Performance Testing

Performance Testing assesses a system's speed, responsiveness, and stability under various conditions.

Important metrics to measure:

• **First Contentful Paint (FCP):** measures the time from when the page starts loading to when any part of the page's content is rendered on the screen. (lab, field)

• **Largest Contentful Paint (LCP):** measures the time from when the page starts loading to when the largest text block or image element is rendered on the screen. (lab, field)

• **Interaction to Next Paint (INP):** measures the latency of every tap, click, or keyboard interaction made with the page, and—based on the number of interactions—selects the worst interaction latency of the page (or close to the highest) as a single, representative value to describe a page's overall responsiveness. (lab, field)

• **Total Blocking Time (TBT):** measures the total amount of time between FCP and TTI where the main thread was blocked for long enough to prevent input responsiveness. (lab)

• **Cumulative Layout Shift (CLS):** measures the cumulative score of all unexpected layout shifts that occur between when the page starts loading and when its lifecycle state changes to hidden. (lab, field)

• **Time to First Byte (TTFB):** measures the time it takes for the network to respond to a user request with the first byte of a resource. (lab, field)

Largest Contentful Paint(LCP)

• LCP measures how long the largest visible element takes to load in the viewport after navigation.

• Good score: 2.5 seconds or less; poor score: over 4.0 seconds.

• Elements considered: images, videos, text blocks.

• Excludes invisible, off-screen, and non-contentful elements.

• Tools to measure: Chrome DevTools, PageSpeed Insights, Lighthouse.

• To improve LCP: optimize server response time, prioritize critical elements, and reduce JavaScript blocking.

Cumulative Layout Shift (CLS):

• CLS measures unexpected layout shifts of visible elements during page loading.

• A good CLS score is 0.1 or less, while a poor score is greater than 0.25.

• Layout shift occurs when elements change position between frames.

• Session window: a burst of rapid layout shifts with less than 1 second between shifts.

• CLS score is calculated using the impact and distance fractions based on element movement in the viewport.

Interaction to Next Paint (INP) measures the latency of user interactions (clicks, taps, keyboard inputs) during a page visit. The final INP value is based on the longest interaction, ignoring outliers.

> • **Good INP:** ≤ 200 milliseconds
>
> • **Needs improvement:** 200ms to 500ms
>
> • **Poor INP:** > 500 milliseconds

INP tracks interaction delays caused by factors like JavaScript blocking, with key drivers including mouse clicks, taps, and keyboard presses.

Metric	Adding 10	Adding 50	Adding 500
LCP	0.31s	0.90s	4.3s
CLS	0.02	0.16	0.63(Poor)
INP	56ms	74ms	1944ms(Poor)