Fujitsu's Approaches to Developing Smartphones

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Amid a paradigm shift from feature phones to smartphones, Fujitsu acquired the top market share in Japan as a vendor of mobile phones with its quick deployment of 11 smartphones for NTT DOCOMO, INC. and KDDI CORPORATION in 2011. While maintaining this strong domestic market position, Fujitsu is aiming to enter global markets in earnest with Raku-Raku SMART PHONEs in 2012. Fujitsu smartphones are founded on two of the company's strengths. The first is the company's technologies–its phones have the best features in the industry because they adopt the latest and fastest platform, they have leading radio technology, and they use Fujitsu's unique technologies that it has cultivated so far, such as human perception technologies for good visibility of displays, good audibility of phone calls, and comfortable touchscreen controls. The other is the company's excellence in manufacturing within factories that are located in Japan. Furthermore, Fujitsu keeps improving its software development ability to use open-source technology which is necessary for smartphone platforms such as Android OS. This paper introduces Fujitsu's smartphone strategy that utilizes these strengths and also its approach to developing new markets.

1. Introduction

With the emergence of the iPhone and the iPad as a turning point, the mobile phone business is undergoing a major paradigm shift from feature phones to smartphones (including tablets) and the Japanese mobile phone market is making a rapid shift to smartphones at a pace exceeding that of the worldwide market (**Figure 1**).

Smartphones are not only positioned as consumer products but also have a role of a ubiquitous front that supports a Human-Centric Intelligent Society. As a new group of products different from feature phones, their market is expected to expand.

Fujitsu was quick to shift its focus to smartphones and has worked on development to establish a firm position, as it has enjoyed with feature phones. In addition to the existing NTT DOCOMO, INC. (hereinafter DOCOMO) market, we entered the KDDI CORPORATION (hereinafter KDDI) market in 2011 by integrating our mobile phone business with that of TOSHIBA CORPORATION (hereinafter TOSHIBA). We brought 11 smartphone models to market, which is the largest number among all Japanese manufacturers, and acquired the top market share together with feature phones.

This paper presents the elemental technologies that form the basis of the features of Fujitsu smartphones whose domestic market share we have successfully increased, approach to improving our development efficiency, and methods of production innovation from the perspective of manufacturing. It also describes the development of new markets and possibility of business that makes use of smartphones as a ubiquitous front.

2. Fujitsu's smartphone strategy

In response to changes in the business structure that result from the rapid shift to smartphones, we have formulated three pillars for a business strategy to further expand the mobile phone business in the future.

1) Strengthening of business in Japan

In addition to the existing DOCOMO and KDDI markets, we entered the SOFTBANK MOBILE Corp.

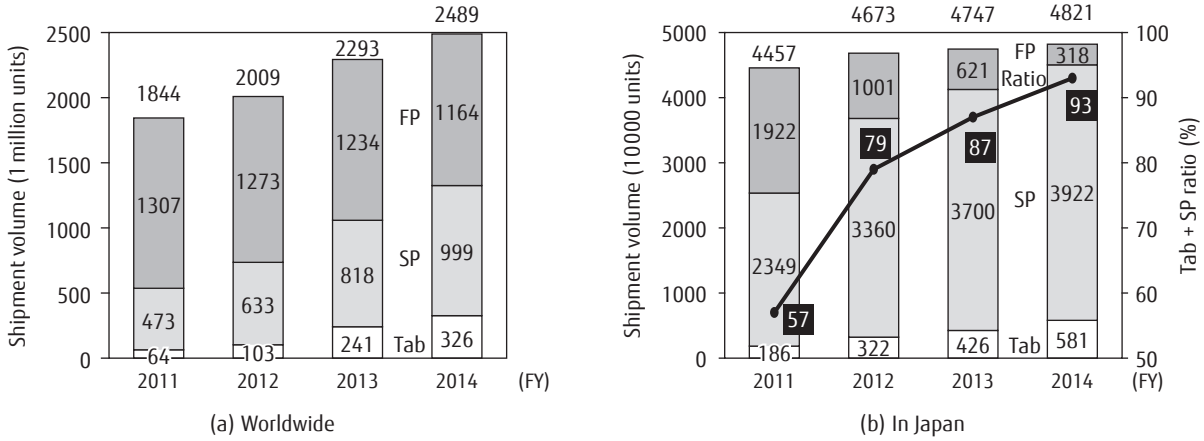

Figure 1
Forecast for mobile phone market.

