

Design and Development of the Smart Mobile Cloud (SMC) - a Cloud Computing Service Platform based on Design Thinking Methodology

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Abstract

The Smart Mobile Cloud (SMC) is a cloud computing service platform. It allows service providers (companies that provide their services via a cloud computing service platform) to launch high quality and equal services more quickly, as well as with less cost. By employing the processes and methods of Design Thinking and human-centered design (HCD) in designing and developing the SMC, it has become possible to provide a service platform that enriches our everyday lives.

Keywords



smart device, cloud computing service, design thinking, human-centered design (HCD), value-added

1. Introduction

In recent years, services using smart devices have been employed in a variety of fields including purchasing, health care, education, public service, local community, etc. A smart device is not just a communication tool any more. It has now become an essential tool for our society.

A cloud computing platform is an efficient solution when service providers launch their systems to provide high quality services that contribute to the abundant human life, quickly and economically. At NEC, we have developed the smart mobile cloud (SMC), a cloud computing services platform for smart devices. When designing a platform for cloud computing services, it is important to visualize the customer's new business by considering their services from the perspective of an end user, and by understanding what an end user is looking for. In order to clarify and meet such needs, we have employed the processes and methods of Design Thinking and HCD to design and develop the SMC. This paper gives an outline of the SMC system and goes on to introduce its development process.

2. Outline of the Smart Mobile Cloud (SMC)

The SMC is a cloud computing service equipped with the following features that enable its implementation as a service suitable for a smart device; (1) providing common components required over a wide range of mobile services, (2) enabling implementation of services quickly and at a lower cost by combining and customizing these components and (3) providing the most suitable NEC "vertical service solution" for each service. It also provides a one-stop service from service management to maintenance.

The SMC incorporates various systems for ensuring safety countermeasures for mobile devices such as a user authentication/approval system and an information leakage prevention system. The SMC, therefore, equips customers with security. Moreover, it provides a mobile payment service, a real-time notification service and a location information service. The real-time notification service provides smartphone users more chance to receive various services while the location information service supports users with advantageous information for purchases. SMC supports service providers in providing equal values to their customers regardless of time and place; which is the key feature of a mobile device. It also supports the ef-

efficient management of retail businesses by analyzing various sales conditions at EC (Electric Commerce) sites.

Optimal use of the SMC will allow service providers to implement their services with high quality and equality, quickly and economically. These features will result in the enrichment of end users' everyday lifestyles. These are significant benefits achieved by the SMC.

3. The Design and Development of SMC by Employing Design Thinking and HCD Processes

A cloud computing service platform provides a cluster of technologies that enables implementation of various services that customers expect to launch, quickly and at low cost. When designing such a platform for a cloud computing service, it is important to visualize a customer's new business by considering their services from the viewpoint of the end user and understanding end users' needs.

At the same time, in order to create various services as quickly as possible via the SMC, it is also important to establish a concept for the overall services and share it with the members of staff who are involved in the service platform development. Market trends and technologies related to services for smartphones are changing significantly and rapidly. Therefore, it is essential to choose a method for checking the requirements of users without adopting complicated procedures, so that a prototype may be created quickly and that requirements are defined at an early stage of the development process.

For this reason we have employed the processes and methods of Design Thinking in creating the SMC. The procedures and methods of the implementation are described in the following section.

3.1 Creation of the Overall Concept

First of all, we tried to complete the "Value Proposition" scheme from the viewpoint of the customer. We identified values provided by the SMC and mapped them in the scheme (see Fig. 1). In order to complete this step, we conducted interviews with stakeholders of the aiming service, and also held brainstorming sessions between HCD specialists and the staff of several departments including sales, project management, development, etc.

The results of the interviews and brainstorming sessions were classified into three different value sets: benefits from the viewpoint of customers, required conditions for achieving these benefits, and user insights (key factors hidden behind user behavior, which makes them feel that they need the service, product, etc.). After completing such classifications, the "Value Proposition" was also compiled as in the Table shown below.

The service value is shaped from the viewpoint of the customer

- Unique value that an enterprise provides end users (the reason of the customer's existence)
- Differentiation with other competitors
 - (1) Values that the customer (the market) expects to provide, and
 - (2) the customer can provide them, however,
 - (3) competitors cannot. This is a value-added service.

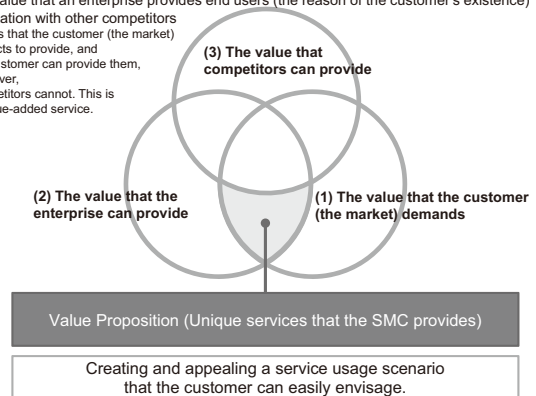


Fig. 1 Value Proposition.

