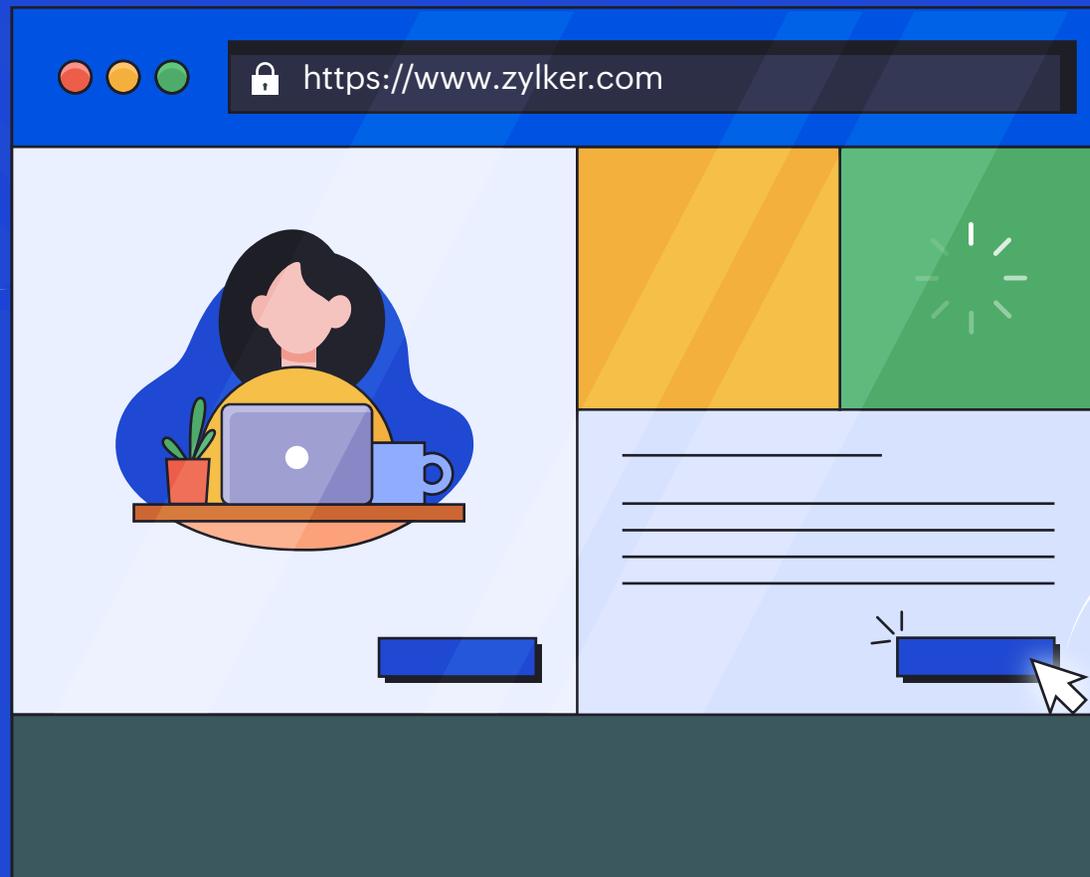


Guide to Core Web Vitals

Cumulative Layout
Shift (CLS)



Largest Contentful
Paint (LCP)

