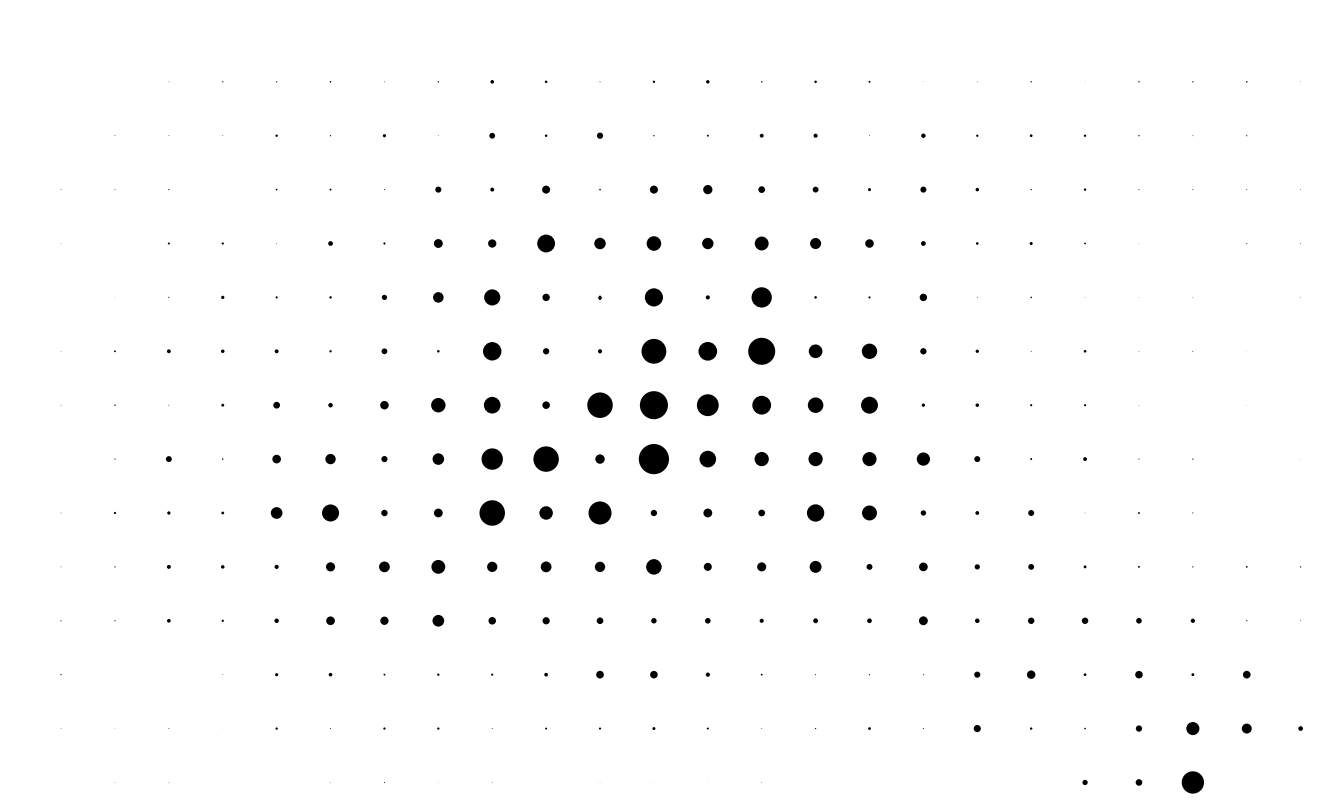


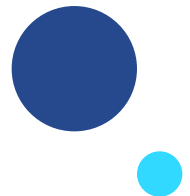
# 5 Steps to Improve Website Performance





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# Foreword

Considering the progress we've witnessed on the web in the last ten years, it's surprising that we still struggle with slow websites today. In 2013, the world's median mobile network connection was sub-3G. At such speeds, it was hard to deliver even reasonably-sized files quickly. Browsers could download only a handful of those files at once and had patchy support for crucial web features, making it hard to reduce the weight of the code we delivered. Further, the average mobile device had a fraction of the computing power of what we see today.

Fast forward to today, network speeds are important but no longer our primary constraint. With widespread 3G, 4G, and expanding 5G coverage, network speed is less of an issue. Browsers are better too: they can download countless files at once, smartly select the resources appropriate for display, and render highly complex user interfaces out of consistent and minimal code. And while mobile device processing power still varies, baseline performance across devices has greatly improved.

With all this progress, our websites really should be faster. But it hasn't turned out that way. As our technology improves, we develop increasingly complicated, shockingly heavier websites. And while fast networks may still deliver those sites' files pretty quickly, some kinds of files—JavaScript, especially—can introduce lengthy delays after they're delivered, particularly on the average mobile device. Worst of all, many sites rely on those already-heavy JavaScript files to subsequently fetch or generate their content, adding fragility and further delays to an already clunky stack.

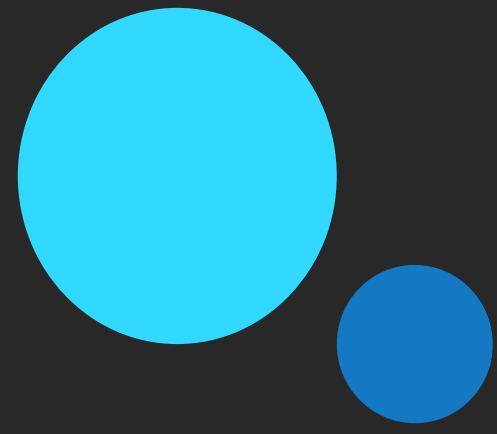
Today, many performance problems are caused by the very patterns we've adopted. We've merely moved the performance burden from the network to the device.

