

Master's Thesis

## **Techniques for Measuring the Loading Speed of Web Pages**

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The loading of a web page usually consists of many small steps. Not all of them have to be completed in order to allow the user to start working with the page. For example, the user does not necessarily have to wait until all ads have been loaded. It would therefore be useful to know when a web page has been sufficiently loaded in order to be used.

The goal of this Master's thesis is to find techniques for measuring the loading speed of web pages and to find heuristics for determining the time when a page is sufficiently loaded.

There are different approaches for that. One common way is to take the time until the "onload" event of a browser is triggered. A more accurate way to measure the loading of a web page is provided by the navigation timing API [1], which gives more detailed timing information. Especially modern web pages are optimized for loading the content "above the fold" (i.e., in the visible part of the web page) as fast as possible and the rest of the page afterwards. When content above the fold is available the page looks completed for the user although the "onload" event has not been fired yet.

To achieve the desired goals, the Master's thesis should cover the following topics:

1. Investigate if it is possible to achieve the goals with JavaScript in the browser
  - a. Is it possible to detect when the DOM content (with pictures) has been loaded in the visible area?
  - b. Are fully/partly loaded images (in the visible area) an indicator for the loading status of a page?
  - c. Are script executions an indicator for the loading status of a page?
  - d. Is it possible to detect if specific elements on a web page (e.g., images, scripts, dynamically loaded contents) have been completely processed?
2. Synthetic (optional)
  - a. Evaluate if it is possible to measure the loading speed of a page by performing synthetic requests to the page [2]
3. If the above approaches do not provide a sufficiently general way to measure the loading speed of each web page, find a way to allow users to specify manually when the loading of a web page is sufficiently complete.

4. Test all the approaches mentioned above
  - a. Test them with different websites and compare the reliability of the measurements.
  - b. Evaluate the performance of the approaches and measure their impact on the loading speed of pages.
  - c. Compare your approaches with existing ones, e.g. “onload” (with navigation timing), Google Speed Test, etc.

The progress of the project should be regularly discussed with the advisor. A time schedule and a milestone plan must be set up within the first 3 weeks. It should be continuously refined and monitored to make sure that the thesis will be completed in time. The final version of the thesis must be submitted not later than April 30, 2017.

[1] Navigation Timing - <https://www.w3.org/TR/navigation-timing-2/>

[2] Web Page Test - <https://sites.google.com/a/webpagetest.org/docs/using-webpagetest/metrics/speed-index>