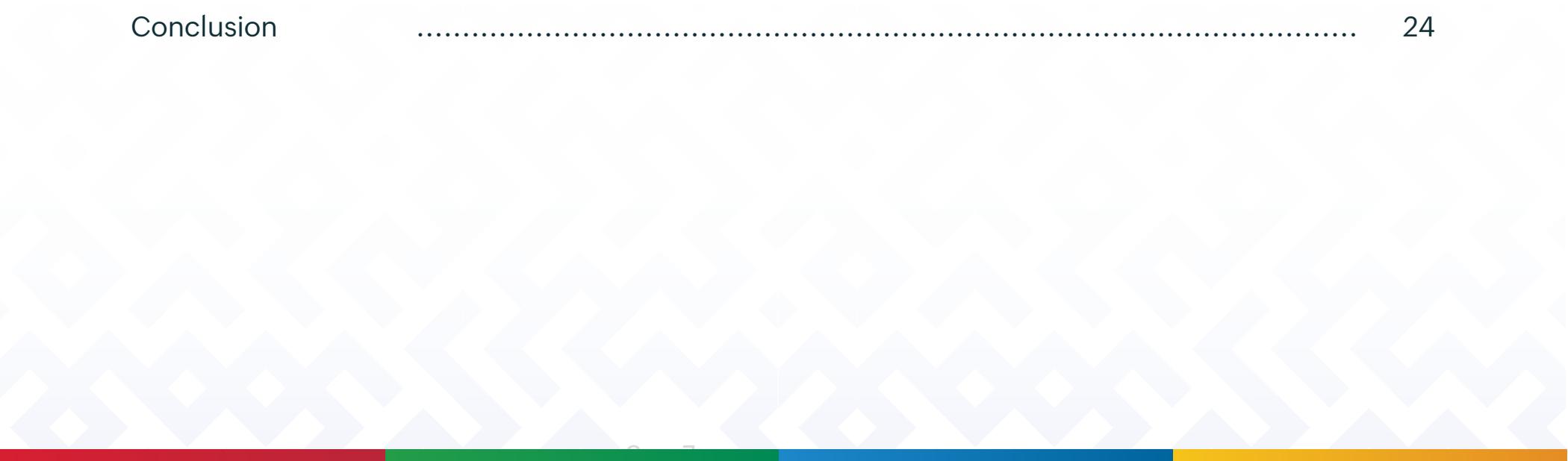


Interaction to Next
Paint (INP)



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Introduction

Core Web Vitals are the top three vital web user experience metrics that Google uses as parameters to rank its search results. Introduced as part of the internet search giant's page experience ranking signals in 2023, the three primary Core Web Vitals are:

Largest Contentful Paint (LCP)

LCP marks the loading performance of a web page by measuring the time taken for the most significant content element, such as a banner image, to load on the user's viewport (the visible portion of the browser screen).

Interaction to Next Paint (INP)

A fresh page-responsiveness field metric, INP is Google's latest addition to Core Web Vitals, replacing First Input Delay (FID) effective in March 2024. Google says that the decision to replace FID with INP was to "capture aspects of interactivity on the web that FID did not."

FID judges a webpage's interactivity by measuring the time taken for the page to become responsive for the user's first input. INP takes it further to cover the whole user experience on the website comprehensively.

Cumulative Layout Shift (CLS)

CLS marks the visual stability of a webpage by measuring how many unexpected layout shifts hamper the page's life cycle.

Even one-click checkout is no longer a cool feature to have. It is the fluidity of interaction and unity of purpose. Users often leave websites when they face frustrating deadlock experiences. That is why the best digital user experience does not end with choosing the right colors or fonts. Well-thought placements of elements and optimum loading speed frequently help a user determine whether to stay or leave a webpage. In doing so, the ideal user experience is ultimately linked to speed.

The Core Web Vitals featured today are the top three factors impacting website performance for the end-user experience and also determine how Google and other search engines rank websites.

Today's online customer experience reflects shortened attention spans, one-click checkouts, hyper-fast and interactive web experiences, and the mobile-first paradigm of expanding network bandwidths. This makes it imperative for website developers, designers, and IT administrators to provide interaction fluidity and a unity of purpose in designing an intuitive content experience without hiccups or frustrations.

Over the past several years, Google has empowered web admins to systematically analyze and improve their Core Web Vitals, using tools such as the Google Search Console (GSC), Google PageSpeed Insights, WebPageTest, Chrome DevTools, and Google CrUX (Chrome User Experience Report). Further, Google's Chrome resource website, web.dev, provides extensive content on best practices, testing, and improving Core Web Vitals scores for web developers.

This e-book explains why the Core Web Vitals are essential and what each of them is, as well as helps you discover how to measure and improve them to boost your end-user experience.

Why are Core Web Vitals important?

Think of an interactive, frequently updated, and globally popular website today. The users access it on a variety of browsers, across differently sized devices and operating systems, from locations throughout the globe, with varying internet speeds, processor capacities, and specific needs.

Behind the beautiful user interface that greets the users within the area of view is a diversified maze of content items delivered by an orchestra of technologies, such as languages, frameworks, cloud servers, security layers, content delivery networks, and third-party scripts.

There are CSS scripts for custom-directing the content's presentation, JavaScript to create responsive, interactive elements, and HTML code to define the structure

To ensure a butter-smooth website end-user experience, website designers often create functionally rich content that slows down the website's loading time, especially on smaller and less-capable devices supported by flaky Wi-Fi. That is why it is vital to consider your website user base's lowest common denominator and not resort to the "it works on my system" defense.



Important web vitals

- **Time To First Byte (TTFB):** Measures the time taken for the browser to display the first byte.
- **First Contentful Paint (FCP):** Gauges the time taken from when a page starts loading to the moment any part of that page's content is rendered on the screen, even a dot.
- **DOM content load (DCL):** Refers to the time taken for the HTML content to be loaded and parsed. DOM refers to the document object model, the tree-structure loading pattern of HTML content.
- **Time to Interactive (TTI):** Measures the time taken from the start of a page load to the page becoming truly interactive.
- **Total Blocking Time (TBT):** Records the time gap, in milliseconds, between FCP and TTI, which shows how long the main thread is blocked.
- **Speed Index (SI):** Calculates how quickly the page contents is displayed on the browser when it starts to load.