Table Examples of the arrangement of values.

	Value Proposition	Insights	Emotional benefits	Functional benefits	Implementation of benefits requirements	Describing users and use scenes
Truly safe to use	Security that protects the mind, information and properties	Always safe to use	Protection awareness	Assistance by professionals (lawyer, etc.)		
				Human help via available information		
		No cheating	Intimate personal relationships without causing offence			
		No failure	Protection awareness			
	Comfort in always enabling the same approach			Elimination of erroneous transmissions		
				Similar quality to TV, PC and mobile phones		
				Similar quality communications with persons either at home or elsewhere		

Next, we have classified these benefits for different users (stakeholders) and compiled them in a scheme called "Benefits of the SMC services" (Fig. 2). We have also mapped and clearly defined the target user ranges in Fig. 3.

After all these processes are completed, several hypotheses of user groups were established by using a simplified persona to shape the image of the user group that the SMC has set as the target user group (Fig. 4). The concept of the service was then created based on the verification results and it was finalized in the "Service Concept Sheet" (Fig. 5). So that all staff members involved in the project were able to share the desired

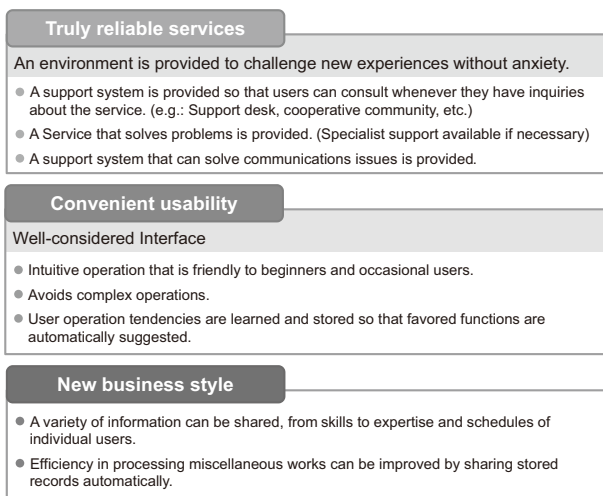


Fig. 2 Advantages of the SMC services.

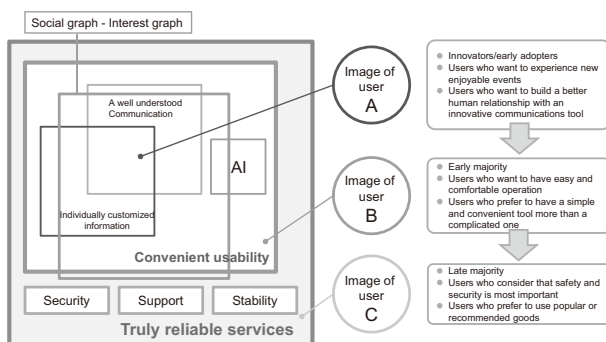


Fig. 3 The range of target users.



Fig. 4 Simplified Persona.

service image and to hold the requisite knowledge in common. Furthermore, we have compiled our ideas about the service system that have made it possible to implement the SMC ser-



Fig. 5 Service Concept Sheet.

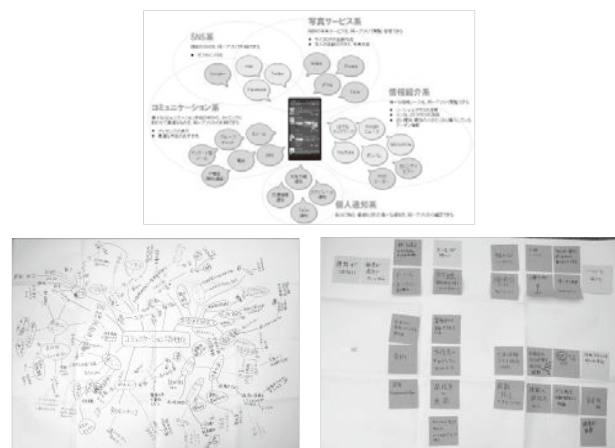


Fig. 6 Brainstorming and Mind Mapping.

vice concept. This process started with sharing ideas among all members of staff by using brainstorming and mind mapping techniques (Fig. 6). It is important to share ideas as much as possible among staff members and also to visualize them, especially for a product or business that demands significant innovation and originality. HCD specialists and UX designers have encouraged sales department staff and engineers to conceptualize as much as possible, and have classified and evaluated these ideas. Among these ideas, the ones with originality were mapped in the “Ideas Sheet” so that they could be shared among related staff members (Fig. 7).

3.2 Examining Requirements for the Newly Introduced Service and Its Prototype Development

As described so far, the SMC forms a cluster of various technologies so that different prototypes are supposed to be developed by different teams in parallel. Therefore, it is important to avoid variance in the business direction of the teams.



Fig. 7 Ideas sheets.

