Institutionen för datavetenskap
Department of Computer science

Examensarbete

Performance test and optimize in HTML5-based web game: a case study of Flappy Bird

by

Ping Liu

LIU-IDA/LITH-EX-A--15/001--SE

2015-11-18

Linköpings universitet
SE-581 83 Linköping, Sweden

Linköpings universitet
581 83 Linköping

Linköpings universitet

Linköpings universitet
Institutionen för datavetenskap

Examensarbete

Performance test and optimize in HTML5-based web game: a case study of Flappy Bird

by

Ping Liu

LIU-IDA/LITH-EX-A--15/001--SE

2015-11-18

Handledare: Min handledare
Examinator: Min examinator

Abstract

Abstract.tex

Acknowledgments

Acknowledgments.tex

Contents

List of Figures

List of Tables

1 Introduction

HTML5 is a valued hypertext language preferred by developers and game professional to build advanced games. Developing advanced games will obviously require more skill and effort on the part of the developer. An advanced understanding of the aspects of graphics, multimedia, and animation all need to be part of a developer's skillset. HTML5 endows the APIs for WebGL, Canvas and WebAudio that are the essentials for constructing advanced games compatible to run in a web browser. The efficient way with which graphics, sounds and animation can be done in HTML5 is very impressive.

Flappy Bird was released in May 2013 but received a sudden rise in popularity in early 2014. It was criticized for its level of difficulty and alleged plagiarism in graphics and game mechanics, while other reviewers found it addictive. At the end of January 2014, it was the most downloaded free game in the iOS App Store. During this period, its developer claimed that Flappy Bird was earning 50,000 dollar a day from in-app advertisements as well as sales. Now, we have different versions realized on website and we will take one of them as a case study.

1.1 Motivation

Nowadays, a lot of Web Games are based on HTML5 Canvas, which is the most widely supported standard for 2D immediate mode graphics on the web. However, with the size of application increased, developers inadvertently hit the performance wall. Actually, there are a lot of articles aim to optimize the performance of Websites, But we find little resource focus on the optimization of web games, especially for HTML5-based web game. As you know, for web games, you need more graphical operations and the users are more sensitive about the delay of the page and really need a quick feedback if anything changes. So performance is more important to web games than web applications.

It is quite interesting to find out how to test performance of a web game and try to optimize it. And we will mainly focus on the web games based on HTML5 by using Canvas. In order to show the optimization procedure, We will take flappy bird as a case study to introduce our way of optimization performance and through this study, we want to find some general suggestions that can help you build high performance web games.

1.2 Aim

Through this thesis project, we want to find out something that can really help us build high performance web games. It is clearly that we can always do some improvement to our project. Usually, we will first try to test the game and then make some improvement, and the test it again. Through this optimization procedure, the performance of the game will be better and better.

We want to make this thesis as a good example of how the optimization procedure works. And by this study,we can list some suggestions that can be taken through generally web games.To be specify, there are several aims of this thesis project:

1. To give the procedure of optimizing performance of flappy bird as a case study
2. To give suggestions of how to build high performance to general web games.

1.3 Research questions

By the motivation and aim above, our research are mainly focus on two parts, one is the optimization procedure through the case study of flappy bird, and another is the general suggestions of web games with high performance.

According to our aim, we figure out several interesting research questions:

1. How to optimize a web game based on HTML5 Canvas?
2. How the optimization procedure works during the case study of flappy bird?
3. What you should take care of when you develop a web game with high performance?
4. How to use Chrome to test performance of your code?

1.4 Delimitations

This thesis is mainly talk about web games that based on HTML5 Canvas, and for the performance test, it is mainly based on the Google Chrome browser.

2 Theory

The main purpose of this chapter is to make it obvious for the reader that the report authors have made an effort to read up on related research and other information of relevance for the research questions. It is a question of trust. Can I as a reader rely on what the authors are saying? If it is obvious that the authors know the topic area well and clearly present their lessons learned, it raises the perceived quality of the entire report.

After having read the theory chapter it shall be obvious for the reader that the research questions are both well formulated and relevant.

The chapter must contain theory of use for the intended study, both in terms of technique and method. If a final thesis project is about the development of a new search engine for a certain application domain, the theory must bring up related work on search algorithms and related techniques, but also methods for evaluating search engines, including performance measures such as precision, accuracy and recall.