Though these metrics are defined by Google, which controls the lion's share of web search, the Core Web Vitals may be applied intuitively with adequate discretion to other web search companies, such as Bing, Yahoo.

In this context, think of the Core Web Vitals as bellwethers of the user experience that help web admins gauge the website's functionality from the user's eyes.

A website with good scores for its Core Web Vitals will likely rank better in search results than a website with similar content but poor scores. The good news is that, with focused attention and constant effort, website owners can improve their Core Web Vitals score by optimizing their code, images, and other resources.

The importance of website performance: A few statistics

- There's a 24% less chance a viewer leaves a website if Core Web Vitals targets are met. (Google, 2023)
- 2 seconds or less is the ideal webpage loading time with the smallest bounce rate probability. (TechReport, 2023)
- 53% of visitors on mobile devices abandon a webpage if it takes 3+ seconds to load. (Google study, 2016)
- As page load times increase, 32%, 90%, 106%, and 123% user bounce rate probabilities are realized after 3, 5, 6, and 10 seconds. (Google/SOASTA research, 2017)
- A 2x ad revenue increase can result from a 5-second improvement in website speed. (Google data, 2016)
- A +8% increase in sales can result from a 31% improvement in LCP. (Vodafone, 2021)
- A +15% increase in conversions can result from improving FCP. (Yelp, 2021)

Quotes

Optimize images and videos to improve page load times. Images are often the most significant contributor to page size and slower page loads. (Bing Webmaster Guidelines)

"Ensure pages are fast enough by looking at it from a visitor's perspective and thinking about whether they would find your site fast or slow." (Martin Splitt, Webmasters Trends Analyst and Developer Advocate at Google for Search & web ecosystem)

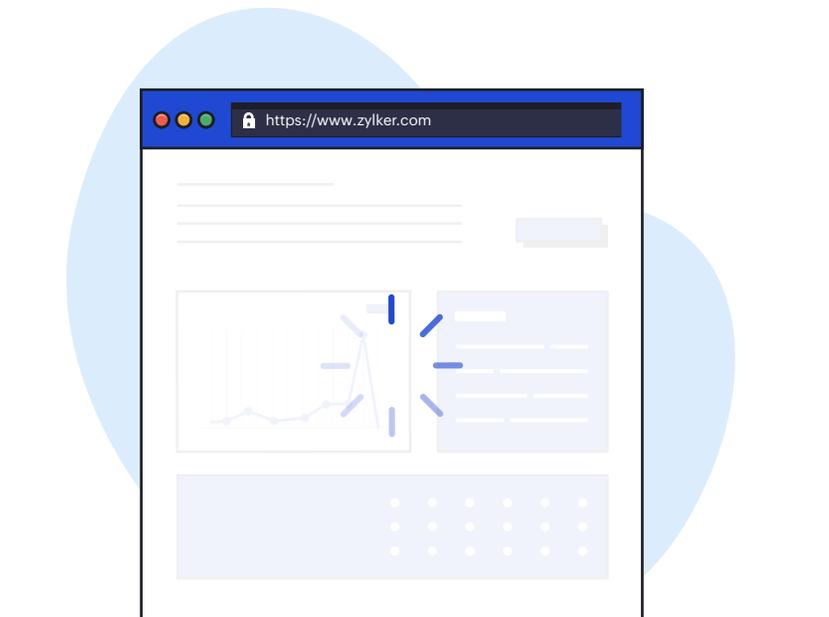
Largest Contentful Paint (LCP)

What is LCP?

LCP is a Core Web Vital that measures the time for the most significant content element to appear on the user's viewport. Though the website can be large, the LCP, which typically occurs on top of a website, is crucial because it profoundly impacts the user experience. An LCP below 2.5 seconds is desirable, and anything more than 4 seconds needs immediate course correction.

Why does LCP matter?

LCP is a mark of how users perceive the website's overall experience; when it falls, users most likely will leave. A study by Google found that a one-second delay in page load time can dent conversions by as much as 7%. Today's users are more impatient than ever and expect data to be available in the blink of an eye. That is why improving your LCP score instantly improves user retention and engagement.



How do you measure LCP?

LCP can be measured using several tools, such as the popular Google CrUX, a free tool that can be used to audit a website's performance. To use Google CrUX, enter the URL for the website you want to audit. Click the "Performance" tab to run a series of tests to generate a performance report that includes the LCP score. You may also use various browser APIs to capture LCP at the code level. The Web Vitals JavaScript Library can be included in your website code to effortlessly collect and report LCP data.

