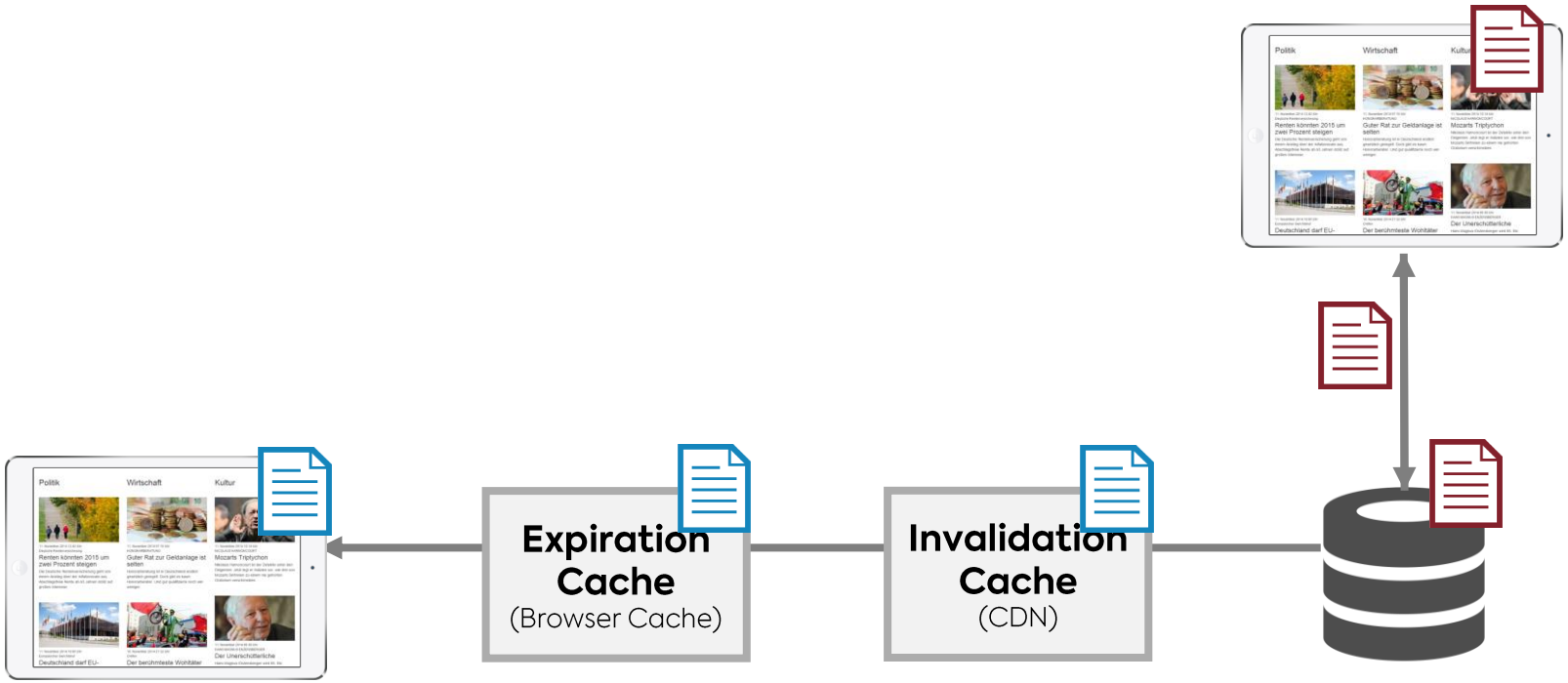

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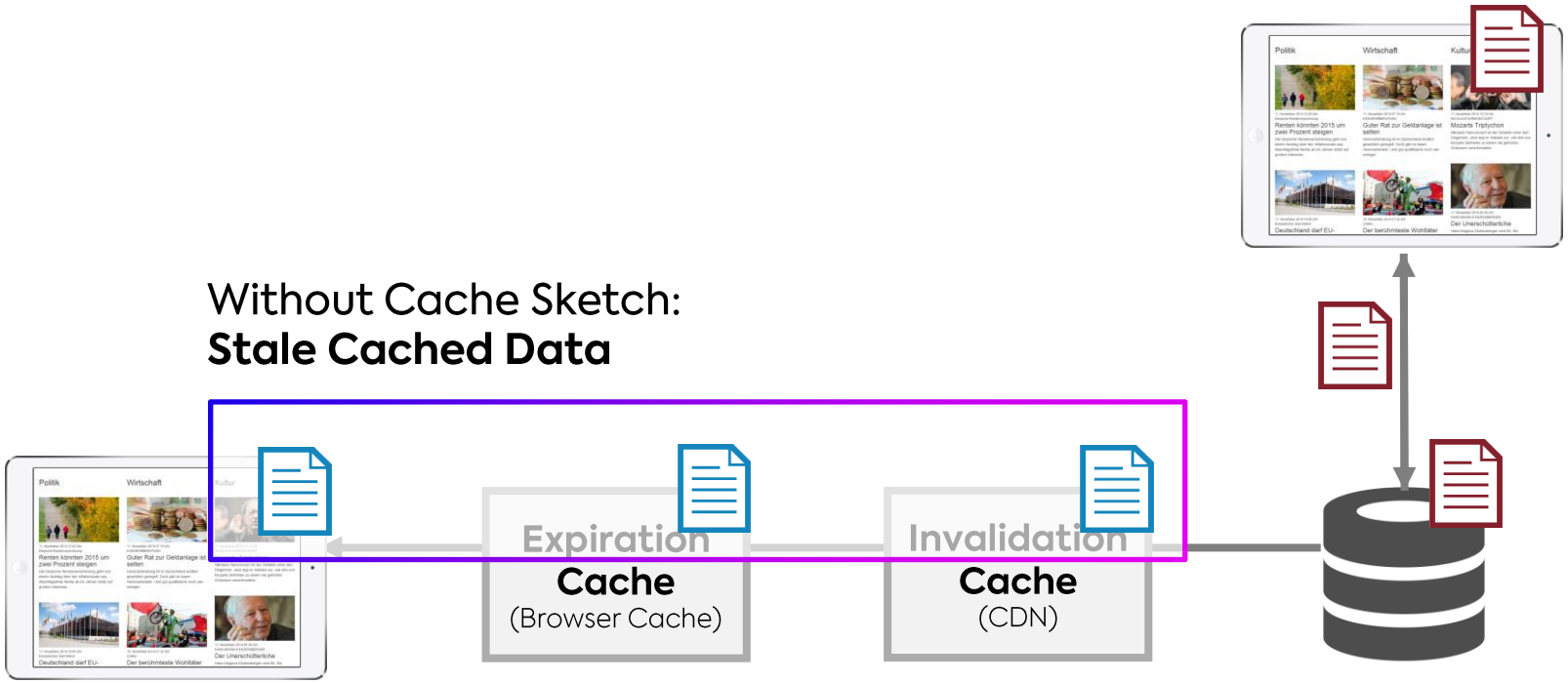