But I'm here with good news: it doesn't have to be this way. If our patterns are the problem, the solutions lie within our control. This guide provides a comprehensive view of modern performance concerns, explaining why performance matters, identifying and addressing performance bottlenecks, implementing continuous monitoring, and establishing a work culture that prioritizes performance.

There has never been a better time to deliver fast, resilient websites, but getting there demands an informed approach. So grab a hot beverage and let this guide illuminate the path forward. Rest assured; you're in capable hands.

**Scott Jehl**

[Author & Web Performance Advocate](#)



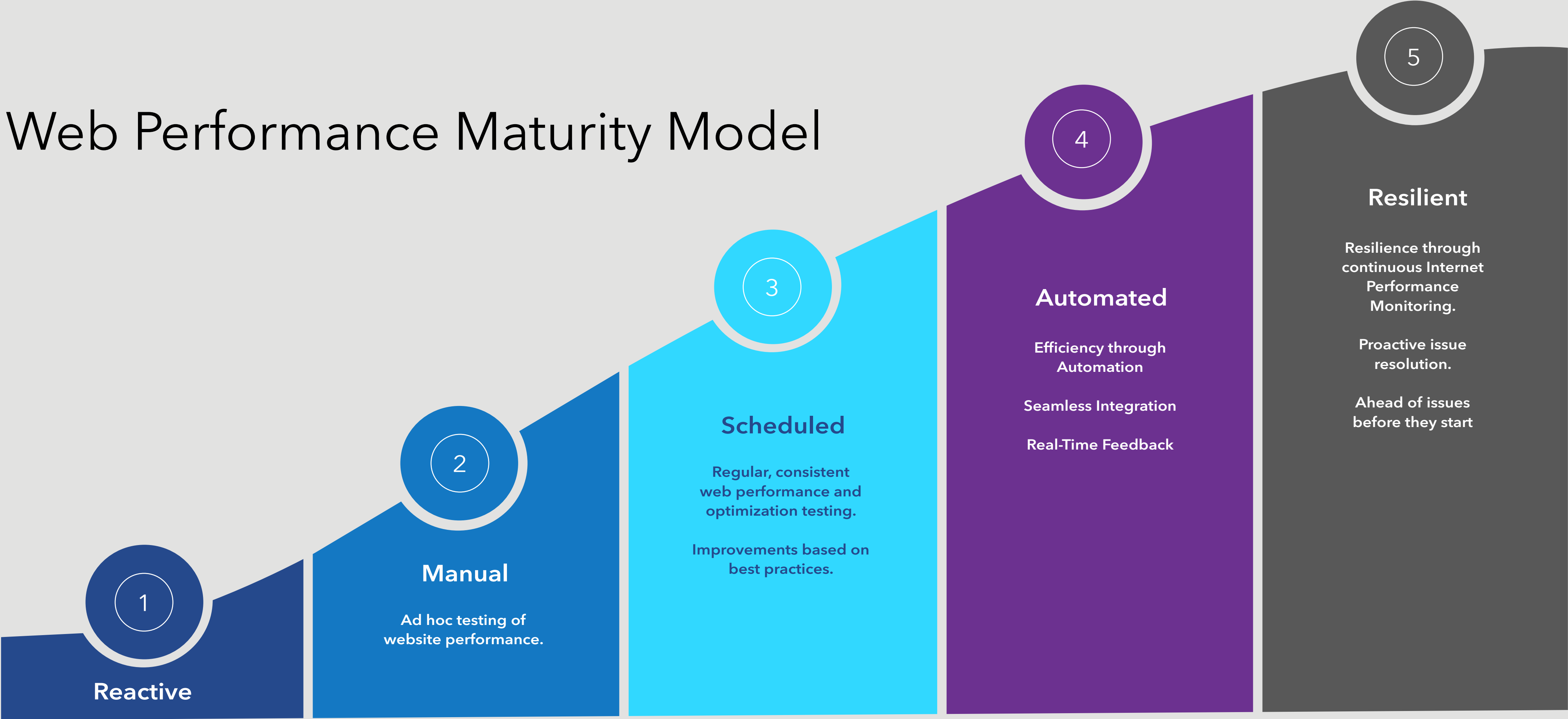
# How this guide will help you achieve a faster, more resilient website

A [Google internal study](#) revealed that even large brands struggle to maintain web performance, with 40% experiencing regression within six months. This underscores the challenge facing smaller or mid-sized companies with limited budgets and resources. While most organizations at least monitor their website's uptime, many still rely on manual processes and an ad hoc approach to web performance management.

Analyzing the best practices of successful digital companies, a clear five-level maturity model for website performance management becomes evident, ranging from reactive to preventative.



# Web Performance Maturity Model



Moving the needle from manual methods of web performance management to adopting a more preventative posture is no small task. It requires internal buy-in, tool and process reviews, and an emphasis on making work better for all your users – your employees as well as your customers.

In this guide, we'll share the essential steps for organizations to achieve web maturity, best practices to achieve this, and Catchpoint capabilities you can leverage to optimize your website's performance and achieve resilience.