How do you fix LCP issues?

A website owner can perform several actions to fix a lagging LCP score. Some typical solutions include:

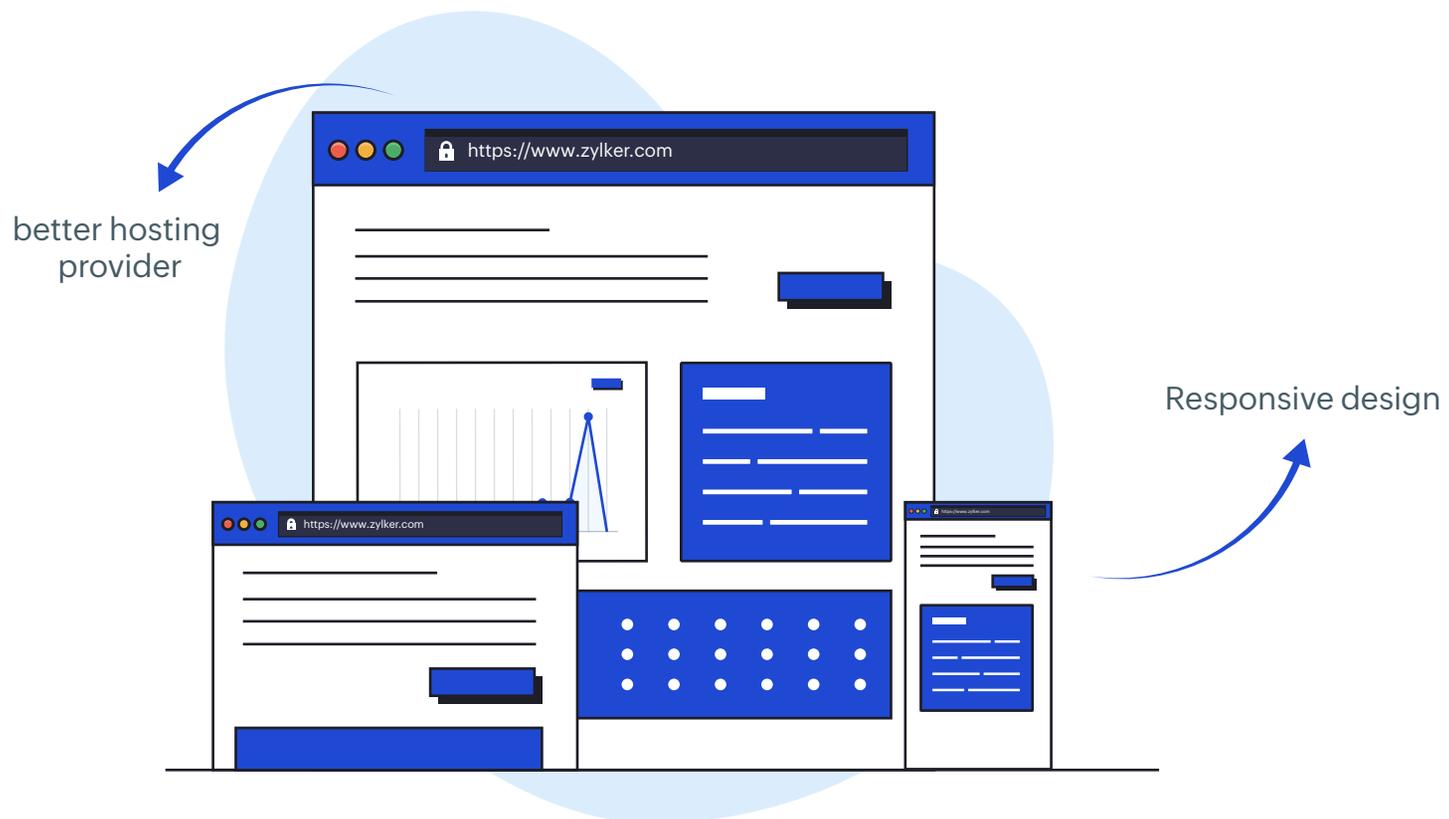
- Optimize images by compressing them without affecting their quality. Ensure your hero element (the largest image on the home screen) loads quickly, always.
- Ensure that lazy-load images, which display individually and relatively slowly, are not visible on the initial viewport. Let the images below the LCP load only when the user scrolls down to view them.
- Employ a content delivery network (CDN) to improve the loading speed of your content by hosting it from servers close to the location where most of your users are.
- Reduce the total size of CSS and JavaScript files to ensure webpages load faster. Whenever in doubt, eliminate clunky elements in favor of minimalistic design elements. Don't fear white space and avoid replacing it with an unnecessary animated element.
- Delay loading non-critical CSS and JavaScript files. Let these components wait to load so your website's initial load time is quick.
- Use caching plug-ins to prefetch static assets like photos and CSS assets to accelerate your website loading.