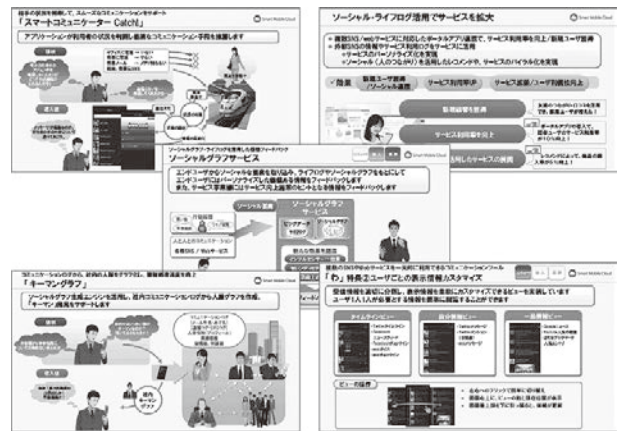


Fig. 10 Implementation scenarios.

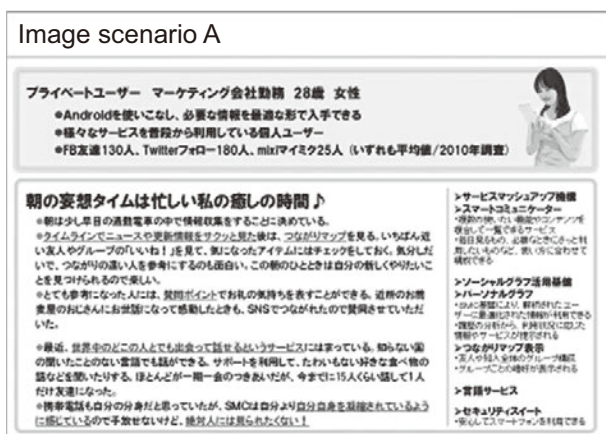


Fig. 8 User Scenario Details.

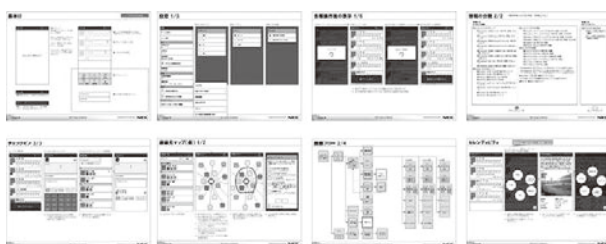


Fig. 9 Prototype development (Examining specifications and UI design).

To share a common understanding of the business concept and of the goal of the mobile cloud computing service among staff members is essential.

In order to achieve this, "Personas" and "User Scenario Details" (Fig. 8) were compiled and shared among staff members. With regard to the details of requests proposed by users, we tried to understand what the true values of the users were, and have thereby created the proposed scenarios. Based on selected ideas including ones that can be implemented easily

in the immediate future and also on ones that must wait some time before starting development, the entire concept of the ideal system was clarified by using visualized specifications. Subsequently, prototypes of the available parts were manufactured in order to evaluate the acceptability and advantages of the service (Fig. 9).

4. Advantages That Result from the Introduction of Design Thinking and HCD

The processes and methods of Design Thinking and HCD are described above, and the acquired advantages are given below.

- The development department staff and HCD specialists worked together on the system development from the early stages so that ideas could be smoothly employed in the prototype development. The developed prototype was demonstrated subsequently at exhibitions, and business meetings, etc., which helped us to compile records more specifically of the customer requests, required specifications, acceptability in the market, etc.
- The service or business implementation scenarios (Fig. 10) and the system development were provided with one-stop service solutions. Therefore, a system that corresponds satisfactorily to the needs and opinions of the customers could be developed.
- The prototype was developed at the early stage of the development process, therefore, customers could visualize scenarios of their new businesses and services. Such a strategy helped them to examine the system before deciding to introduce it.

5. Conclusion

Employing the processes and methods of Design Thinking and HCD has made it possible to complete the design and de-

velopment of SMC quickly. This strategy has resulted in the timely launch of this innovative platform.

We are now ready to provide basic common components for mobile devices, and have already started to provide purchasing and communications support services. We regard this as the initial stage of the SMC. The mobile service market is expected to expand rapidly in the future and we will catch up with any market advances and introduce new technologies and systems from the perspectives of “society” and “humans.” In order to achieve this, we will continue to create new values in collaboration with engineers and HCD specialists.

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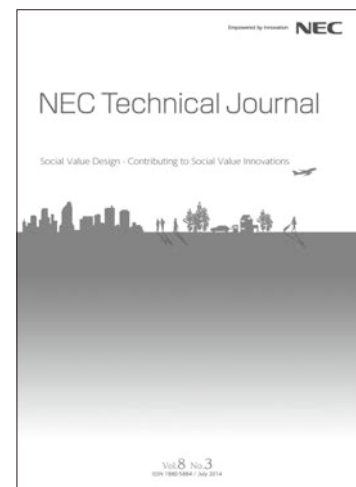
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