Smartphone Design at Fujitsu

● Mitsuhiko Kawami

The expansion of the communications infrastructure and advances in Web services, applications, and user devices are accelerating the switchover from conventional mobile, i.e., feature, phones to smartphones in Japan. However, while Japanese makers have been dominant in the development of feature phones for the Japanese market, overseas makers have been the dominant force in smartphones, and this situation is bringing about a gradual change in Japanese attitudes toward preferences and quality. This market environment calls for smartphone designs that customers find attractive, and to this end, Fujitsu needs to develop designs that embody customer values on the basis of an understanding of usage scenarios and customer preferences. At the same time, Fujitsu needs to clarify the design requirements so that the products produced reflect Fujitsu's originality and thereby make them distinguishable as a Fujitsu smartphone. This paper outlines the evolution of mobile phones, describes Fujitsu's three steps to smartphone design, the design requirements associated with each of these steps, and Fujitsu's response to those requirements. It also presents specific design examples.

1. Introduction

Internet access from mobile devices has been rising in Japan since 2008 thanks to the construction of high-speed communication environments such as 3G and Wi-Fi, the provision of always-on connections due to inexpensive, fixed-rate communication fees, and the availability of diverse service content and applications.

In addition, the switchover from conventional mobile, i.e., feature phones to smartphones has been accelerating since 2010 owing to improvements in carrier services, the evolution of the iOS/Android operating systems (OSs), and the growing number of users of social networking sites (SNSs) like Facebook and Twitter. In response to this trend, Japanese mobile device makers have been rushing into the smartphone market, which has so far been dominated by overseas makers, resulting in a rapidly growing number of smartphones that match the values and lifestyles of Japanese customers. In such a market environment, a device maker must come up with phone designs that customers find attractive and compelling. To do so, it must be knowledgeable of what makes a phone easy to use under various conditions and have a good understanding of customer preferences.

In this paper, we introduce the three main steps that we take to smartphone design at Fujitsu, clarify the design requirements of each, discuss our response to these requirements, and present specific examples of smartphone design.

2. Three steps to design

The smartphone is synonymous with touchscreen operation, which differs from the 10-key operation of conventional mobile phones. This difference has caused many users of feature phones to voice anxiety over ease-of-use when considering a switch to a smartphone. With this in mind, our objective at Fujitsu is to develop the "world's easiest-to-use smartphones" by making use of the knowledge gained in designing and manufacturing our "Raku-Raku (easy-to-use) PHONE" series of handsets and by addressing key issues in how to make touchscreen operations more comfortable and enjoyable for users.

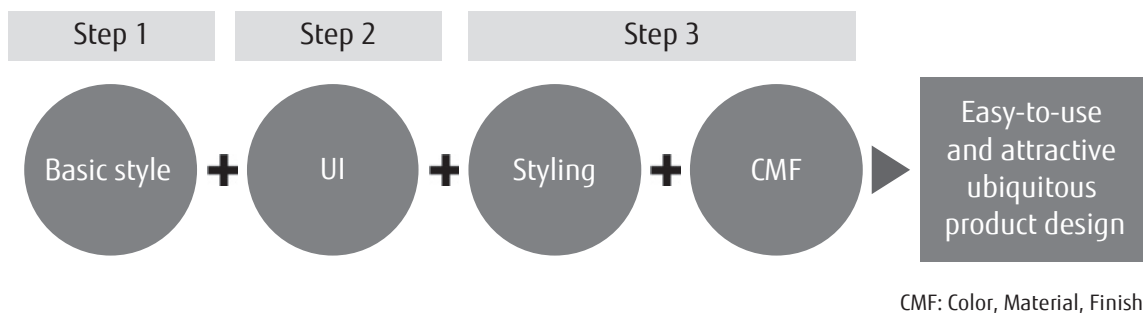To this end, we take the following three steps to smartphone design (**Figure 1**).[1]

220

FUJITSU Sci. Tech. J., Vol. 49, No. 2, pp. 220–226 (April 2013)

