

Java Smart Card

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Abstract

This short paper introduces the issues and challenges of next generation Java-based smart card platforms. Betting on a continuous evolution toward open computing devices, next generation cards will consist in embedded Java micro-server platforms. Those platforms will be able to serve various types of services and applications thanks to two important system features: adapt ability and maintainability. Two features that have to be carefully taken into account in the research perspectives described in this paper: real Java for cards, cards integration in a networked world, and flexible and adaptable cards.

Keywords- Real Java Smart Cards, Flexible and adaptable cards.

1 Introduction

The research perspectives described in this paper leverage the vision of generic, adaptable, and maintainable smart cards that will meet the requirement soft both the adjustment of smart card systems to the environment and the persistence of smart card applications in an evolving environment. The technology used to

implement these smart card systems blur classical boundaries such as those between distributed and embedded systems, those between low- and high-end card platforms, or those between pre- and post-issuance (the term "post- issuance" describe the ability for smart cards to host and to run applications after they have been issued. Thus, the goal of research perspectives is to bring some consistency to the possible solutions to these issues.

This paper is organized as follows. Research perspectives are presented within the following three categories:

- "Real Java for smart cards"; this category reminds the central place of Java in smart cards, the Java limitations of the current Java Card 2.x specifications, and the will to provide a new groundbreaking release for next generation Javabased smart card;
- "Cards integration in a networked world"; extends the notion of interoperability from the current point of view of portability of Java Card programs to any Java Card platforms to integration of Java Card programs with other programs residing outside of the card;

– ”flexible and adaptable cards”; refines the use of Java to support multi-application smart cards, to the use of Java to support well tailored customization of the card system depending on the target.

2 Real Java for smart cards :

2.1 State-of-the-art

Java Card is now seen as the dominating platform for high-end microprocessor based smart cards. And according to market analysts [3] this trend should continue for at least the next four years. Smart card vendors are focusing their strategy on this technology and an important part of their research and development resources is working on Java Card. There is no important development of a proprietary multi-application operating system in none of the major smart card companies.

2.2 Issues

These issues with the Java platform as it is defined by the current Java Card specifications are threefold:

1. The very stripped-down version of Java provided by the Java Card
2. specifications is targeted to very low-end chips. Therefore, drastic choices have been made that yield to very poor specifications in term of functionality compared to ”standard Java”. For instance, these drastic choices are optional integer numbers, no multi-threading, no (or optional) garbage-collection, specific file format different from the class file format that prevents on-board linking and reflection, a persistent memory model, etc.

3. Finally, because the Java Card specifications only consider the execution platform (virtual machine and runtime environment) plus the standard APIs, they miss some aspects of the smart card life cycle such as its initialization, its personalization, the way applications are installed during the pre-issuance stage, or during the postissuance stage.

2.3 Challenges the Java Card specifications will surely evolve toward a ground-breaking release with the following principles: to target high-end (and possibly at the same time low-end) 32-bit chip platforms and take benefits of their new hardware capabilities, to get closer to mainstream Java functionality, it is also important that research perspectives don’t only adopt an on-card standpoint, but also adopt a system standpoint in which a smart card is seen as part of global systems, as well as a flexible system by itself. These two last aspects complement the vision of a radically new and richer Java-based platform for smart cards. They are discussed in the two following sections.

3 Cards integration in a networked world

3.1 State-of-the-art :

One of the most promising feature for paying the price of Java in smart cards was the cross-platform compatibility brought by the use of Java and by the Java Card specifications. Looking backward, we now know that it wasn’t painless. For instance, mobile networks operators using a Java Card from one card manufacturer had to virtually redevelop the applications to run on different vendor’s Java cards.

3.2 Issues

Networked applications is about connecting information systems and exchanging information. They provide a great opportunity to make information more convenient to use and to be pieced together in order to achieve a common goal such as a complex service requiring, for example, distributed data and distributed processing.

3.3 Challenges

One of the research perspectives is about providing application developers with Java Card supported technologies that will ease the card integration, and that will support the end-to-end argument . These technologies range into the following categories: .) a standard communication protocol stack able to interconnect with diversity of networks, allowing distant accesses, and supporting multiple bidirectional communication exchanges at the same time.

.) the use of "standard" Java components to take benefits from the existing Java tools and from the widespread use of Java components (file format, idioms, APIs, etc.) in the information systems surrounding smart cards. format, idioms, APIs, etc.) in the information systems surrounding smart cards.

4 Flexible and adaptable cards :

4.1 State-of-the-art and issues

Java Card has been marketed as the ideal platform for multi- application smart cards. Technically speaking, it is not erroneous. The flexibility to offer new services and to update data without physically swapping out the chip card is supported by Java Card.

4.2 Challenges

Finally, another research perspective is about providing application issuers with Java Card supported technologies that will ease the card flexibility and adaptation in order to allow the platform to incorporate at best the only needed features for the context in which they operate and the applications they serve.

5 Conclusions

We have defined next generation Java-based smart card as a platform enabling the efficient development, deployment and management of the on-card parts of networked applications. For that purpose, the platform has to provide a powerful and efficient execution environment as well

as a flexible and operable management context within constrained environments.

Such a platform also has to offer an harmonized interface to operate the services in a distributed and dynamic fashion required by me-commerce and m/e- services operations. Other technologies also have to be developed and should be added to these research perspectives. Some of them are quite independent of the platform capabilities. Most evident ones are: secure Java technologies, delegation of

operations to card, and card management. Their efficiency and reliability have to be precisely measured whether or not they are developed in convergence with the card platform, or with the possibility to influence some features of the card platform.

□ □ <http://www.smartcard.com/whatis/>
□ □ “Understanding Java Card 2.0”.

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