Follow this guidance to improve your LCP score and deliver a better user experience.

Additional tips

Here are some additional ways to improve your LCP score:

- Choose a responsive design. Responsive design makes your website look good and load quickly on all devices.
- Switch to a better hosting provider with fast servers to handle your website traffic better.
- Constantly monitor your LCP score. Use tools like Google CrUX to track your LCP score over time and ensure it improves.
- Fetch field data using real-user monitoring (RUM) metrics to gauge and optimize your LCP and combine your insights with lab data from synthetic monitoring.



Interaction to Next Paint (INP)

What is INP?

INP is a surefire way to judge how fast a web page displays the screen after user inputs, albeit for longer periods of usage, typically several minutes. For the measurement to register, FID demands a minimum user input. A legitimate INP value requires the page to register some interaction in the form of a click, tap, or keypress.

To present it as an analogy, while the FID is the time taken for a waiter in a restaurant to attend you first, INP is a review of how fast the waiter serves you overall. So, INP includes FID, too, as the first of many transactions it measures.

If the above interactive inputs aren't made and the user simply scrolls through and exits, INP values remain at zero. While INP scores of under 200ms is good, and scores between 200ms and 500ms need improvement, anything above 500ms is a red flag in terms of usability. Also, INP doesn't get measured when users hover over parts of the page, or when the page gets scanned by a bot, or during GUI-independent testing, such as running Selenium scripts. Though INP will eventually become extensible, the new Core Web Vital is currently available only for Chrome browsers.



Why does INP matter?

Experts consider INP to be a significant step to gauge the overall responsiveness of a website on both desktop and mobile devices. INP gives an accurate benchmark of sustained user experience that helps developers work on the code and design in its entirety to make impactful improvements. INPs acts as an indicator of your website's interaction latency, which has a direct impact on your business outcomes. FID considers only the first interaction that likewise forms the first impression on the user;

it is only a load responsiveness measure. FID goes all the way beyond first impressions by measuring how the website responds throughout the usage period, providing a trustworthy metric on how your website functions. In other words, while FID scratches the surface, INP delivers an accurate measurement of how satisfied a user is and, correspondingly, has a pulse of the website's business impact.

How do you measure INP?

INP scores are available in your Google search console as a page experience metric under the site performance section (replacing FID), and can be viewed through the Core Web Vitals Chrome extension. Additionally, the INP can be obtained using Google's PageSpeed Insights tool by entering the URL of your choice, and clicking Analyze. After a few seconds, the tool displays the INP score. You can study the diagnostic report in detail to identify the key issues that are slowing your website down.

The INP score is presented as one value, in milliseconds, based on the worst latency reported while ignoring the outlier events like random hiccups every 50 interactions. An INP score of 200 milliseconds and below is considered good if it sustains for at least 70% of your page load for all devices. INP takes into account the latency of all interactions (JavaScript and some CSS-based interactions), such as mouse clicks, taps on the touchscreen, or a keypress on either a physical or an on-screen keyboard.

INP can be improved by merging insights from both field data (RUM) through PageSpeed Insights and proactive synthetic testing. It is also important to merge insights from such RUM data with synthetic monitoring data to validate your INP further.

How do you fix INP issues?

- Start by employing a RUM solution to arrive at your INP value.
- Drill deep into your RUM report to spot areas that were responsible for spiking your INP scores.
- Determine the time of occurrence for the slow interactions, be it during the page load or specific user input.
- Use synthetic testing to simulate common user actions, especially during busy events like the main thread loading to find areas in need of improvement. Implement synthetic testing before launching your website, and in parallel with RUM data after the launch.
- Reproduce RUM data in synthetic testing and find ways to optimize your website.
- Cut page sizes, perform image and script optimization, simplify your UI, and improve static caching. Optimize every web asset.

- Employ a CDN if it helps speed the site up, and choose server-side rendering, lazy loading, and asynchronous JavaScript loading.
- Explore ways to optimize your website content, such as breaking JavaScript tasks into discrete bursts instead of a long-running task that blocks your main thread, reducing unwanted interactions, graphical excesses, and third-party scripts and embedded elements. This makes your website a fluid, minimalist, highly functional, and responsive website.
- Practice the Pareto principle and focus on the top 20 issues that will invariably result in improvements to the top 80% of performance concerns. Remediating these will result in significant improvement in the overall Core Web Vitals score, including the INP.

Additional tips

There are limitations to INP. Though INP is independent of network latency, some resources fetched from other domains, like widgets or ad content, can still cause your INP scores to increase, potentially misleading you in site optimization decisions.