# Step 1: Understand why performance and resilience matter

**A fast, resilient website is no longer a luxury; it's a necessity.**

## On the modern web, every second counts

Attention spans are shorter than ever, users expect web pages to load quickly and seamlessly.

Key stats ([wpostats.com](https://wpostats.com)):

- Publishers whose mobile sites load in 5 seconds earn up to 2x more mobile ad revenue than sites loading in 19 seconds.
- 53% of visits to mobile sites are abandoned after 3 seconds.
- BBC has seen that they lose an additional 10% of users for every additional second it takes for their site to load.

Slow-loading websites not only frustrate users but also negatively impact your search engine rankings, as speed is one of the factors considered by search algorithms. In essence, by enhancing your web page's loading speed, you can anticipate improvements in user experience (UX), conversion rates, and ultimately, your sales revenue.

## Resilience is essential

With tolerance for Internet disruptions at an all-time low, downtime or poor performance can damage your company's reputation, result in lost revenue, and potentially lose you customers.

A 2023 commissioned study on the [cost of Internet disruptions on eCommerce companies](#) conducted by Forrester Consulting on behalf of Catchpoint found:

- Internet disruptions cost eCommerce companies millions: In the month before the study, 37% of respondents estimated their companies lost \$100,000-\$499,000, and 39% lost \$500,000-\$999,999 due to disruptions.
- Sixty-six percent of respondents said Internet disruptions led to increased customer churn, with 64% reporting a loss of consumer confidence in their brand
- 65% of respondents stated that even small disruptions in the flow of commerce can cause customers to halt their purchase cycle.

By making your website more resilient (more on this later), you'll protect your bottom line, ensuring that it remains available, and performant even during times of peak demand or unexpected challenges.

Now that we've established the significance of speed and resilience, let's move on to Step 2: Identify problems – Tools for analyzing website performance. By pinpointing these problem areas, you can take targeted action to optimize your site for speed and resilience.

# Step 2: Identify problems – Tools for analyzing website performance

You can't improve what you don't measure.

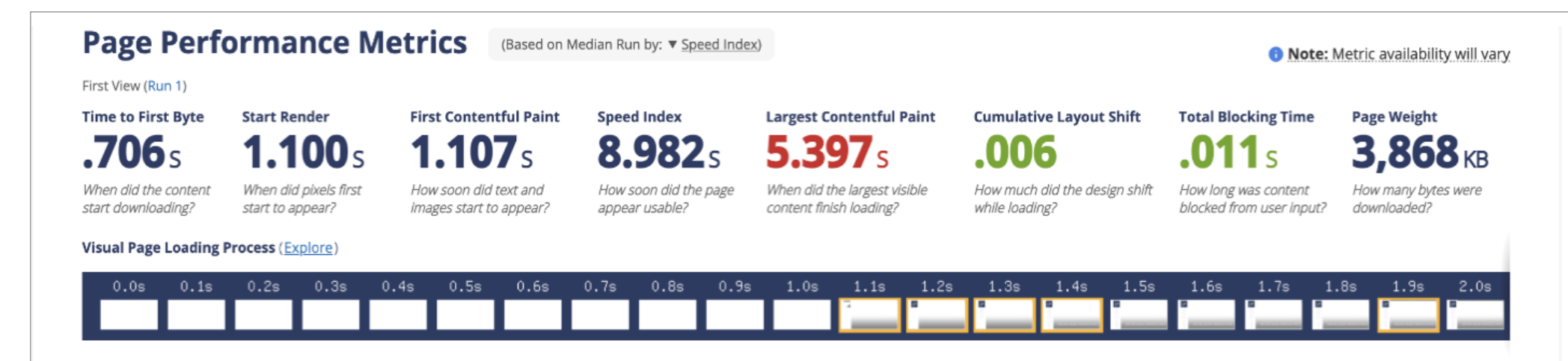
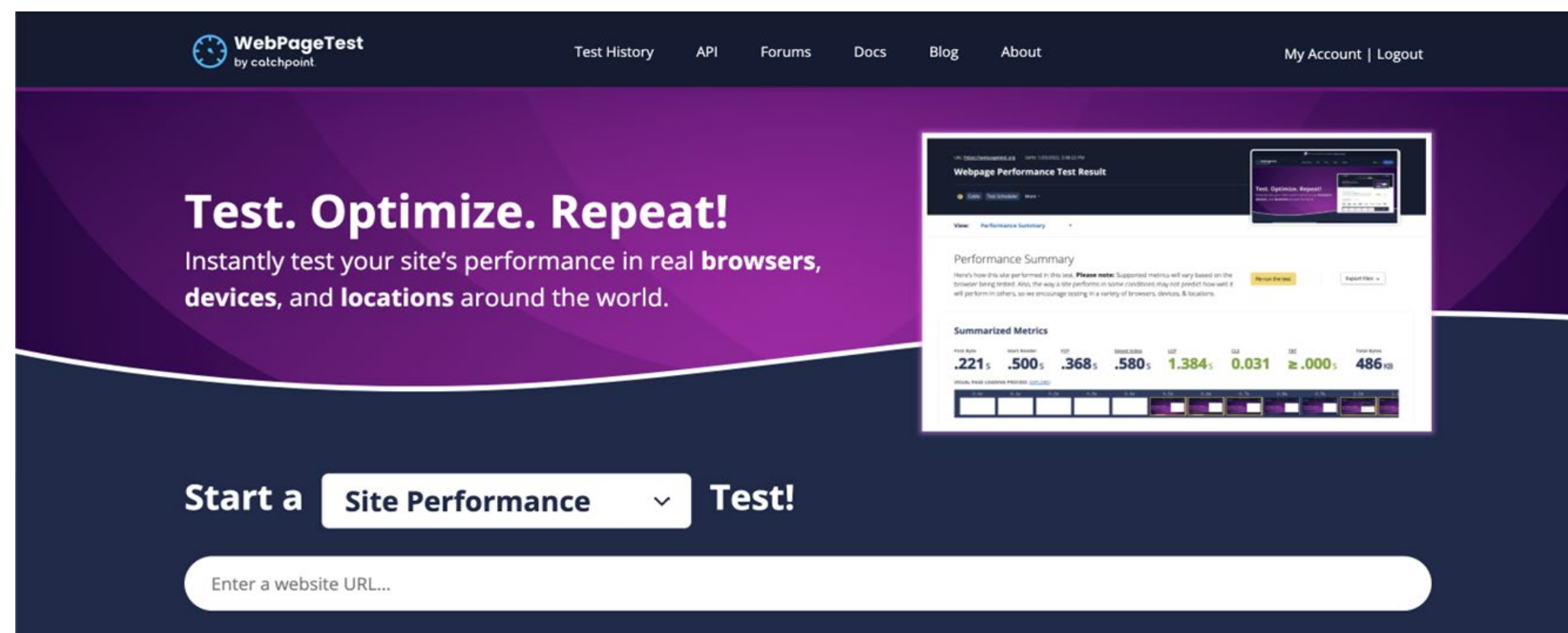
## Leverage the right tools for your website analytics