Figure 1
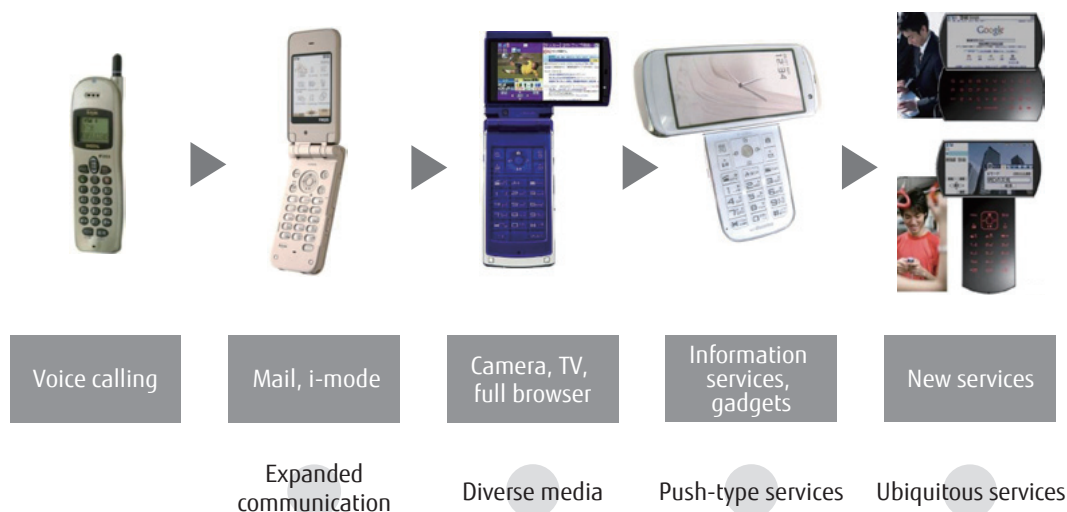**Three steps to design.**

CMF: Color, Material, Finish

Figure 2
Development of basic styles tailored to services.

- Step 1

  Create a Fujitsu "basic style" that fits information and communications technology (ICT) services and usage scenarios.
- Step 2

  Create a "user interface (UI)" that fits human psychological and cognitive characteristics.
- Step 3

  Create "styling" and "color, material, and finish (CMF)" that fits customer values and lifestyles.

We are convinced that we can provide a smartphone design that customers find easy-to-use and attractive by merging in a single product the requirements obtained from each of these steps and our way of thinking on how to best satisfy each of those requirements.

3. Smartphone basic style

The design of mobile phones as ubiquitous products has evolved toward a style that is most suitable for handling new services (**Figure 2**). The transition in mobile phone design at Fujitsu up to the present can be described as follows.[2]

In the 1990s, when voice services were mainstream, the basic style of mobile phones was the "candybar style," which made calling easy. Then, with the launch of i-mode services by NTT DOCOMO, INC. (hereinafter, DOCOMO) in 1999 and the appearance of new applications like e-mail, the "clamshell" or "folding-type" of mobile phone with a larger screen became dominant. Next, with the coming of diverse media functions and services such as one-seg broadcasting, full Internet browsing, and built-in cameras, the "swing-type" of mobile phone with a screen that could be rotated to the most suitable viewing position