That is why you should constantly test your pages with other tools, and compare and contrast your overall Core Web Vitals score to arrive at hard conclusions. Don't make hasty decisions on your website without gaining a holistic picture.

Since INP is still an emerging metric fresh out of the experimental stage, experts say it may take a while for score standards to stabilize and, as a rule of thumb, you should work constantly to optimize your website holistically by reducing longer tasks, fixing network issues, employing a CDN, performing code fixes. Ensuring an uncluttered and maximally functional UI will also improve performance scores.

Cumulative Layout Shift (CLS)

What is CLS?

CLS indicates the total individual layout shift scores per unexpected change in the page design throughout the user session. While a perfect score is zero, the usual score is slightly more than that. A good CLS score is less than 0.1, and up to 0.25 is considered tolerable.

CLS scores of more than 0.25 mean that the site is horrible for the end users, and needs urgent intervention by the web team. A high CLS score means more frustration for users, and a higher number dropouts and bounce rates. Layout shifts are counter-intuitive to good user experience.

Why does CLS matter?

Humans are creatures of habit. Our eyes see before the hand clicks, and our second brain, i.e., habitual behavior (common sense), is often the pilot that navigates us through user elements. That is why a layout that follows logic and a flow greatly annoys or drives away customers when there is an adverse shift. The CLS is a Core Web Vital that measures how intrusive the flow of a website is.

CLS measures and quantifies how content (text, pictures, videos, pop-ups, banners, layouts) blocks, jumps, or shifts around as the page loads. A stable, "what you see is what you get" (WYSIWYG) form of straightforward design helps achieve the best CLS scores. Unstable elements with impact shifts (how an element jumps within a frame) and distance shifts (how far an element moves relative to the screen size) bring your CLS scores down.

Even seemingly minor shifts, like media elements without dimensions, ads, embeds, dynamically injected content blocks,

and custom web fonts that take time to load, result in an overall CLS score impact. Therefore, giving ample space for elements by dedicating frames for all elements by design and controlling image parameters improves CLS scores.

How do you measure CLS?

CLS is calculated by multiplying two factors: the impact fraction and the distance fraction. The impact fraction measures how unstable the elements impact the viewing area between scrolls, and the distance fraction is the largest distance that any unstable element moves within the frame divided by the largest dimension. In other words, the impact fraction tells you how unstable an element is, and the distance fraction tells you how far it moves across the screen, making it inconvenient for the user.

CLS is measured using several tools, such as Chrome DevTools (in the performance tab), PageSpeed Insights, and Google CrUX, the Web Vitals Chrome extension, that gather data from real Chrome users around the world.

How do you fix CLS issues?

A website owner can perform several things to fix their CLS scores. Some standard solutions include:

- Go for asset-independent layouts in framing your website, and ensure elements are given adequate and appropriate positions before loading them that are dynamic for desktop and mobile versions.
- Adopt minimalism in your website design, and go for frugal and space-conscious designs with large amounts of white space.
- Use a SPA framework, PWA app shells, and AJAX methodology to determine the flow of content on a webpage without completely refreshing the entire page. Such initiatives help improve the Core Web Vitals overall.
- Never stop the content flow, but balance it with asynchronous JavaScript loads to ease the loading of the overall website in favor of readability.
- Be an essentialist. Avoid annoying chatbots that pop up immediately on a page load. Delay it for about 10 seconds, or make it available from a click.

How do you win the Core Web Vitals game?

Combine insights from multiple tools

Though we have several tools, such as Web Vitals extension, Google Search Console, and PageSpeed Insights, to measure the Core Web Vitals, there are some subtle differences. These tools use different data to measure the vitals and have their pros and cons.

Google Search Console helps you gauge the page's performance in the real world, and PageSpeed Insights integrates well with Google Search Console to extract specific metrics. Analyze your specific needs and preferences before choosing a tool. Don't always restrict yourself to just one tool, and extrapolate your data from the observations made from multiple tools for better accuracy and insight.

Know the limitations of Core Web Vitals

Google's Core Web Vitals is only a part of the larger gamut of search signals by Google that includes PageSpeed Insights. These obtained insights are mobile-friendliness, HTTPS security, non-intrusive pop-ups (interstitial elements), and other browsing standards. While the Core Web Vitals are measured at the end-user level, the insights on page speed are determined by Google as it crawls the site.