A decent website performance and analytics tool will provide diagnostic information about how your website performs under a variety of conditions. The most effective tools, however, go a step further by conducting tests from different global locations, on real browsers, over any number of customized network conditions.

Trusted by industry titans to validate their own telemetry, Catchpoint WebPageTest has earned its reputation as the gold standard for performance testing thanks to its incredibly accurate synthetic browser testing methods.

## Focus on the metrics that matter

When a user navigates to a webpage, they're typically looking for visual feedback to reassure them that everything is going to work as expected. Metrics such as Time to First Byte, First Paint, First Contentful Paint, Time to Interactive and Total Blocking time – they're the crucial user-centric performance metrics that you want to measure. They make up the core of your performance summary when you run a test on WebPageTest.



## Core Web Vitals

[Core Web Vitals](#) were introduced by Google in 2020. They are a set of metrics used to measure user experience on websites, including loading time, interactivity, and the stability of content as it loads. Google uses Core Web Vitals as part of their search ranking algorithm. Websites that perform well on these metrics can potentially see a boost in their search rankings.

### 1. Largest Contentful Paint

The [Largest Contentful Paint](#) (LCP) indicates the loading time of the most substantial chunk of data, whether it's an image or text, within the visible screen area. Unfortunately, LCP presents the greatest challenge for developers, with only about 57% achieving the desired load time of 2.5 seconds or less.