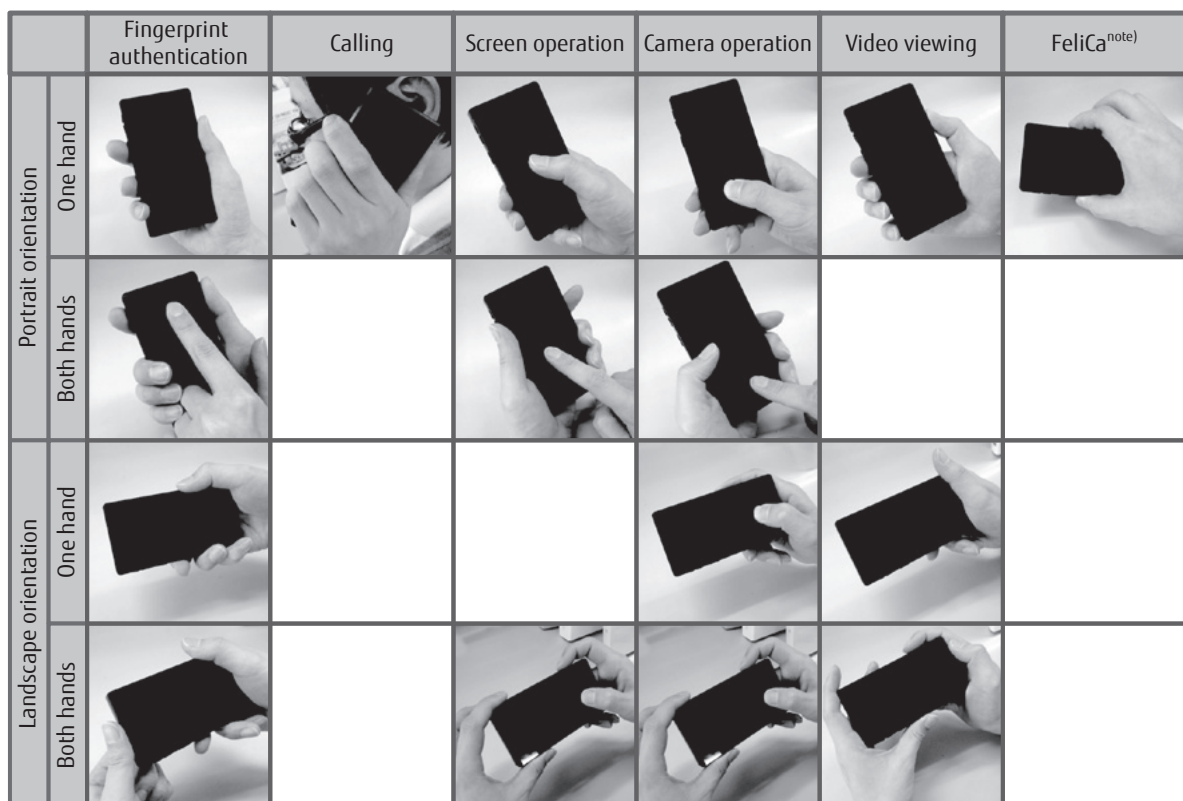FUJITSU Sci. Tech. J., Vol. 49, No. 2 (April 2013)

221

became mainstream. This style subsequently evolved into a "slide/swing-type" with a large screen to accommodate new PUSH-type services and an increase in the amount of displayed information. Then, to enable mobile users to enjoy the many and varied composite services that began to appear in 2008 (including more PUSH services plus content services, SNS services, and games), Fujitsu mobile phone design evolved into a "slate-type" touchscreen style with a large screen that met the demand for compactness and comfortable operation.

In 2010, Fujitsu announced a progression of its slide/swing style with its new series of "separable handsets" (docomo PRIME series F-04B) that enables the screen and keyboard unit to be detached from each other. Compared to the present slate-type smartphones, this separable style enables a variety of hardware options (keyboards, projectors, etc.) to be attached according to the usage scenario and purpose. In the above way, Fujitsu has been developing ubiquitous products with a basic style that evolves in parallel with the expansion of provided services. In a similar manner, smartphones must incorporate requirements that reflect a wide variety of services and usage scenarios.

Today, in smartphone design, common design policies for hardware and UI are advancing in the form of "human flow and fit," which aims for design that fits human actions and emotions. In the basic style of a slate-type smartphone, the screen takes on a variety of roles. In addition to serving as a browser, it must also serve as a pad for inputting characters and as a finder and shutter for capturing images and video. Consequently, since human behavior in this regard (the way in which a user holds and operates the smartphone and user intent in relation to such actions) changes from moment to moment depending on the usage scenario and purpose, providing a smartphone shape that goes well with the human hand (i.e., a "sense of fit") and that makes it easier to hold the handset is important in the creation of a basic style (**Figure 3**).

To achieve this sense of fit, due consideration must be given to a symmetric shape that does not

		Fingerprint authentication	Calling	Screen operation	Camera operation	Video viewing	FeliCa[note]
Portrait orientation	One hand	■	■	■	■	■	■
	Both hands	■		■	■		
Landscape orientation	One hand	■			■	■	
	Both hands	■		■	■	■	

note) Japan's original contactless smartcard

Figure 3
Typical ways of holding a smartphone.

affect the way the handset is held, edges that enable the handset to be held firmly, and a form that makes it easy to pick up the handset.

4. UI optimization based on human-centric design

The factors affecting ease of use in the case of smartphones can be divided into two main categories: those of the solid user interface (SUI) covering hardware aspects such as shape and size and those of the graphical user interface (GUI) covering the display, layout, and visual effect of icons and other elements displayed on the screen.

First, we consider how ease of use with respect to a smartphone's SUI means ease of holding the handset and ease of operation for different usage states and purposes.

