A Study on the Performance Enhancement Method for HTML5 Smart Virtual Machine using Offloading

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Abstract. HTML5 Smart Virtual Machine is a virtual machine based solution to executing contents on various platforms such as PC, Smart TV, and mobile devices by web browsers that support HTML 5. This HTML 5 SVM has an advantage as a virtual machine, but the VM based execution method raise a problem on executing performance.

This paper proposes an offloading method to solve this performance problem by the performance enhancement of the HTML5 SVM with cloud system. By the proposed method, HTML5 SVM is enhanced its performance extremely using cloud server side execution on complexed and time consumed functions.

Keywords: Computational Offloading, Context Managing, Virtual Machine, HTML 5 Smart Virtual Machine

1 Introduction

HTML5 SVM (Smart Virtual Machine) is a virtual machine based solution to executing contents on various platforms such as PC, Smart TV, and mobile devices by web browsers that support HTML 5 [1, 2, 3]. This HTML 5 SVM has an advantage as a VM (virtual machine), but the VM based execution method raise a problem on executing performance.

Moreover, HTML 5 SVM has an additional overhead on execution with web browser based execution. Especially, in case of mobile device, the computing power is too lower than the PC environments, it is difficult to execute complex contents on the mobile devices.

In this paper, we deal with a computational offloading method for the HTML5 SVM to increase the execution performance of the given contents. By the proposed method, the web based HTML5 SVM’s performance is extremely enhanced.


2 Related Studies

2.1 HTML5 Smart Virtual Machine

HTML5 SVM is a virtual machine based solution to provide an integrated environment on developmental / executional phase by supporting not only web based execution environment but also multiple programming languages [3, 4]. Because separate development and execution environments exist in existing smart devices, according to target devices or platforms, separate development work had to be carried out per platform to provide one type of content to various smart devices.

HTML5 SVM can execute the various contents on the heterogeneous target devices with web browsers, but it needed devices’ sufficient performances to gain the smoothly executed results of contents like FPS (Frame Per Second). Thus, the performance and QoS (Quality of Service) of the given contents are depended on target device’s computing power.

Fig. 1 shows the system configuration of the HTML5 SVM, there are largely separated 2 layers; SVM core and SVM adaptation layer. The SVM core has a role for contents execution and it is combined by 4 components as SEF (Smart Executable File) loader, interpreter, runtime environment, and built-in library. Next, the SVM adaptation layer has 6 components for interfacing with target HTML5 based web browsers.

Fig. 1. System Configuration of the HTML5 Smart Virtual Machine
2.2 Computational Offloading

The computational offloading is a cloud computing technique to outperform executing for the given contents or programs on restricted computing-powered environments [5-8]. A complexed task needed higher computing power consequently, thus if the target device has not sufficient computing power then the QoS of the given contents/programs is down. In this case, the offloading is one of the solutions. By using the offloading techniques, the target device delegates complexed tasks to cloud server instead of directly executing itself. Fig. 2 shows the offloading concept.

Fig. 2. Computational Offloading Concept Model [9]

3 Offloading Module for HTML5 Smart Virtual Machine

In this study, the offloading unit is a function of program, and the HTML 5 SVM can delegate tasks of the target contents by function offloading unit. Figure 3 shows the proposed offloading model for HTML5 SVM. Firstly, the interpreter requests the offloading specific function which marked as overheaded to the offloader module while executing given contents. Then the offloader module starts the preparation step for function offloading. First step is a collecting information phase which is gathering essential context information of the target function will be send to the server. For this phase, the offloader request context collecting task to the context manager which is designed to handle context information while offloading functions. Next is a context information transfer phase. The gathered context information is serialized for easily transmission and then sends to server’s SVM. After receive context information,
offloaded function can be executed in server. The offloaded function executed using server’s high performance computing power, and the execution results with context information for the state after execution will be send to client’s SVM.

Fig. 3. Proposed offloading model for HTML5 Smart Virtual Machine

It is an important issue that sharing context information between a client HTML5 SVM and a server side SVM, because the context information combined by essential information for executing interpreter like stack frame, program counter, related heap information, and so on. Thus, the offloading module must be synchronizing the device and server’s context information while transmit context data.

4 Experimental Results

In this chapter, the implemented offloading module for HTML5 SVM is experimented to show the validity of the offloading method proposed in the present paper. The experimental results of the proposed offloading technique are as shown in Fig. 4.

The target program is a prime number calculation algorithm and the target devices are follows; PC, Galaxy Note3, and iPad2. In the experiments, we uses the web browser of each target devices as execution platform for HTML5, and the compared execution performance result – device only; not using offloading, device with cloud; using offloading – of each device is shown in following figure.
Proposed offloading model for HTML5 Smart Virtual Machine

As a result, Fig. 4 shows the performance enhancement of the target content using offloading method. Overall performance is dramatically enhanced but in the case of PC’s first 2 time; No. 500, 1000, it shows rather lower performance. It can be interpreted that the offloading benefit is must greater than the offloading overhead.
5 Conclusions and further researches

HTML 5 SVM has an additional overhead on execution with web browser based execution, moreover in case of mobile device, the computing power is too lower than the PC environments, it is difficult to execute complex contents on the mobile devices.

In this paper, we examined an offloading technique in order to increase the performance of the HTML5 SVM. By using these offloading techniques, enables the execution of complex and various contents because cover the disadvantage - lower performance - of the VM with low computing powered devices. In the future, we will research on profiler for optimal offloading time decision. By the profiler, the offloading method can be more efficiently than using the manually decided offloading time.

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References