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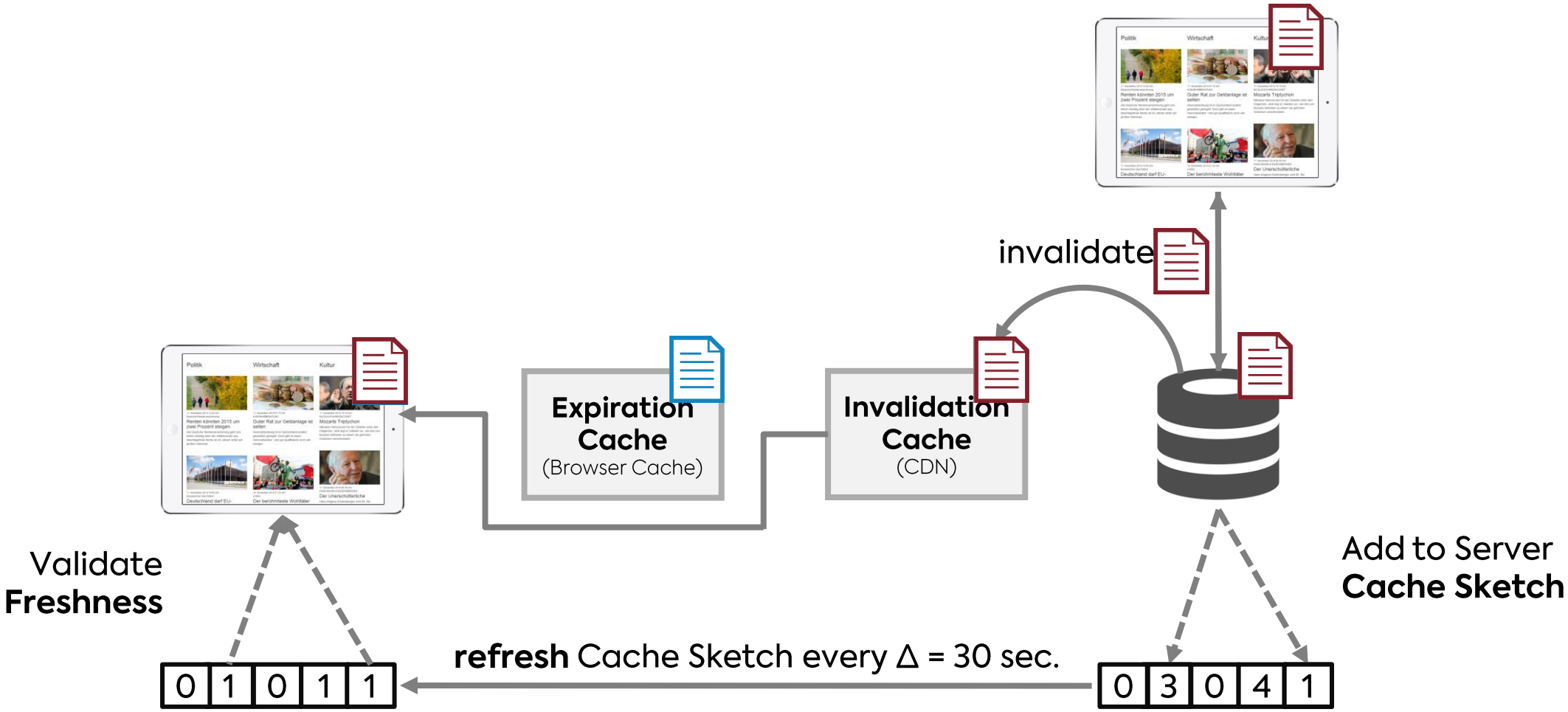

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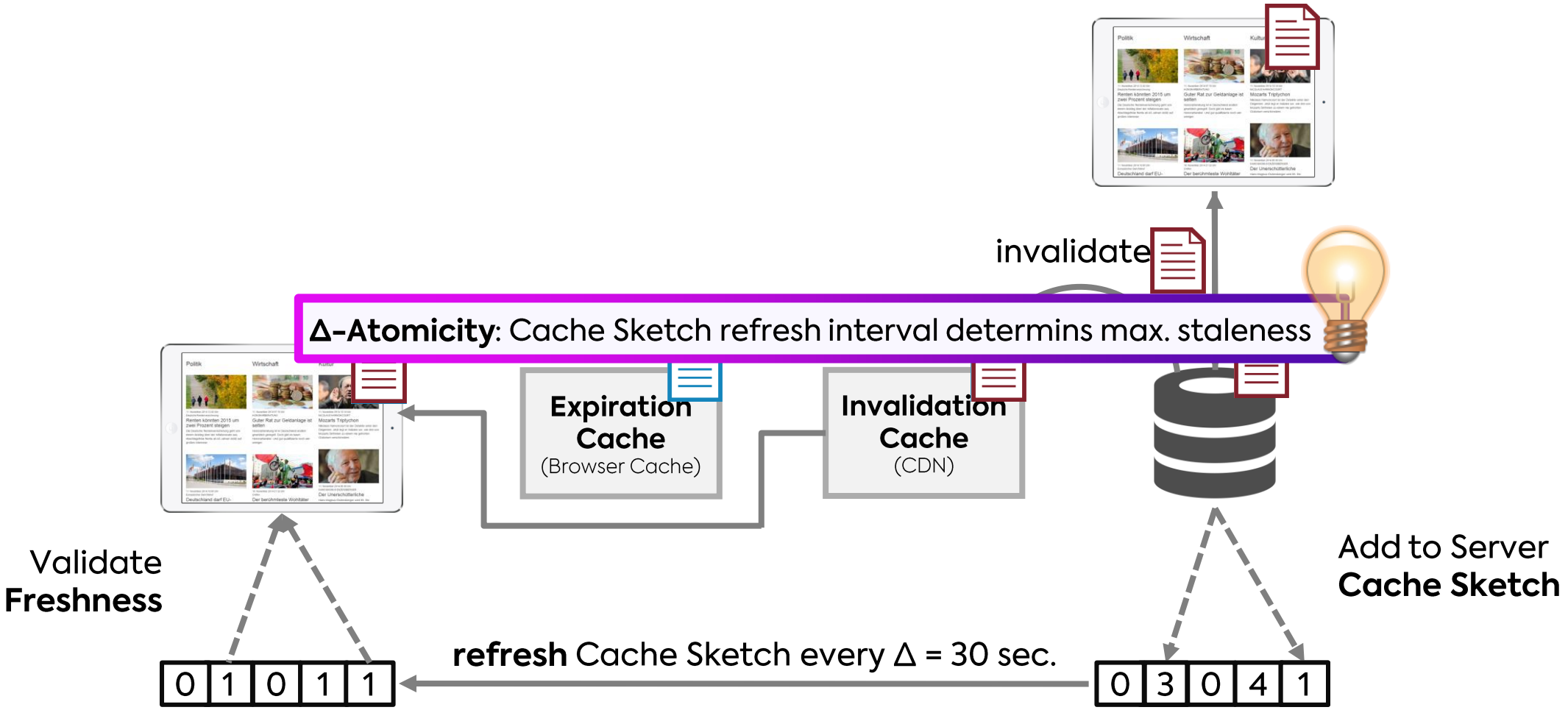
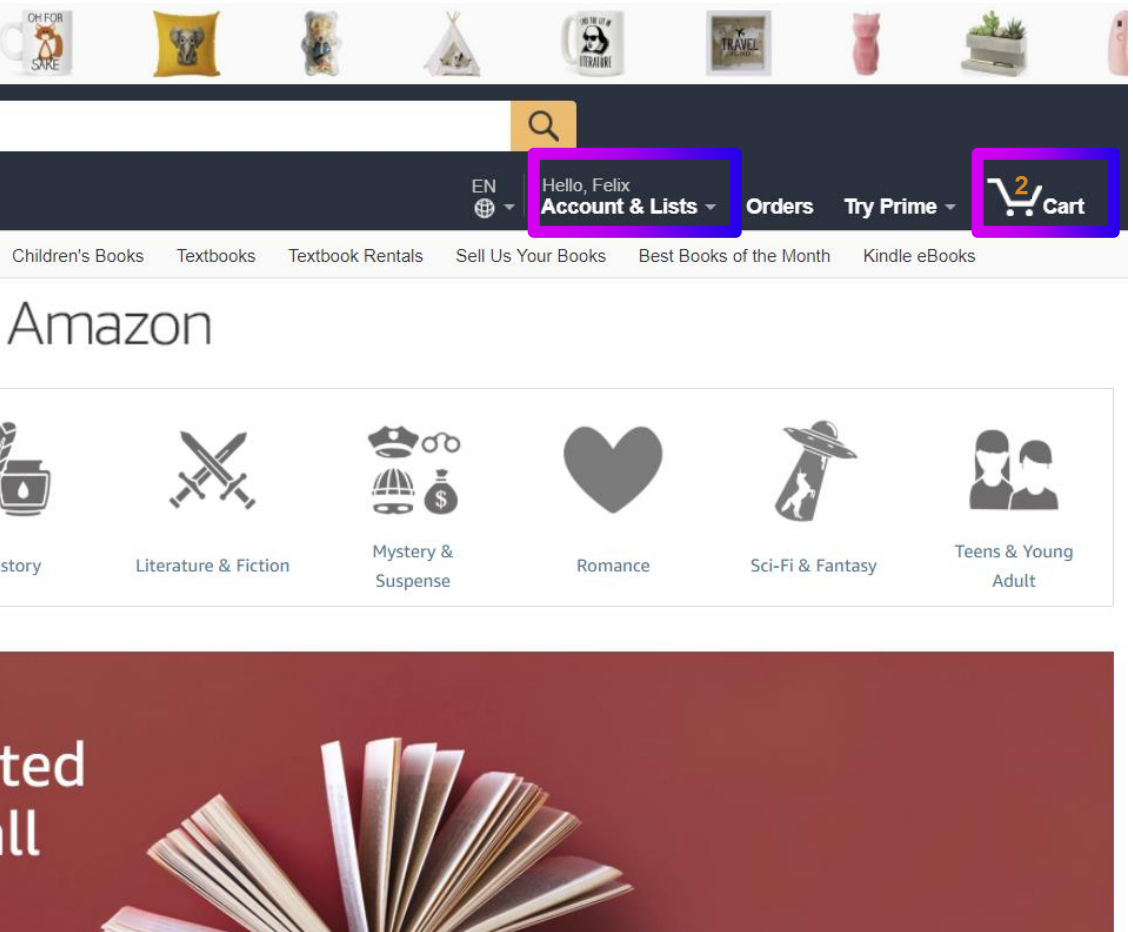