At Fujitsu, we define usage state as a combination of three types of characteristics as follows:

Physical: moving, stationary, special

Action: browsing, inputting, holding, carrying

Intent: browsing related, input related, handset holding related, carrying related

These three elements can be combined with the usage purpose such as "calling" or "screen operation" to extract a variety of usage scenarios. The usage scenarios envisioned in this manner can be analyzed by asking, "Where, when, and why is the smartphone being used, how is the handset being held, and how is the smartphone being operated?" Next, on the basis of this analysis, we can optimize the arrangement of those SUI elements that affect ease of operation (such as the power key, fingerprint sensor, connectors, and volume keys), as shown in **Figure 4**. We can then perform a usability test for each of these SUI constituent elements, evaluate the position and size of each element in millimeter units, and save the evaluation results.

Finally, by applying these requirements associated with the SUI's ease of use while taking into account actual model specifications and implementation requirements, we can decide on a design that makes the operations required for any usage scenario more intuitive.

The basic design requirements for the GUI can be broadly divided into "ease of understanding," "ease of viewing," and "aesthetically pleasing."
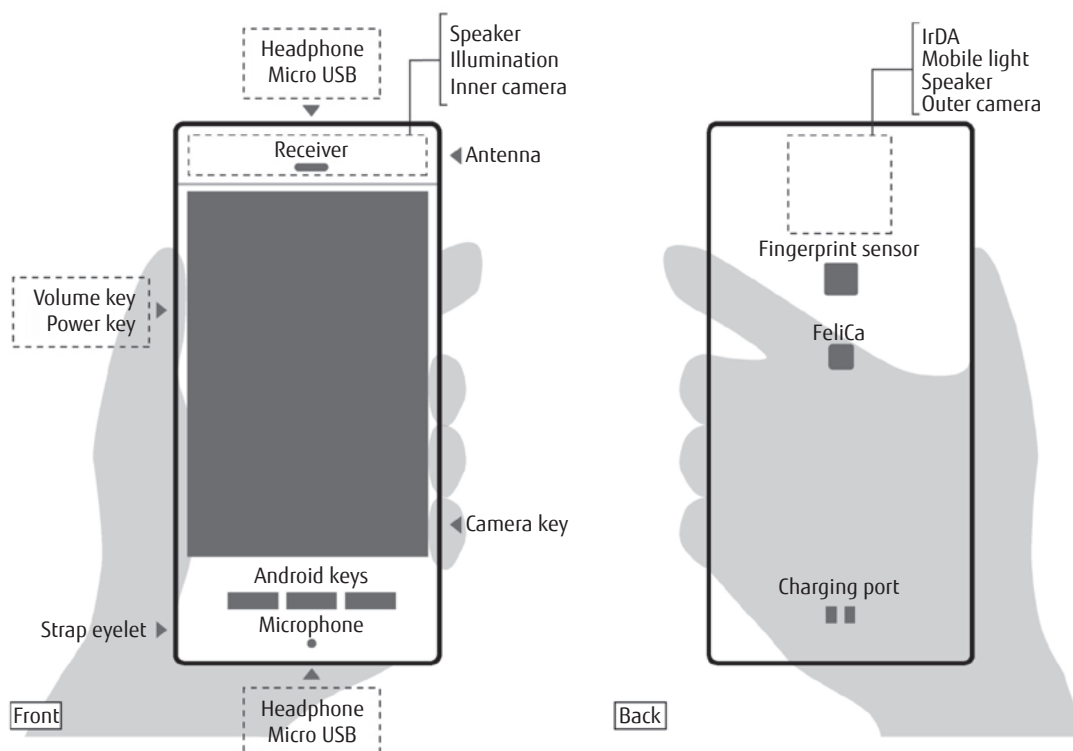

Figure 4
Optimal arrangement of SUI elements.

FUJITSU Sci. Tech. J., Vol. 49, No. 2 (April 2013)

223

1) Ease of understanding

This requirement is mainly influenced by user knowledge and experience. For example, a user confronted with a button labeled in a foreign language that he or she does not understand may respond by saying, "I don't understand how to use this button!" This problem may relate to the user's age or level of learning, but, in any case, there is a need to consider labeling buttons, menu items, content, etc. to make usage as easy to understand as possible.