(hereinafter SOFTBANK) market to firmly establish our position in the Japanese market.

Specifically, we will launch a full line-up of models including Raku-Raku SMART PHONEs in the DOCOMO market and actively propose products to other carriers so that we can ensure a certain volume of sales, thereby steadfastly maintaining our top share in the domestic market.

2) Full-scale entry to global market

By targeting the senior market, we will enter our target markets with Raku-Raku SMART PHONEs in FY 2013, and we will gradually expand those markets.

At the same time, we will further cooperate with Fujitsu's overseas bases so that we can enter the corporate market, which has the potential to expand in the medium to long term.

3) Development of new markets as ubiquitous front

In addition to business models with handsets alone, we will aim to launch a handset-based new business model by combining products with hardware and services.

To that end, we will offer handsets that support various applications in accordance with the expansion of business areas as a ubiquitous front and work on developing new markets.

3. Features of Fujitsu smartphones

1) Wide variety of products

Fujitsu smartphones adopt three-tier architecture. Specifically, there are functions common to all models including top performance operations achieved by fundamental technology and ultimate user-friendliness based on Fujitsu's unique human-centric technology. On top of this are features which are added according to users' preferences and usage situations as new value for the respective models. In this way, we have developed a wide range of products that meet diverse user needs (**Figure 2**).

In FY 2011, we not only launched the ARROWS brand but also brought out a line-up of products that fill varying needs. They include high-end models that were among the first to support DOCOMO's Xi service, models for female users, thin and water-resistant models, REGZA Phone, Disney-collaborated smartphone, high-speed WiMAX handset for KDDI and the world's first model integrating Windows Phone 7.5, and they have won praise from the market (**Figure 3**).

2) Industry's top basic performance

We introduced a leading-edge platform before others and optimally customized it to Fujitsu's proprietary hardware so as to achieve the industry's top performance.

As hardware platforms, we have led the adoption of multi-core processors in Japan (dual-core in FY 2011 and quad-core in FY 2012) and achieved products with the smoothest operational feel in the industry. As software platforms, we have adopted Windows Phone 7.5 for the first time in the world in addition to Android OS to meet diverse user needs.

In the future, we intend to continue to quickly

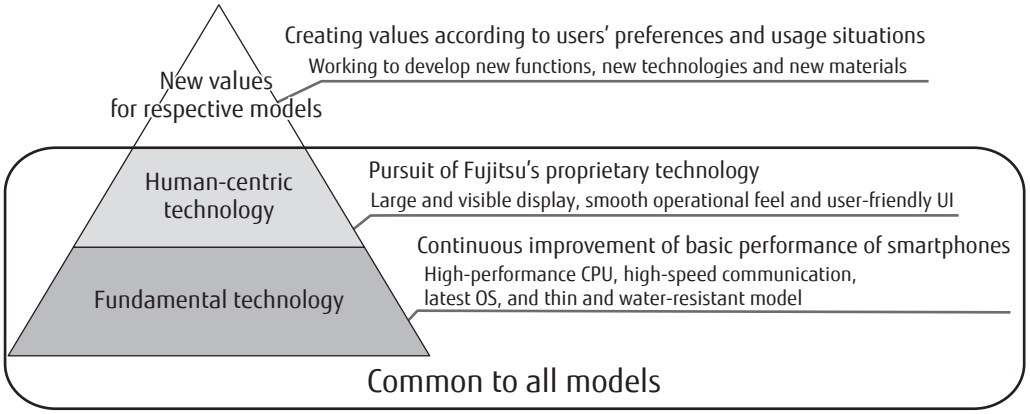

Figure 2
Smartphone architecture.