# HTML Caching With Dynamic Blocks

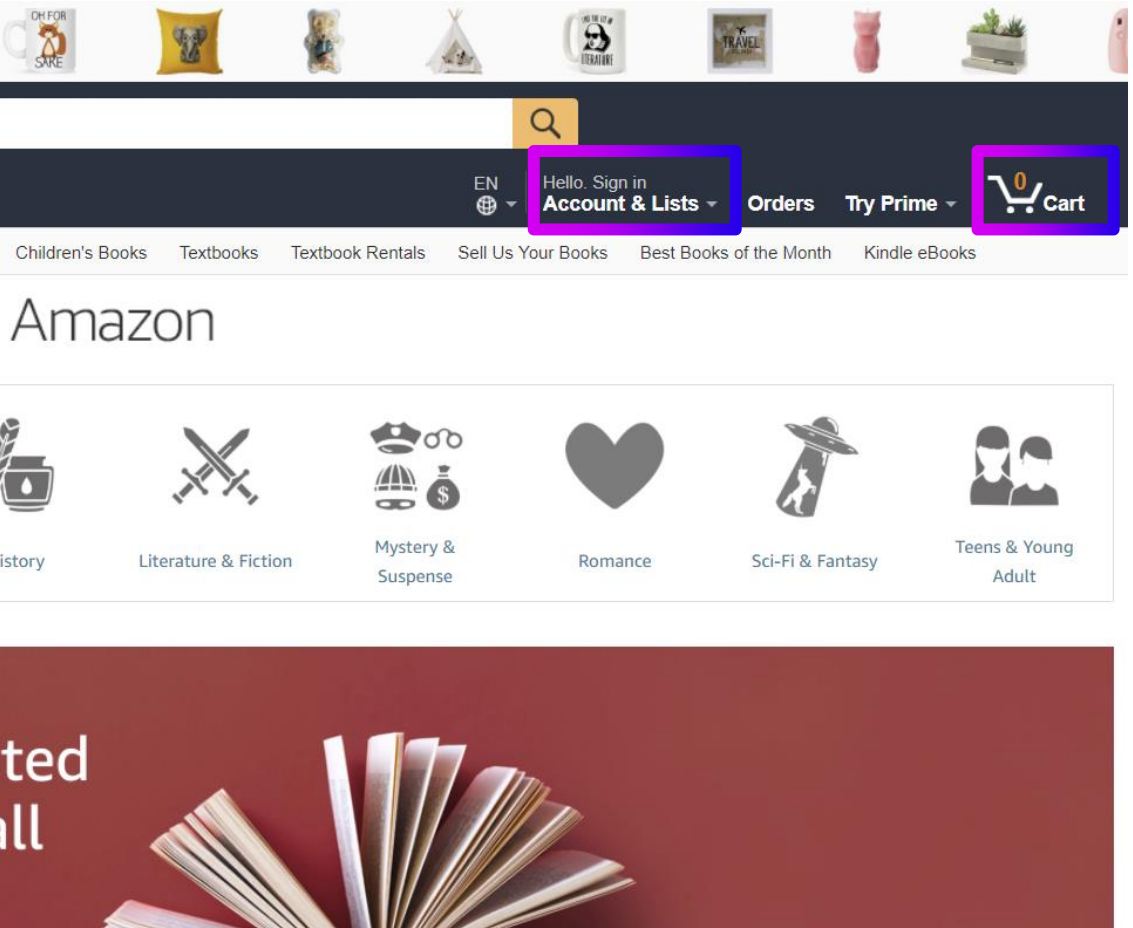



Speed Kit's **Dynamic Blocks** for recommendations, carts, wishlists, A/B tests, etc.:

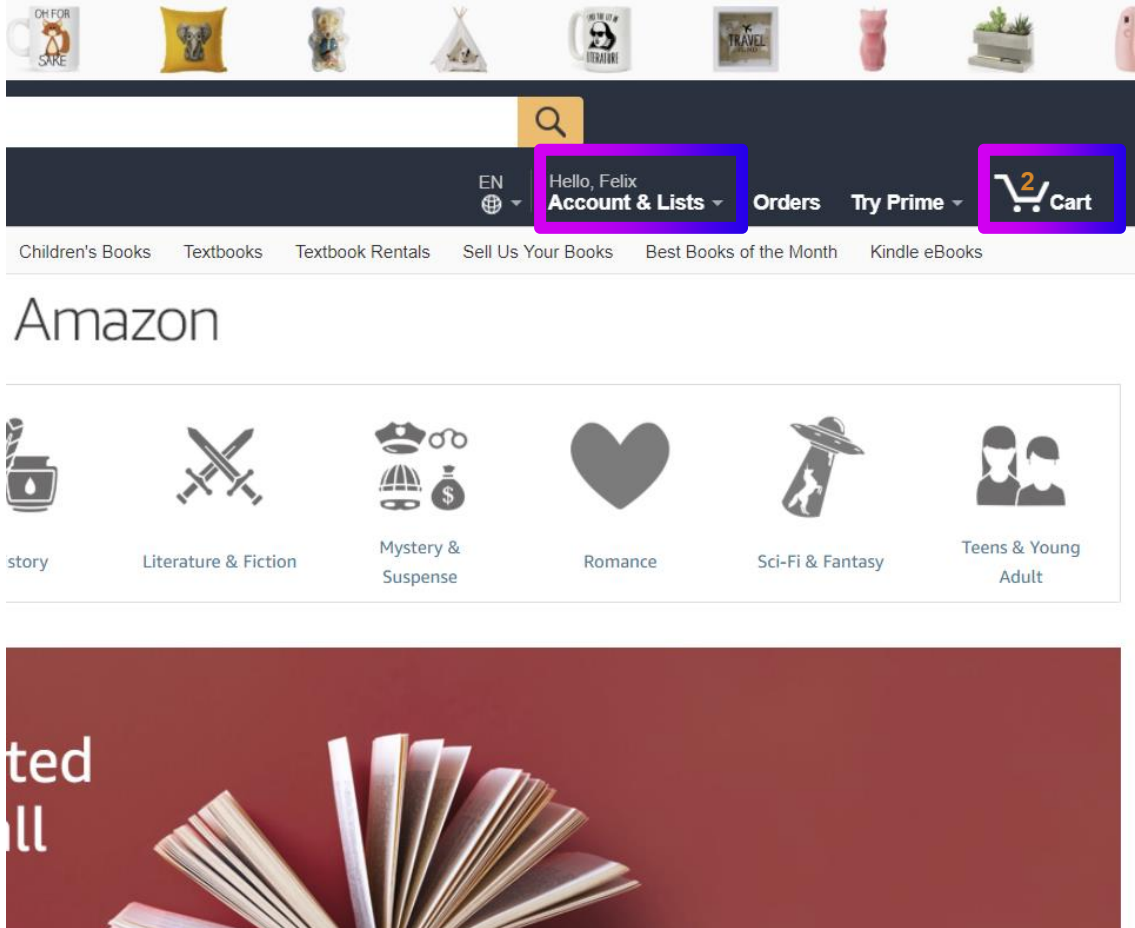
1. Blocks **defined** by selector.
2. Speed Kit loads a fast anonymous & the personalized view in **parallel**.
3. Dynamic blocks are **replaced**.

# HTML Caching With Dynamic Blocks

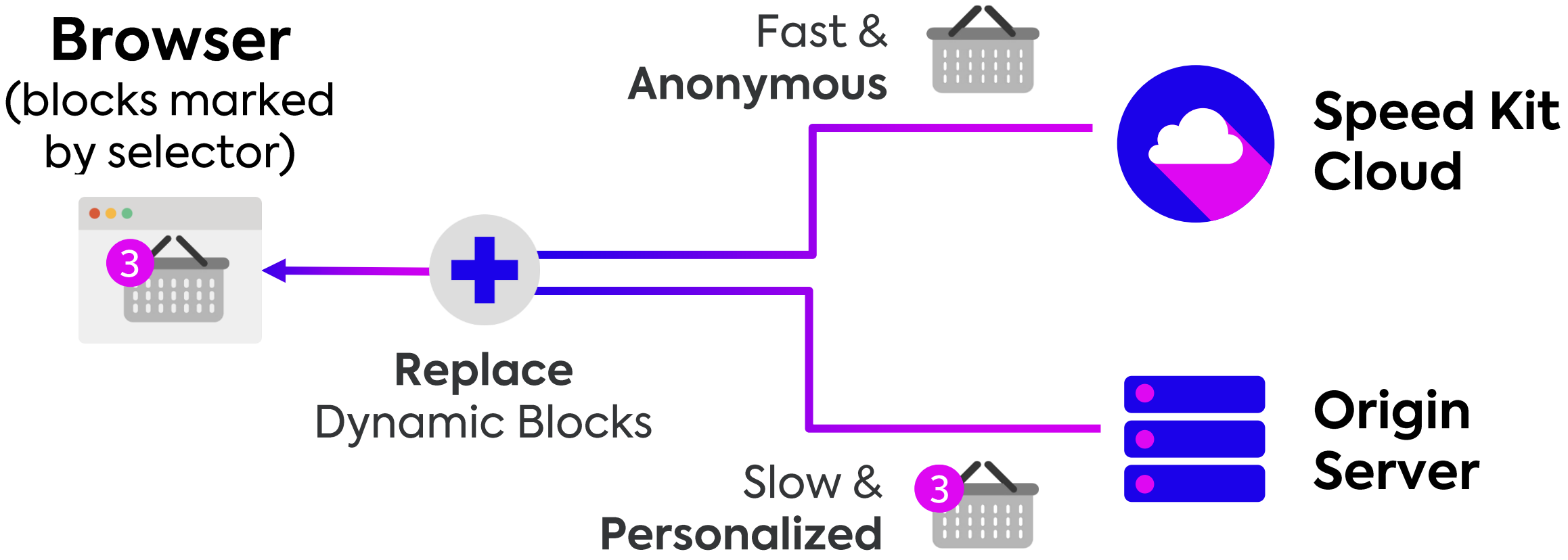
## Anonymous




## Personalized



# USP: Accelerating Personalization



# GDPR Compliance By Default

No external processing of sensitive user information.