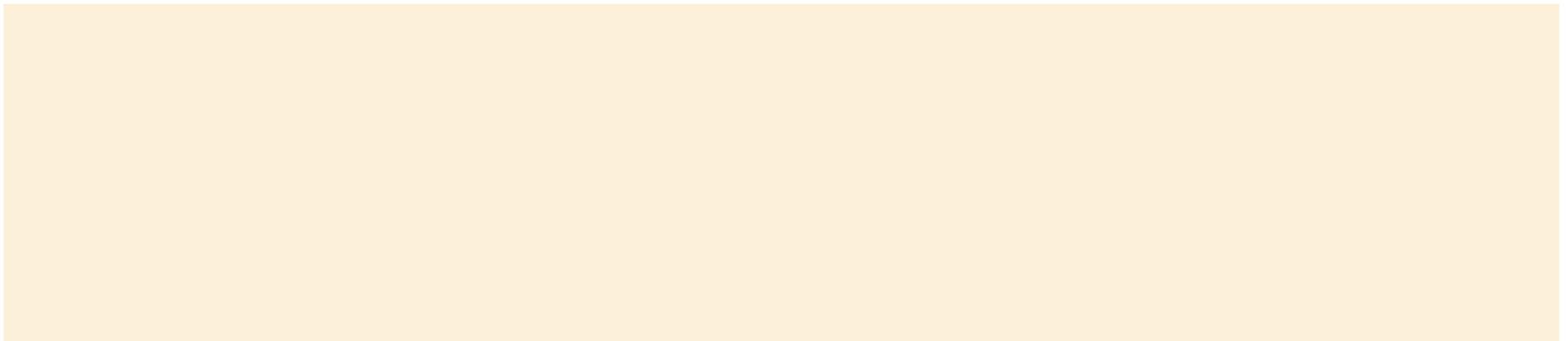
Mobile-friendliness involves providing a device-agnostic and smooth mobile browsing experience across bandwidths. HTTPS security has become a standard for trusting websites, especially those involving commercial transactions and personal data. Interstitials, intrusive pop-ups, and weird layout shifts are often frustrating for webpage visitors; therefore, your website ranks lower if you include them. Google Safe Browsing, a service that alerts users if they attempt to navigate to a dangerous website, helps users avoid exposure to malicious content that can lead to data theft and financial assets.

User actions are dynamic, and rigid metrics might miss out on measuring the actual state of thread-blocking scripts; users may click now, later, or even never. Faster thumbnail loading on search page results might also be the factor for a user to click immediately and then face a slower website as other parts continue to load in the background. This is a real catch-22 situation! If the website loads fast, the user clicks can be even quicker; if the website loads slowly, a user might not click on page elements at all!

Several legacy websites, including some popular technology websites, score relatively low on the Core Web Vitals. Yet, they display at the top of SEO rankings due to their dominance in the industry and authority over rich content.

Adopt a holistic approach

Adopting a holistic approach to improvement ensures users of the best digital experience. Continuously improving the Core Web Vitals cuts user bounce rates, improves conversions, and reduces frustration signals. While improving Core Web Vitals is a continuous process that has a definitive impact on a company's brand reputation and revenue, these strategies are not the only ways to achieve the best website end-user experience. Beyond Core Web Vitals, there are several extraneous real-world factors that website admins should care for.



Here is a list of techniques website admins can adopt beyond fixing their Core Web Vitals to ensure their websites win in the long run.

A: Fix SEO and other low-hanging fruits:

First, remember to fix the low-hanging SEO issues, such as removing duplicate content, adding missing alt attributes, fixing broken links, and addressing title tag and meta description issues. Correct your H1 tags, optimize text-to-HTML ratio and on-page links, and address code-level problems such as missing language declarations that announce the language of the content on the webpage. Further, focus on keyword strength, not just density, plant trusty backlinks, and ensure a robust and dynamic sitemap. Include social signals, feeds, and shareability across your site, as customers and search engines favor them for rankings.

B: Adopt the latest technologies:

Websites built on modern stacks, such as React or Angular, are proving to be faster and more responsive than websites built on older stacks. Constantly review your choices and ensure your website's technology fits the current and emerging network conditions, device trends, and user behaviors.

Beyond striving to improve Core Web Vitals, make your website universal. Ensure back/forward cache compatibility with various browsers, not just Google Chrome, to ensure a consistent experience for everyone. Use APIs to time website load performance events to gauge and improve your Core Web Vitals like FID on non-Chrome browsers.

C: Implement best practices in design:

User interface (UI) and user experience (UX) improvements are crucial to ensure your websites are enjoyable to interact with. As most websites are consumed vertically, on mobile screens of varying sizes, engineers can improve UI/UX universally by implementing best practices, such as responsive design, using clear and concise language, using optimized-quality images and videos, and ensuring that the design structure is genuinely device agnostic and not patchwork.

Switch older protocols, such as TCP, to the more capable UDP that provides faster, simpler, safer, and more efficient delivery of user interface elements. Web designers should use these emerging technologies to their advantage and design fast and fluid interfaces.