	First half	Second half
NTT DOCOMO		ARROWS X LTE F-05D — All-in-one, high-spec, water-resistant smartphone
	NEXT series	ARROWS μ F-07D — Ultra-slim, water-resistant smartphone
	F-12C — Compact, water-resistant smartphone	REGZA Phone T-01D — REGZA Phone
		ARROWS Kiss F-03D/Girls' — Water-resistant smartphone for women
	with series	Disney Mobile on docomo F-08D — Disney-collaborated smartphone
	tablet	ARROWS Tab LTE F-01D — World's first water-resistant LTE tablet
KDDI	REGZA Phone IS11T — REGZA Phone	ARROWS Z ISW11F — WiMAX, high-spec, water-resistant smartphone
	Windows Phone IS12T — World's first WP 7.5 smartphone	ARROWS ES IS12F — Ultra-slim, water-resistant smartphone

Figure 3
FY 2011 smartphone line-up.

determine the industry trends and seek to adopt the latest platform of the age (**Figure 4**).

3) Product deployment centered on proprietary radio technology

A radio platform is used that brings together the world's first-class radio technologies that have undergone continuous development since the first-generation FOMA handsets. In research conducted by ITmedia[1)], ARROWS Z and ARROWS X placed first and second in the industry in terms of download traffic speed (average of the values measured in three locations in Tokyo), which shows that consumers appreciate Fujitsu's ability.

In the future, we intend to make use of software-defined radio (SDR), a next-generation radio technology, to accommodate a wide variety of wireless systems for overseas markets while also deploying products in Japan (Figure 4).

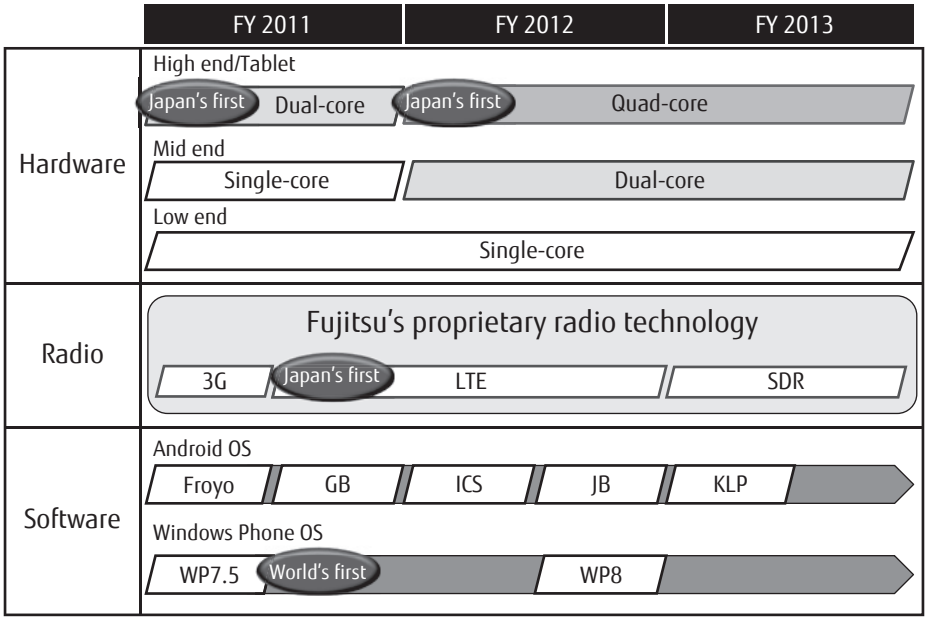

Figure 4
Platform roadmap.