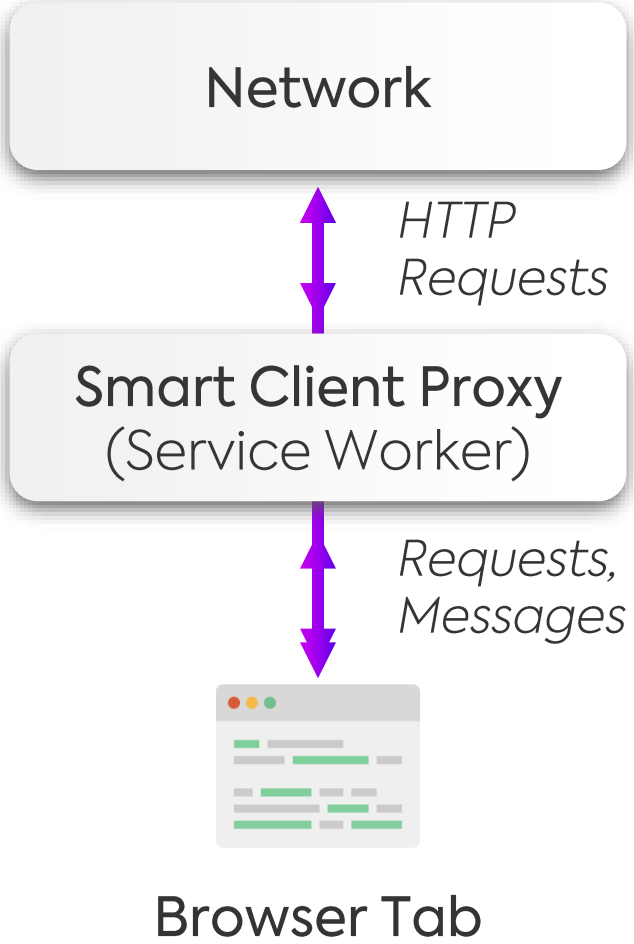
**Privacy by default**

No cookies leaked &
only public data cached

**Full Control**

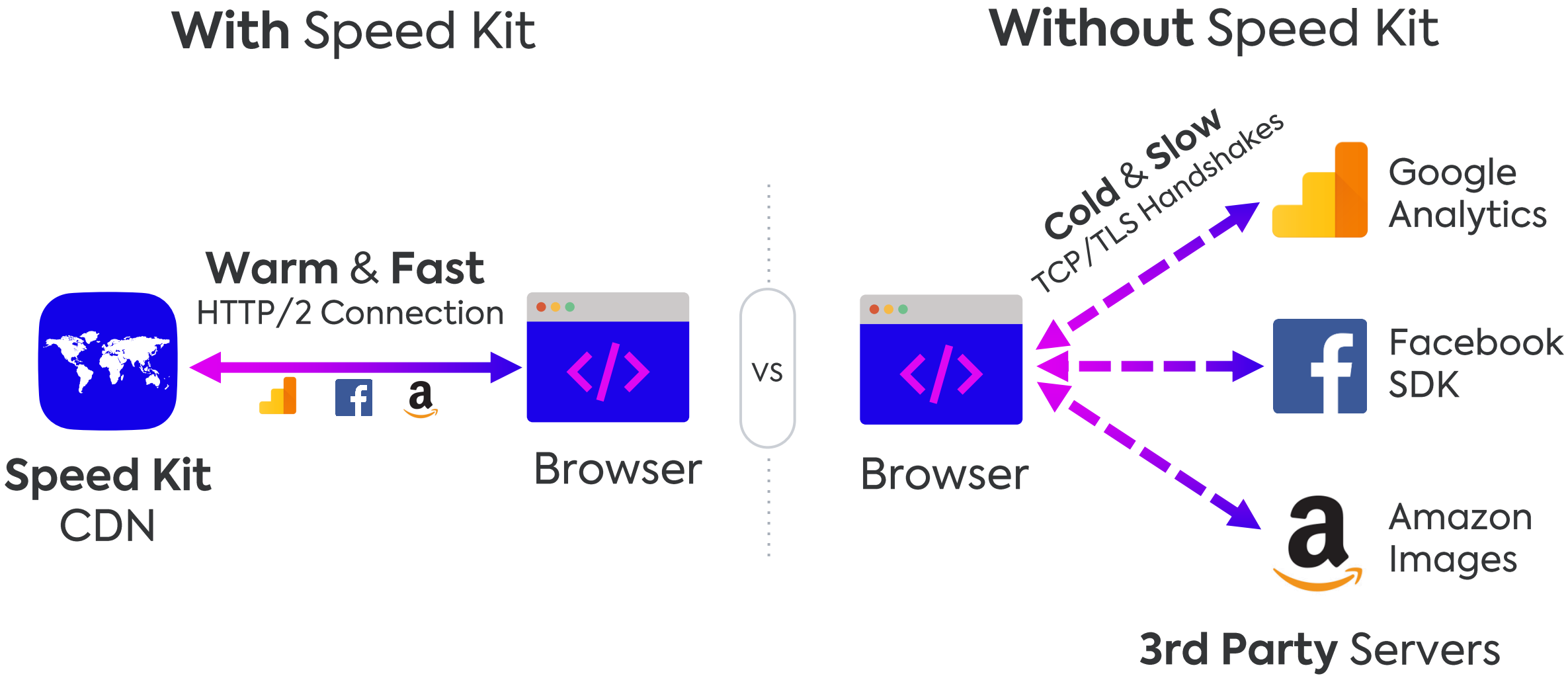
Decision what to handle
made in client (whitelist)

# Key Technology: Service Workers

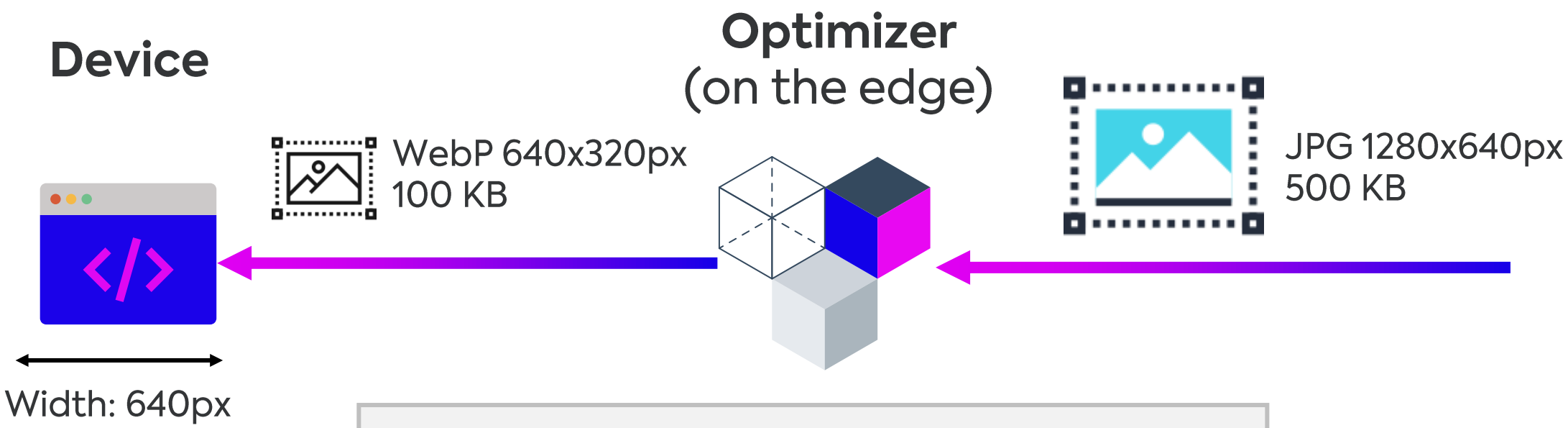



- Programmable **Network Proxy**, running as a **Background** Process, without **DOM** Access.
- Capabilities:
  - Intercept & rewrite **HTTP requests**
  - **Cache** data (`CacheStorage`)
  - **Store** data (`IndexDB`)
  - Respond **offline** or in slow network
  - Sync data & handle push