The chapter shall be structured thematically, not per author. A good approach to making a review of scientific literature is to use *Google Scholar* (which also has the useful function *Cite*). By iterating between searching for articles and reading abstracts to find new terms to guide further searches, it is fairly straight forward to locate good and relevant information.

Having found a relevant article one can use the function for viewing other articles that have cited this particular article, and also go through the article's own reference list. Among these articles on can often find other interesting articles and thus proceed further.

It can also be a good idea to consider which sources seem most relevant for the problem area at hand. Are there any special conference or journal that often occurs one can search in more detail in lists of published articles from these venues in particular. One can also search for the web sites of important authors and investigate what they have published in general.

This chapter is called either *Theory, Related Work*, or *Related Research*. Check with your supervisor.

3 Method

In this chapter, the method is described in a way which shows how the work was actually carried out. The description must be precise and well thought through. Consider the scientific term replicability. Replicability means that someone reading a scientific report should be able to follow the method description and then carry out the same study and check whether the results obtained are similar. Achieving replicability is not always relevant, but precision and clarity is.

Sometimes the work is separated into different parts, e.g. pre-study, implementation and evaluation. In such cases it is recommended that the method chapter is structured accordingly with suitable named sub-headings.

4 Results

This chapter presents the results. Note that the results are presented factually, striving for objectivity as far as possible. The results shall not be analyzed, discussed or evaluated. This is left for the discussion chapter.

In case the method chapter has been divided into subheadings such as pre-study, implementation and evaluation, the result chapter should have the same sub-headings. This gives a clear structure and makes the chapter easier to write.

In case results are presented from a process (e.g. an implementation process), the main decisions made during the process must be clearly presented and justified. Normally, alternative attempts, etc, have already been described in the theory chapter, making it possible to refer to it as part of the justification.

5 Discussion

This chapter contains the following sub-headings.

5.1 Results

Are there anything in the results that stand out and need be analyzed and commented on? How do the results relate to the material covered in the theory chapter? What does the theory imply about the meaning of the results? For example, what does it mean that a certain system got a certain numeric value in a usability evaluation; how good or bad is it? Is there something in the results that is unexpected based on the literature review, or is everything as one would theoretically expect?

5.2 Method

This is where the applied method is discussed and criticized. Taking a self-critical stance to the method used is an important part of the scientific approach.

A study is rarely perfect. There are almost always things one could have done differently if the study could be repeated or with extra resources. Go through the most important limitations with your method and discuss potential consequences for the results. Connect back to the method theory presented in the theory chapter. Refer explicitly to relevant sources.

The discussion shall also demonstrate an awareness of methodological concepts such as replicability, reliability, and validity. The concept of replicability has already been discussed in the Method chapter (3). Reliability is a term for whether one can expect to get the same results if a study is repeated with the same method. A study with a high degree of reliability has a large probability of leading to similar results if repeated. The concept of validity is, somewhat simplified, concerned with whether a performed measurement actually measures what one thinks is being measured. A study with a high degree of validity thus has a high level of credibility. A discussion of these concepts must be transferred to the actual context of the study.

The method discussion shall also contain a paragraph of source criticism. This is where the authors' point of view on the use and selection of sources is described.

In certain contexts it may be the case that the most relevant information for the study is not to be found in scientific literature but rather with individual software developers and open

source projects. It must then be clearly stated that efforts have been made to gain access to this information, e.g. by direct communication with developers and/or through discussion forums, etc. Efforts must also be made to indicate the lack of relevant research literature. The precise manner of such investigations must be clearly specified in a method section. The paragraph on source criticism must critically discuss these approaches.

Usually however, there are always relevant related research. If not about the actual research questions, there is certainly important information about the domain under study.

5.3 The work in a wider context

There must be a section discussing ethical and societal aspects related to the work. This is important for the authors to demonstrate a professional maturity and also for achieving the education goals. If the work, for some reason, completely lacks a connection to ethical or societal aspects this must be explicitly stated and justified in the section Delimitations in the introduction chapter.

In the discussion chapter, one must explicitly refer to sources relevant to the discussion.

6 Conclusion

This chapter contains a summarization of the purpose and the research questions. To what extent has the aim been achieved, and what are the answers to the research questions?

The consequences for the target audience (and possibly for researchers and practitioners) must also be described. There should be a section on future work where ideas for continued work are described. If the conclusion chapter contains such a section, the ideas described therein must be concrete and well thought through.