2) Ease of viewing

This requirement is usually affected by physical factors such as age-related drops in visual abilities or individual color-perception characteristics. Various means must therefore be considered to make viewing easier, such as by increasing the contrast between characters and background, using a font that makes it easier to read characters without error, and providing means for changing character size to fit the target user. At the same time, ease of viewing can often be affected by the performance of the LCD panel, which means that testing for ease of viewing should be carried out under actual viewing conditions.

3) Aesthetically pleasing

Satisfying this requirement is essentially a pursuit of universal beauty. The GUI should also satisfy the user emotionally. It should feel aesthetically pleasing and be enjoyable to use without the user getting bored.

We apply these requirements to actual models, and with respect to "ease of understanding" and "ease of viewing," we provide uniformity in design and icon representation so that the user can understand the functions of icons, buttons, text-input areas, etc. with one glance (**Figure 5**). We then combine the above with matching effects, resulting in a UI with more intuitive operations that also feel exciting, such as flick actions that are easy to physically perform and master and screen effects that generate a feeling of smoothness.

5. Styling and CMF tailored to user values

Simply providing a product that is easy to use is not enough to get a customer to pick it up at a retail store, to like it, and to purchase it. In the end, it is also necessary to create a highly aesthetic design that fits customer values and lifestyles.
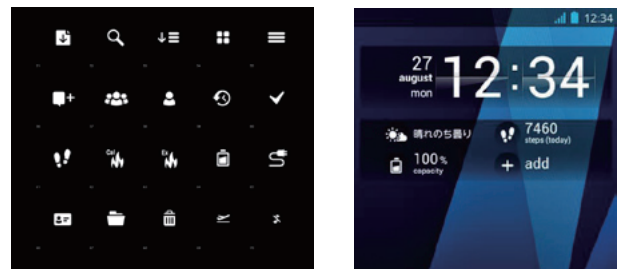

Figure 5
Uniformity in icon representation.

To this end, customer attitudes toward design both in Japan and in overseas markets must be understood, and those aspects of style that customers tend to value must be clearly reflected in design. It is also necessary to keep an eye on design trends, color trends, and future designs of competitors in order to provide a level of styling and CMF optimized for customers.

In the following, we first describe attitudes toward design and value points in both Japanese and overseas markets and then introduce lifestyles and values defined by the user segments.

5.1 Design preferences in Japanese and overseas markets

Customer preferences in Japan are dominated by the idea that a mobile phone or smartphone is an "accessory that choreographs my life." As a result, customers tend to like decorative and emotive designs that "feel novel," "match one's lifestyle," and "have preferred colors." Designs can therefore cover a wide range of styles from linear, simple styling to curvy, softer styling while having a wide variation in colors.

For this reason, "common elements" that would be uniformly applied to reflect a product brand are relatively few while designs that strongly reflect the marketability of a product in terms of customer values are many.

In contrast, customer preferences in overseas markets are greatly affected by the idea that a conventional mobile phone or smartphone is, in the end, a "tool" for performing basic tasks like making telephone calls and sending e-mail. Customers in these markets therefore tend to like practical designs that make a handset "easy to hold," "difficult to break when dropped," and "slip-resistant." Styling here has therefore been dominated by round shapes having an integrated feel that take into account a good fit with the hand and by product

224

FUJITSU Sci. Tech. J., Vol. 49, No. 2 (April 2013)

durability. As for CMF, the aim here has been to reflect a "practical tool with a high-class image" that combines a metallic texture with black or other dark tones with a rubbery feel that resists slippage. Additionally, while there are products with different types of marketability (in terms of price, target users, functions, performance, etc.), there are also common elements that reflect a company's brand (logo, basic shape, distinguishing elements, key shapes, CMF, etc.). In short, each company tends to create a "family design" as a brand product group. The reason given for this is that customers place more importance on brand than on individual differences in product marketability.

As described above, preferences differ widely depending on the destination market (Japan or overseas) and customer values. How to go about clarifying the values and lifestyles that characterize each market is therefore an important issue in styling and CMF.

5.2 Perspectives on application and specific design examples

We present in the following subsections two design examples that portray how Fujitsu's smartphone design requirements and ways of thinking about design as described in the previous sections have been applied to the development of actual commercial products.

To create a foundation for "ease of use" as a common feature of Fujitsu smartphone products, we treat the "sense of fit," as described in the section on "basic style," and optimally arranged GUI elements, as described in the section on "UI optimization," as common requirements for smartphone design and apply these requirements to all products.