# Accelerate 3rd Parties



# Automatic Image Optimization



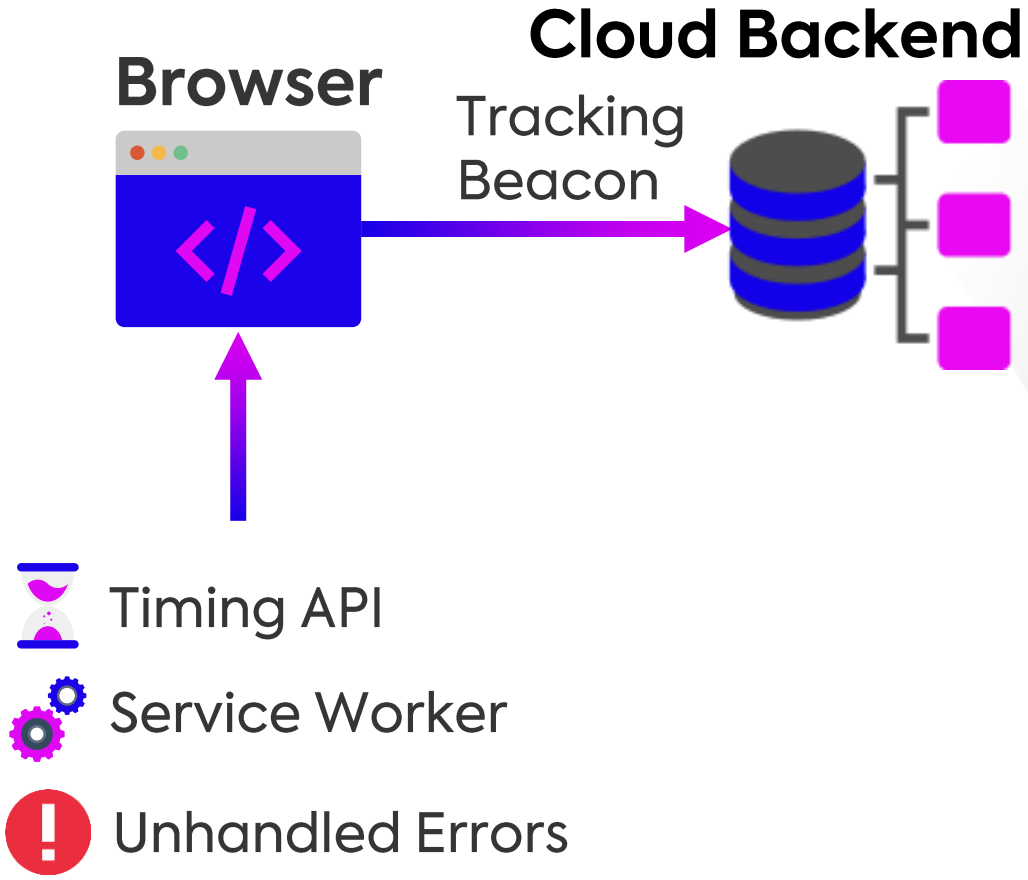

- Images transcoded to **WebP**
- Rescaled to match **Screen Size**
- JPG and PNG **Recompression**

# Reliable Opt-in

**>90%** browser support.

In older browsers (and upon errors):
**fallback** to original site.

# Integrated Real-User Monitoring




**Performance**
- Time-to-First-Byte
- First (Contentful) Paint
- DOM Timer
- First Input Delay

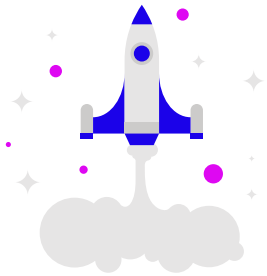
**User Engagement**
- Session Length
- Time on Site
- First User Interaction
- Bounce Rate

**Business KPIs**
- Cart Size
- Transactions
- Conversion Rate
- Revenue

**QA Metadata**
- Page Views & Sessions
- Browser Distribution
- JavaScript Errors
- Caching Insights

# Split Testing For Web Performance

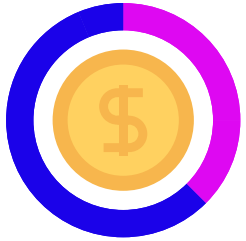
## Speed Kit Users



Tracking

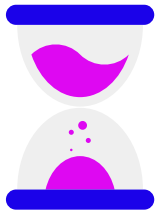
- Speed Kit enabled

## vs.



- **Measurable uplift**:
  - + Performance
  - + User engagement
  - + Business success

## Normal Users

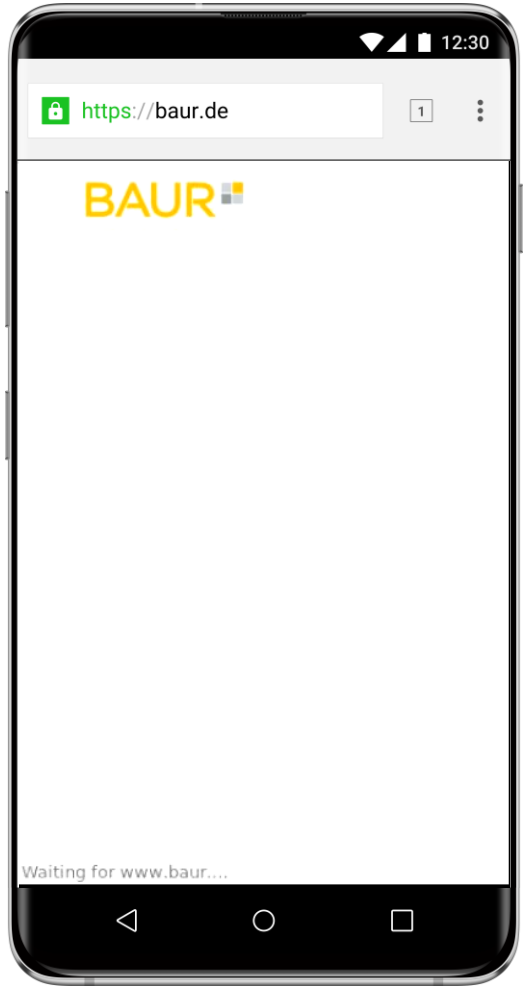


Tracking

- Speed Kit disabled (no acceleration)