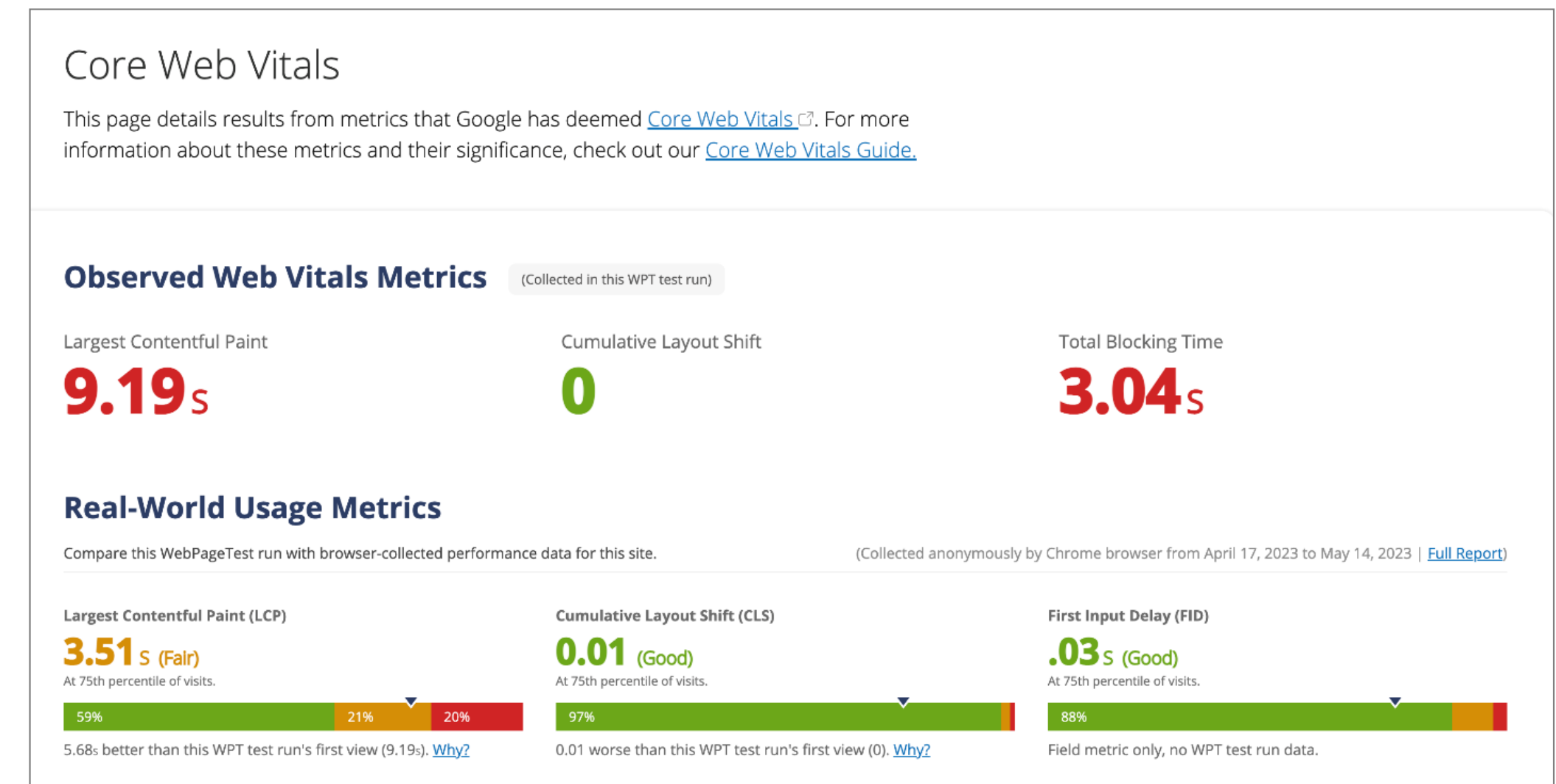
### 2. Cumulative Layout Shift

The [Cumulative Layout Shift](#) (CLS) evaluates the stability of a webpage. It's closely related to user experience as it quantifies unexpected movements of content on a page. This can often be due to various performance issues, such as slowly loading elements that abruptly pop up within the visible area of the page, causing other content to move.

### 3. First Input Delay

[First Input Delay](#) (FID) gauges the time between a user's interaction, like clicking a link, and the browser's response. However, recent research on performance and user experience has shown that 90% of a user's time on a site occurs post-initial load. As a result, Interaction to Next Paint (INP) was introduced as a more suitable metric for addressing interactivity bottlenecks and is expected to replace FID. Ultimately, subpar interactivity, characterized by an inability to engage with content, often results in a poor user experience.

Our Core Web Vitals dashboard allows you to view these key metrics at a glance so you can easily identify areas for improvement and optimize your website's performance accordingly.



For a quick look at your website's performance, run a [WebPageTest for free](#).

While being able to identify performance issues is crucial, resolving them and maintaining fast website speeds is a different challenge altogether. In the next section, we'll explore best practices for improving website performance, and ensuring that your web applications continue to deliver optimal speeds.



# Step 3: Boost performance – Essential best practices to follow

## Improving website speed

It's easy to make a site fast if speed is the only priority we have to care about, but that's never the case. Any site can be made faster by stripping away its costly features, but we can't just make a site faster at the expensive features that are necessary to the business or to user goals. It's that intersection where the hard problems are. Here are some industry best practices for improving website speed.

## Start with your Core Web Vitals

Enhancing your LCP, FID, and CLS could yield benefits both for your users' experience and your mobile search result rankings. A single position rise on the first page of search results could lead to a significant uptick in traffic. Here are some strategies to improve your website's Core Web Vitals.

## Largest Contentful Paint

72% of the time, LCP is comprised of image content. Therefore, adhering to image loading best practices is crucial in improving this metric.

- Optimize the image content for the quickest delivery: having the smallest image possible that can also be discovered as quickly as possible. Using the preload and/or fetch priority attributes would be recommended.
- **Use a Content Delivery Network (CDN):** A CDN can ensure faster delivery of web page resources.
- **Leverage Browser Caching:** Utilizing browser caching can speed up the delivery of web page resources, improving LCP.

“ Catchpoint is a great tool that meets our business requirements to measure the performance of our pages globally and take the necessary proactive actions to improve latency. ”

Paypal

### Cumulative Layout Shift

Often, the issue lies with unsuitably sized content that intrudes into the viewport, displacing other elements. Pre-sizing these elements can reserve necessary space, thereby minimizing viewport shifts.

- **Use Set Dimensions:** Always specify dimensions for any media (images, videos, GIFs, infographics etc.) This helps the browser allocate the correct amount of space while the page is loading.
- **Reserve Space for Ads:** If you're using ads on your site, try to statically reserve space for them. This prevents them from suddenly pushing content when they load.
- **Avoid Inserting Content Above Existing Content:** Unless responding to a user interaction, avoid adding new content above existing content on the page, as it can cause elements on the page to shift.
- **Use CSS Aspect Ratio Boxes:** This can force the browser to include the space needed for the image before it fully loads.
- **Stable Elements:** Ensure buttons and other elements have a set position and size to prevent them from moving and causing layout shifts.