D: Have empathy at every step:

Design your site to open external links on new tabs, stabilizing user interaction. Also, in UI/UX, use common sense to base your design decisions. Have you made the site search button obvious? Is there an accessible toggle for switching to the dark mode? Do you provide enough contrast? Is your URL human-readable, or is it a random alphanumeric mess? Is your menu level simplified and obvious, with zero blind spots in content discovery? Every minute detail is essential.

Always evaluate from the customer's point of view. Site owners may fuss about menu items, banners, carousels, overlays, ad positions, sticky footers, third-party content, and infinite strollers. But the users only care about three things when they visit a website: helpful content, a predictable interface, and instant feedback.

UI is what a user sees, UX is what a user experiences, and these are two different realms. Regarding UX, consider adding value to your 404 error (resource not found) page and include guidance, quirky trivia, and other links. Make your customer smile. Get out of the way of your users consuming your content by choosing non-intrusive floating menus. Always show the index and reading progress indicator to ease user anxiety. Permanently eliminate inappropriate pop-up sounds and distracting elements. Try delaying your chatbot loading for 10 seconds or more. Ensure alt text and translation capabilities extend support to all.

There are three fundamental questions UI/UX designers should ask about any page element: "Is it working?", "Is it responsive?", and "Is it useful?". The rest shall fall in place.

E: See what your customer sees (RUM)

RUM measures real performance from a real user's point of view. RUM unearths issues with deeper context, such as loading metrics by countries, browsers, devices, and other user-defined dimensions. As poorer countries widely use data saver features, ensure you provide a lite version of your website without heavy JavaScript/CSS scripts and visual elements.

A decade ago, Facebook imposed a constraint of 2G Tuesdays, where engineers were forced to work at 2G speeds on Tuesdays to empathize with what the customers go through, to find ways to make the site lite, with zero distractions, bloatware, and heavy graphical features. When in doubt, always adopt a minimalistic approach. Less is more!

F: Unify field data with lab data:

To improve website performance profoundly, site owners can combine their monitoring approach by merging insights from what they get from RUM with lab-generated synthetic monitoring data observed from various endpoints. Simulate the journey your customers might experience, and check every instance constantly, and from different approaches. Rinse, repeat.

Think beyond Core Web Vitals

Google's Core Web Vitals is Google's way of asserting what works in user experience, which makes it a great starting point for marketers, business owners, website designers, and web admins to think together to gain deeper insights into their website's performance and hold them as benchmarks to improve the end-user experience constantly.

Since the repercussions of attaining high scores in Core Web Vitals are universally beneficial for all end users, their business benefits extend beyond just search rankings, as a happy customer will not press the back button or call it quits. High scores on your web vitals also help you achieve good rankings with other leading web search portals and serve as a global benchmark.

However, there are some limitations. Though the Core Web Vitals are a hot topic in the web dev world, they are not the final frontier--yet. It is wise to arrive at business forecasts based on more than Core Web Vitals scores, as there is often a shortage of historical data to back regression tests to determine exact outcomes.

While content quality is crucial for users to benefit from your website, the Core Web Vitals reflect the top usability factors. These quantifiable experience indicators result from constant innovations by Google and are understood to be constantly evolving. Along with other performance measurement metrics, the Core Web Vitals are a forerunner to good customer experience and invariably contribute to higher rankings in Google search engine page results.

More than website loading speed is needed to guarantee digital delivery success. Just as a car purchase decision considers usability, comfort, economy, responsiveness, and flexibility in the driving experience and not just the top speed, the web experience is a sum of several variables, one being speed.

While Google, Bing, and other search engines place a premium on speed, the ultimate user experience and overall website usefulness also contribute to a rise in a website's rankings. Attaining high search rankings is the ultimate success for consumers because it comes from balancing absolute page load speed with providing contextual and engaging content.

Despite the widespread assumption that the Chrome browser's performance is the worldwide standard to beat, the performance for other browsers, like Edge, Firefox, Safari, Opera, Ulaa, and many others, features other important nuances. Non-Chrome browsers load, refer, and execute JavaScripts in their unique ways, so a comprehensive user test that exhaustively tracks many or all browsers will arrive at the actual user experience holistically.

Organizations should avoid obsessing over keywords and other SEO-related hacks, and should chalk out a holistic content strategy that provides contextual, relevant, and helpful content for everyone who visits the website.

Conclusion

Following these tips, website owners can improve the user experience and increase conversions and revenue. Beyond SEO issues, owners can also pool their efforts to switch their website stack to modern ones to implement better UI/UX practices. A holistic, empathetic approach that puts humans first is essential to ensure the best digital end-user experience for your website users.

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