# Baur.de

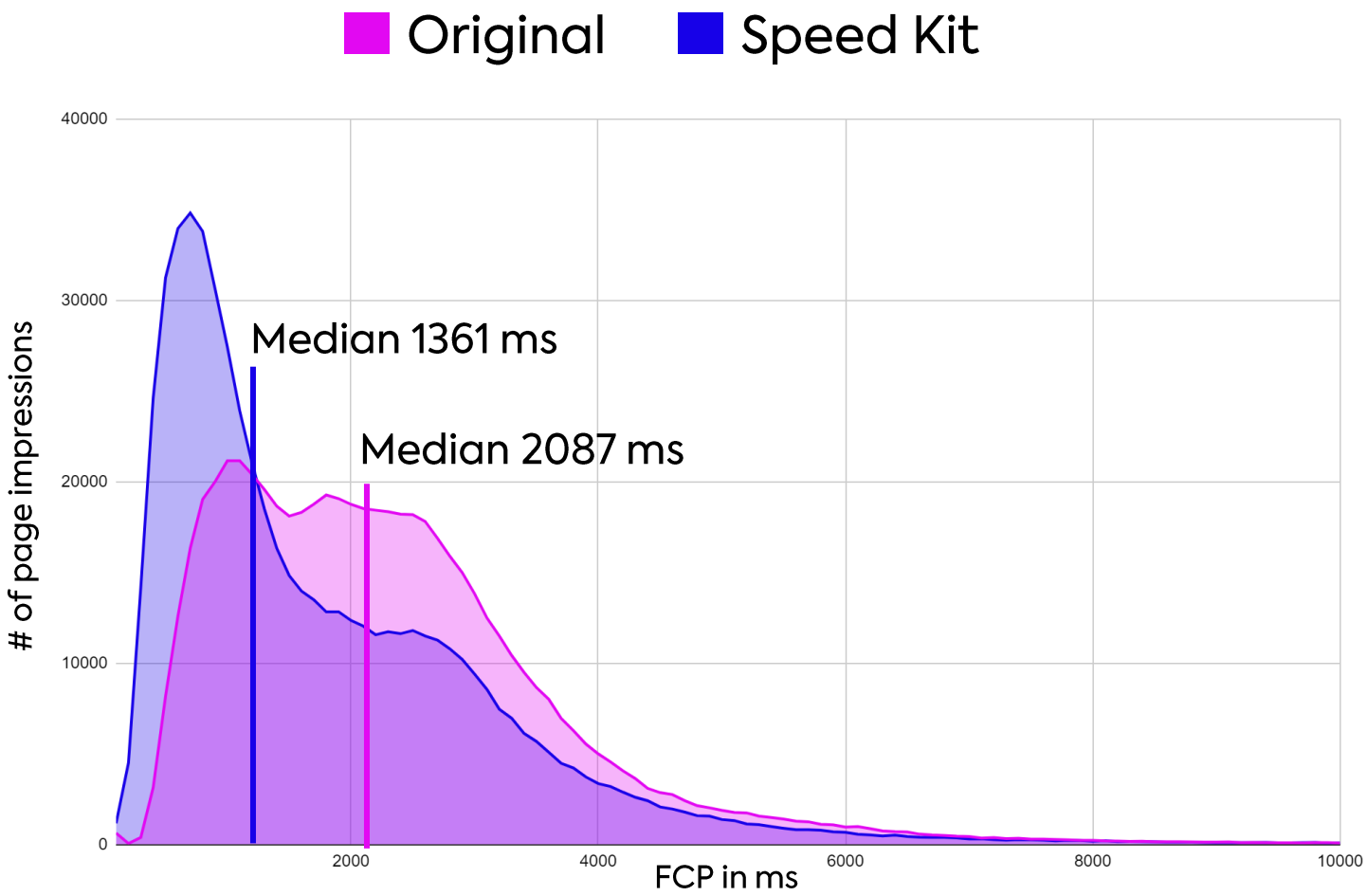
**Before**
Speed Kit




**1.5x faster**

**After**
Speed Kit

# Overall Performance Uplift For Baur.de

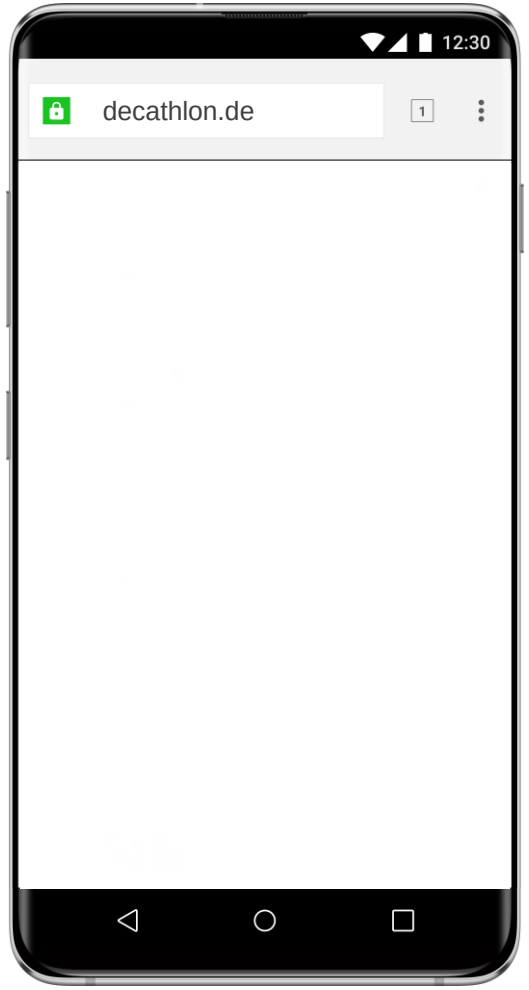



**First Contentful Paint Histogram**

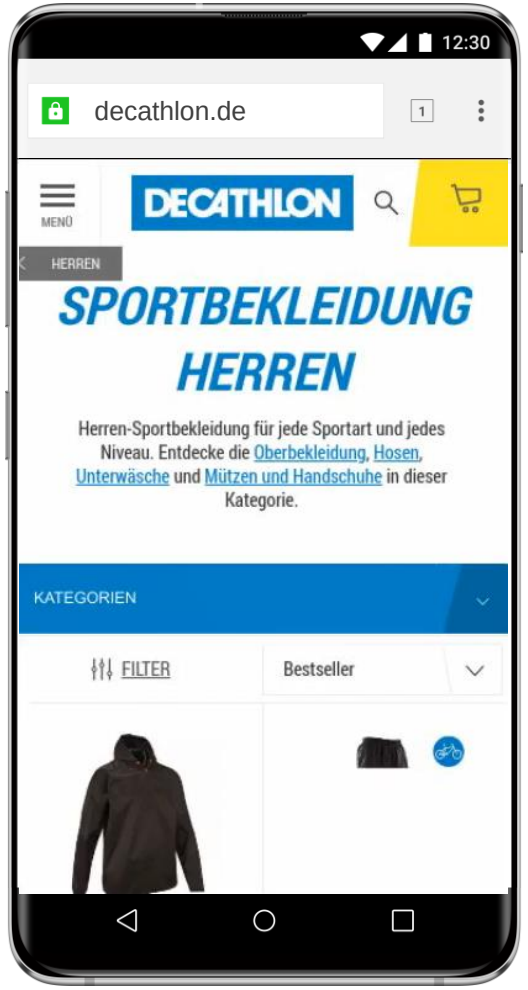
*Histogram of first contentful paint on PDV pages compared between the two A/B test split groups