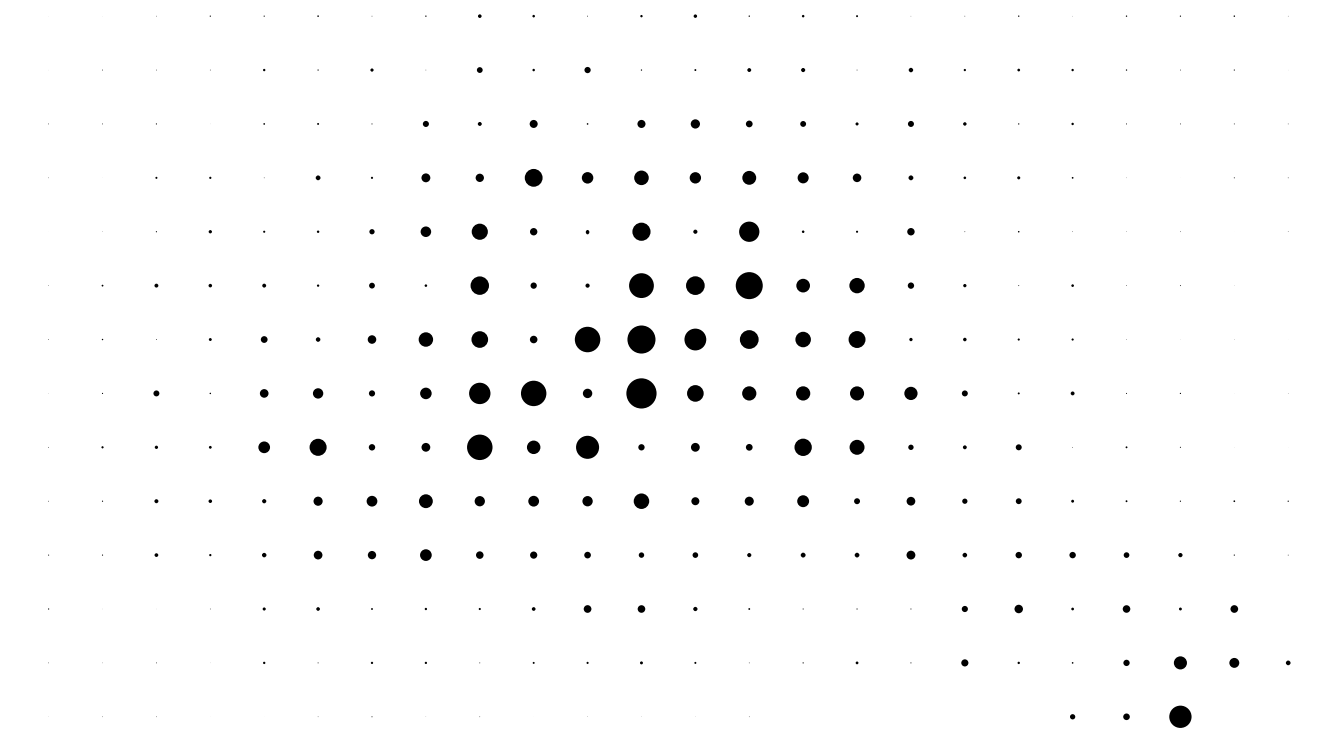
### First Input Delay

It's important to note that Interaction to Next Paint (INP) is a newer metric that is set to replace FID, but the following tips generally apply to improving both:

- **Minimize JavaScript:** Limiting the amount of JavaScript on your page can reduce the time it takes for the browser to become interactive. Splitting long tasks into smaller ones can also be helpful.
- **Reduce Third-Party Scripts:** Third-party scripts can block the main thread and increase FID, so it's beneficial to limit their use as much as possible.
- **Implement Web Workers:** Web Workers run JavaScript in the background and can help keep your main thread free for user inputs, reducing FID.

### A note on Page Weight

Strive to reduce page weight as much as possible without compromising the functionality or aesthetics of your page. This can involve techniques like compressing images, minifying CSS and JavaScript files, and removing unnecessary code or resources.



# Step 4: Automate performance testing

## Streamline and accelerate performance testing with automation.

With the ever-increasing amount of data to analyze, the need for automation becomes crucial. This is where the Catchpoint WebPageTest API comes into play, offering pro users a wide range of valuable capabilities and benefits. By harnessing the power of automation, you can take advantage of improvement opportunities and no-code experiments to streamline your performance monitoring processes.