We then overlay "styling" and "CMF" on this foundation to embody customer values in accordance with various types of product marketability and treat the result as a Fujitsu smartphone design.

While preserving the common requirements to optimize design, we modify styling and CMF for each destination market in accordance with customer design preferences and the importance customers place on the brand.

5.3 Application example: design of docomo NEXT series ARROWS X F-10D

The F-10D smartphone (**Figure 6**) was put on sale through DOCOMO in July 2012. It is considered

Fujitsu's flagship smartphone model, succeeding the F-05D model that went on sale in December 2011. The F-10D targets customers who always want the latest technology in their hands, and Fujitsu expects most of the purchasers to be people who have a high level of information-communications literacy. With a high-performance chip set and advanced network functions for enjoying new services and content, the F-10D is set to provide users with a rich and exciting mobile life.

With this model, Fujitsu took customer value to mean "extreme cutting-edge" and sought to create a new image that would make a clear departure from previous smartphone designs. To this end, each of the four corners of the enclosure was given a cut-like design in contrast to the round or square-shaped corners common to past designs, thereby creating a new style with a polyhedral shape and an impressive, futuristic look. This design was combined with a firm, curved back that ensures a sense of fit with the hand while generating a sense of tautness. Then, in terms of CMF, the paint was mixed with fine glass particles and the body of the handset was painted in graduated shades to more effectively generate a three-dimensional effect. By combining this styling and CMF, Fujitsu was able to create a high-tech, futuristic design heretofore unseen.

Figure 6
ARROWS X F-10D.

Figure 7
ARROWS Kiss F-03D.

5.4 Application example: design of docomo with series ARROWS Kiss F-03D

The F-03D smartphone (**Figure 7**) was put on sale in November 2011 targeting users who would like to choose a smartphone in the same way as an accessory. Fujitsu envisions most purchasers of this product to be people whose usage patterns center about information retrieval and communication with friends. Designed as a glittering, elegant smartphone befitting the concept of "product as accessory," the F-03D provides ease of use and a convenient size while incorporating "eye-appeal" elements.

With this model, customers were seen as favoring glamour and cultivation, as in jewelry, and the design objective was to create a feeling of glitter and shine emanating from the entire smartphone. To this end, a "round form" was adopted in terms of styling to generate a classy impression while enabling the handset to fit neatly in a smaller hand. In addition, the front buttons were given a "gem-cut" design and made to light up and sparkle through background illumination in response to certain events. The back of the handset was also designed with an illumination function so that the area near the user's ear will appear to sparkle, making for another enjoyable feature. In addition, the periphery of the enclosure is subjected to a vapor-deposition process to produce a shiny look, and full-gloss paint mixed with abundant glass particles is used to accentuate the round form. The end result is a smartphone design that effectively conveys a sense of class and

flamboyance. Fujitsu has thus created a smartphone with features that will appeal to people who value an attractive appearance.

6. Conclusion

In this paper, we described how Fujitsu takes three steps to smartphone design. These steps reflect the requirements for hardware design and UI design in smartphones, Fujitsu's way of thinking about satisfying these requirements and developing actual products, and specific examples of smartphone design. The design process is not simply a matter of satisfying all common requirements since there are always tradeoffs among specifications, implementation conditions, and other requirements. We thus plan to repeatedly test design requirements in the development of future models with the aim of providing our customers with the easiest-to-use smartphones.

Looking forward, we can expect smartphones to evolve at an accelerated pace in parallel with technical innovation and the rapid creation of new and compelling services. To fulfill their role as a front end supporting the "Human-Centric Intelligent Society" promoted by Fujitsu, smartphones must become even more integrated and supportive in the lives of people. At Fujitsu, we feel that our mission in smartphone design is to use the steps outlined here to create new basic styles, provide optimal UIs, and deliver products scoring high in customer satisfaction to people around the world.

References

1) Y. Ueda and K. Matsumoto: Human-Centric Design Approach for Ubiquitous Products. *FUJITSU*, Vol. 61, No. 2, pp. 206–214 (2010) (in Japanese).
2) Y. Ueda: Proposal for Service-Oriented Design Processes. *Fujitsu Sci. Tech. J.*, Vol. 45, No. 2, pp. 171–178 (2009). *http://www.fujitsu.com/downloads/MAG/vol45-2/paper08.pdf*

Mitsuhiko Kawami
Fujitsu Design Ltd.
Mr. Kawami is engaged in the design of smartphones.