# Decathlon.de

**Before**
Speed Kit




**2.5x faster**



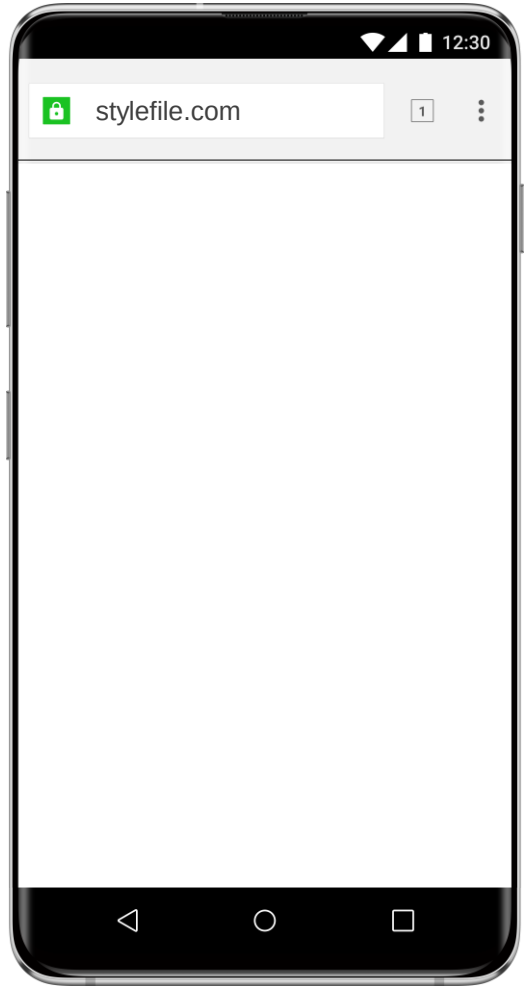

**After**
Speed Kit

# Decathlon: Uplift According to Google

*time until First Contentful Paint according to Google's Chrome User Experience Report (CrUX)

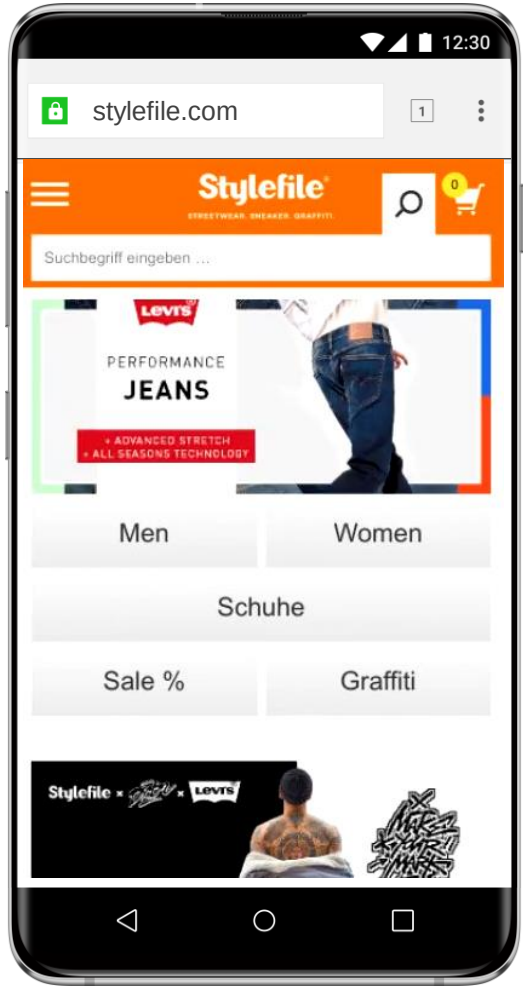
# Stylefile.com

**Without**
Speed Kit




**2.1x faster**

**With**
Speed Kit



# Stylefile: Business Uplift

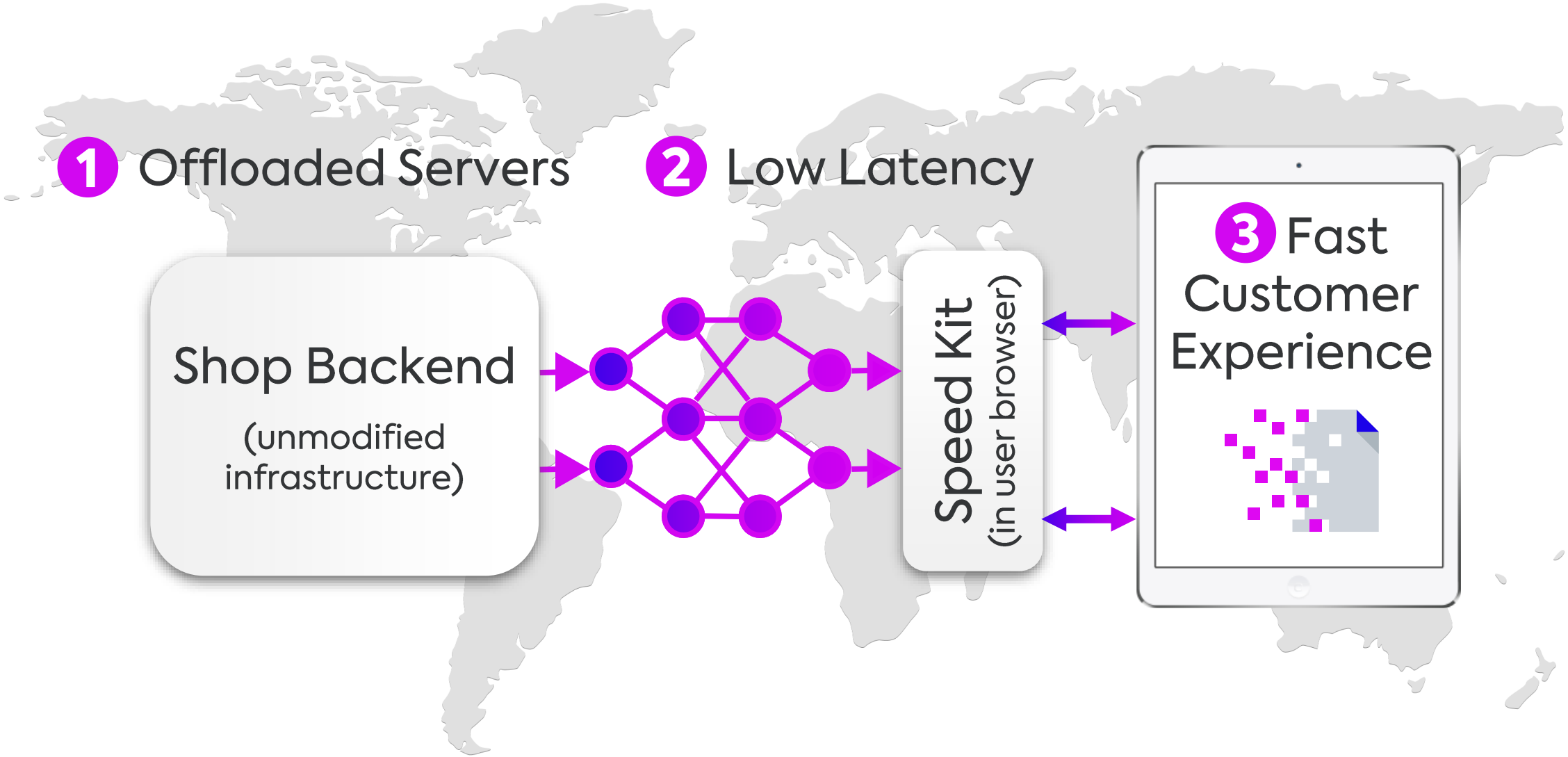
User-Based Conversion Rate

**+ 1.9%**

Average Order Value

**+ 3.8%**

# Speed Kit Optimizes End-To-End



# Thanks! Questions?

Details & newsletter on

speedstudy.info

Wolfram Wingerath wolle@baqend.com