### Catchpoint WebPageTest API lets you:

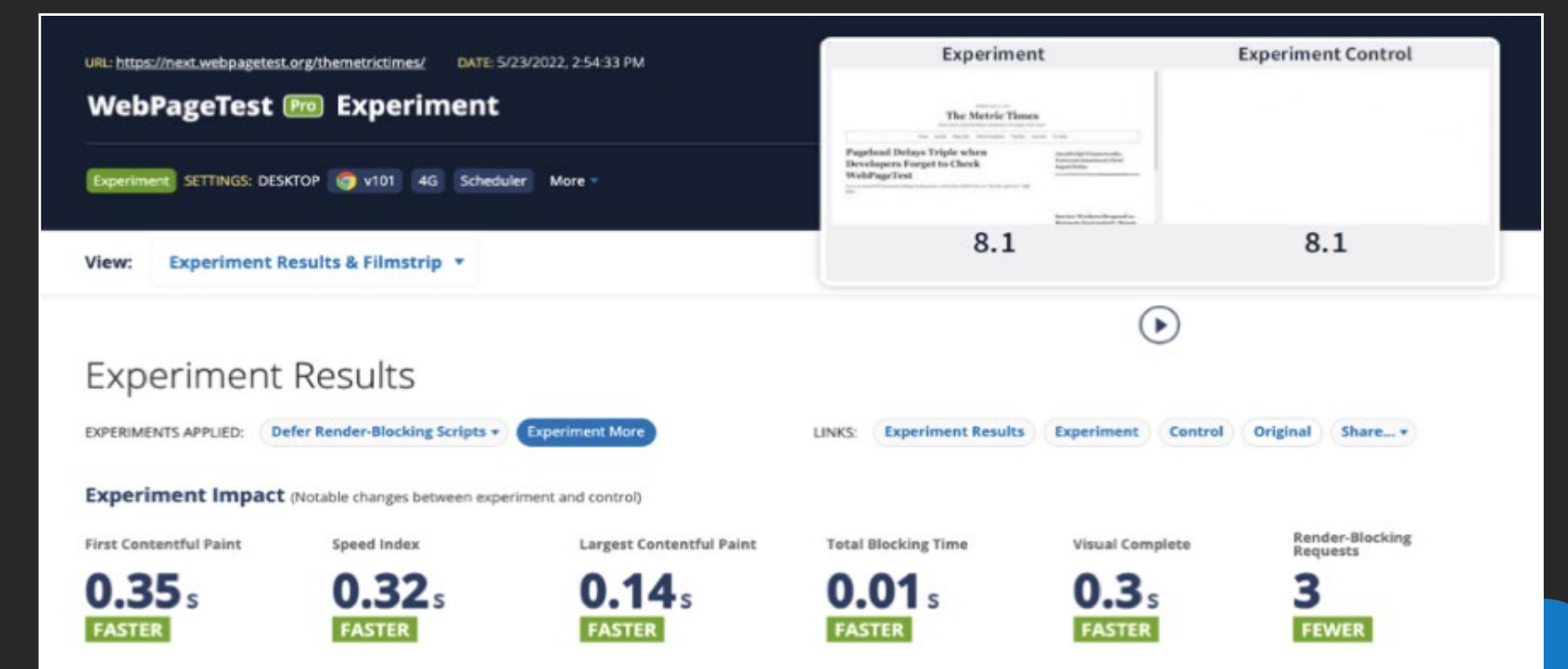
- Use NPM wrapper for NodeJS to integrate with your existing CI/CD tooling easily.
- Run tests within VSCode to quickly test the impact of changes right from your code editor.
- Check code changes with GitHub Actions and set performance budgets.
- Debug, triage, and collaborate with your teams within Slack.
- Build visualization dashboards with Google Sheets, Grafana, and more.

### Opportunities and Experiments

Even the best web performance teams often spend days or weeks identifying and implementing a potential improvement based on standard scores and metrics, just to be underwhelmed by the changes or find that it breaks other parts of their users' experience.

This is where our opportunities and experiments feature comes in:

- **Opportunities:** WebPageTest Opportunities allows users access to unique and actionable insights generated by test results. IT teams receive suggested best practices, such as deferred or async JavaScript, right-sized images, and security fundamentals.
- **Experiments:** WebPageTest Experiments gives users access to custom and automatically generated optimization tests that show how their websites could benefit from specific, actionable improvements with zero changes to the codebase. By making on-the-fly changes to the site's HTML, JS, and CSS without changing any deployed code and comparing it to a control test, developers can instantly gauge the potential for success of their performance tuning.



“Experiments are a game changer for quantifying the speed impact of performance optimizations. What took days of technical work is now just a few clicks. Not only will this save tons of time, it will let us test and iterate ideas to find the right mix of recommendations efficiently. I’m blown away this exists, it feels like magic.”

Todd Parker, Partner, Filament Group

# Step 5: Ensure resilience through Internet Performance Monitoring (IPM)

## Catch issues before they impact your website

You can have the best website in the world, but if no one can reach it, there is no experience to speak of. Catchpoint's Internet Performance Monitoring (IPM) enables deep visibility across the Internet Stack – the tangled web of distributed network systems that connect your web applications to your users, including BGP, CDN and DNS services. Our cloud-native platform ensures Internet Resilience across your organization with five enterprise IPM solutions, including a best of breed Website Experience Solution.

### Website Experience, powered by IPM

Not only does Catchpoint's Website Experience Solution empower you to monitor your site's speed, usability, and resilience in real-time across various browsers, devices, and global locations, it also allows you to rapidly identify and fix performance issues before they impact your business.

#### Key benefits

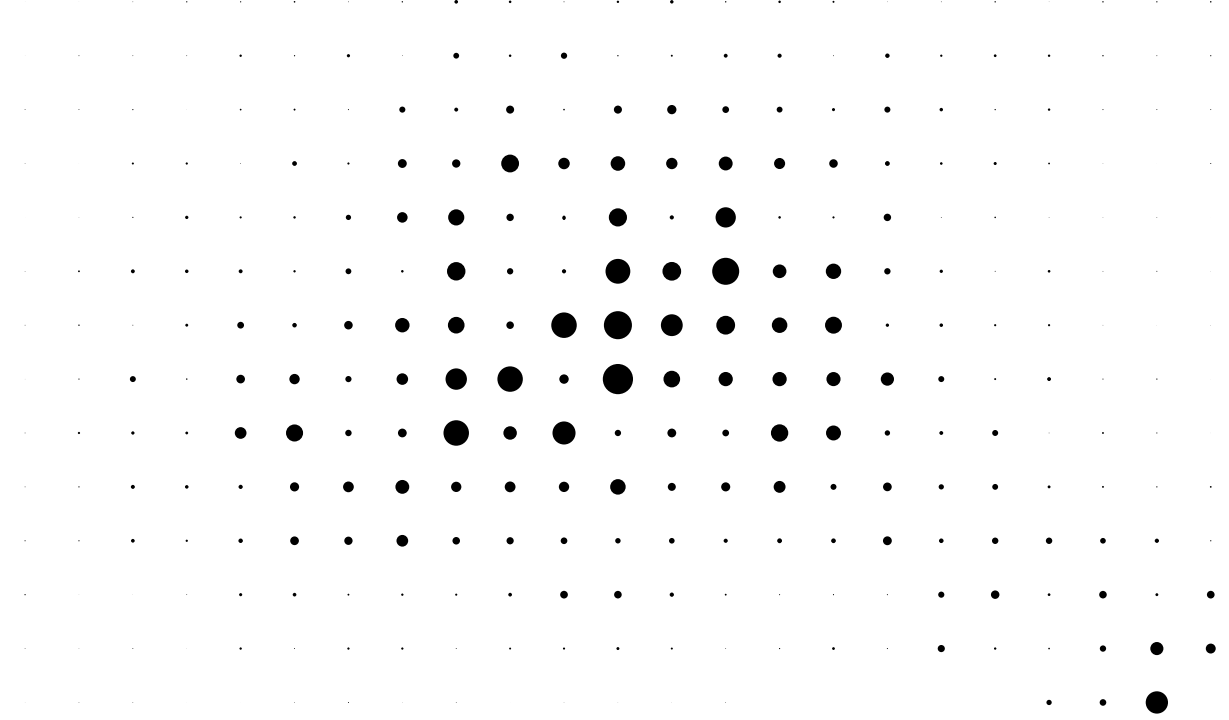
- Leverage WebPageTest's extremely accurate synthetic browser testing methods to monitor all your web pages' key metrics in a single dashboard.
- Find and fix performance complications before they impact revenue.
- Ensure reachability - not just availability.
- Alert individuals when performance thresholds are exceeded.
- Monitor DNS, BGP, CDNs, third-party assets, and other possible bottlenecks from real devices and browsers around the globe.
- Compare and contrast your web pages between releases.
- Compare your website's performance to your competitors and uncover opportunities for improvement with side-by-side benchmarking tests.
- Leverage RUM to paint a precise picture of your user base.

The significance of continuous, proactive monitoring cannot be emphasized enough in today's digital environment. Even slight differences in your website's speed, reliability, and accessibility can have a significant impact on your ability to surpass competitors in search rankings, maintain user engagement, and successfully convert visitors into customers.



“ Catchpoint, originally purchased as our main alerting platform, has become our trusted go-to-strategic partner for continuous web performance monitoring, analysis and optimization. Not only can we more quickly identify and resolve problems, but Catchpoint's analytics have helped us uncover many new opportunities for system and business improvement. ”

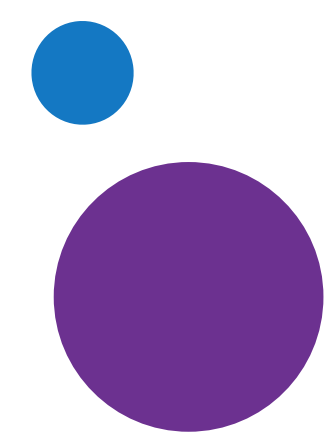
Priceline



# Building your web performance strategy with Catchpoint

Catchpoint helps you deliver fast, snappy websites, convert more users, perform better on Google, and stay ahead of the competition, no matter where you are in your operational maturity.

- Our [Website Experience solution](#) is the first comprehensive web performance tool for the modern enterprise allowing you to monitor your site's speed, usability, and resilience in real-time across various browsers, devices, and global locations to rapidly identify and fix performance issues before they impact your business.
- Our use of WebPageTest, the gold standard in web performance testing, provides the most accurate and comprehensive performance tracking tools available. With it, you'll elevate your SEO and web performance optimization, and measure user journey performance across devices, browsers, and networks.



“ If you really want to go to bed at night and not worry about your website, you'll consider Catchpoint. ”

Blue Nile

## Learn more:

- Get a well-rounded understanding of front-end web performance in our free course: [Lightning-Fast Web Performance](#)
- Learn how to prepare your eCommerce and enterprise sites for peak network traffic events: [5 Ways to Prepare Your Website for High Traffic](#)
- Discover the true cost of Internet disruptions: [Forrester Opportunity Snapshot: Increase Revenue with Internet Performance Monitoring](#)
- Find out how to detect and mitigate the impact of Internet outages: [Preventing Outages in 2023: What We Learned from Recent Failures](#)

# About Catchpoint

Catchpoint is the Internet Resilience Company™. The top online retailers, Global2000, CDNs, cloud service providers, and xSPs in the world rely on Catchpoint to increase their resilience by catching any issues in the Internet Stack before they impact their business. Catchpoint's Internet Performance Monitoring (IPM) suite offers synthetics, RUM, performance optimization, high fidelity data and flexible visualizations with advanced analytics. It leverages thousands of global vantage points (including inside wireless networks, BGP, backbone, last mile, endpoint, enterprise, ISPs and more) to provide unparalleled observability into anything that impacts your customers, workforce, networks, website performance, applications and APIs.

**Catch issues before they impact your business**

[www.catchpoint.com](http://www.catchpoint.com)