4) Ultimate user-friendliness

We offer ultimate user-friendliness that distinguishes us from our competitors by taking advantage of proprietary technologies such as displays with good visibility, phones where the speaker's voice is very audible, comfortable touchscreen controls, and peace of mind combined with convenience, which we have cultivated with feature phones and Raku-Raku PHONEs. We have integrated these technologies into an LSI as Human-Centric Engine (HCE) and mounted it in smartphones, thereby achieving user-friendliness comparable to or higher than that of feature phones and Raku-Raku PHONEs.

From now on, we are committed to making products that further conserve power and have even higher performance, and making Fujitsu's proprietary UI even easier to use so that we achieve the "most user-friendly smartphone in the world" (**Figure 5**).

In addition, we will continue to work on providing the water-resistant feature that is a synonym for Fujitsu mobile phones for all models, and work to reduce size and thickness in the same way as with feature phones.

5) Support for various usage situations

We have improved the usability of our handsets by accommodating various usage situations of customers by offering diverse functions. They include the top-level image representation in Japan achieved by the REGZA Engine and a variety of consumer electronics linking functions by REGZA LINK, which have been made available by business integration with TOSHIBA. They also include Japan-specific functions (so-called "Galapagos phone functions") essential for feature phones including IR communication, One-seg broadcasting TV and Osaifu-Keitai as well as a function to link a handset with a car navigation system.

We will continue to provide functions by considering new situations in which customers use our products.

4. Approach to strengthening of development ability

As we are now in the smartphone age, competition with global vendors is intensifying. In such a business environment, we urgently need to enhance our development ability so that we can be competitive in the global business market.

1) Strengthening of software development ability

Feature phone development was carried out in a closed environment in which most software functions were developed in-house. In contrast, smartphone development is increasingly taking place in an open environment based on open-source software (OSS) such as Android. In such an environment, a company's

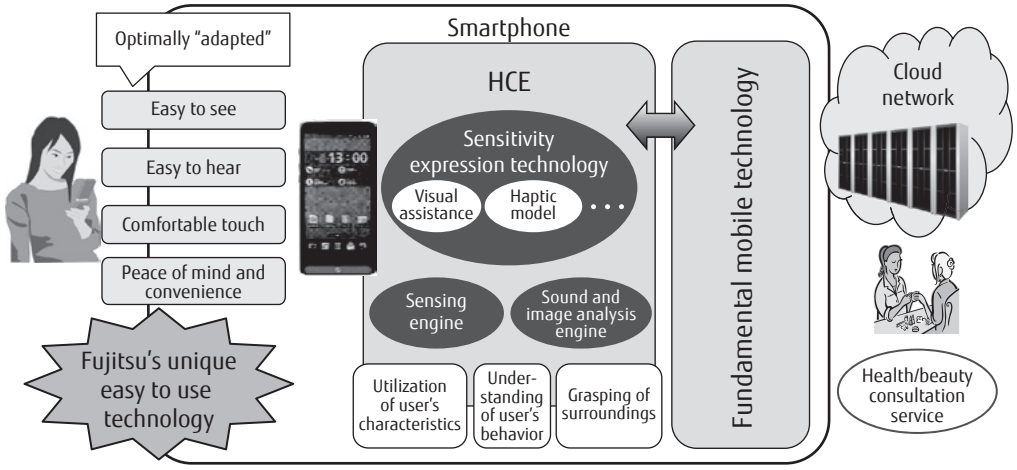

Figure 5
Overview of Human-Centric Engine.

software development ability plays a key role in its product competitiveness, and Fujitsu is also working hard to enhance its ability.

First, we brought together Android engineers from the outside as well as in-house as immediate contributors to move ahead with the development of models which were shipped in FY 2012. Furthermore, we intend to share and extend the technological know-how gained in the process to increase the number of Android engineers in the medium to long term.

2) Strengthening of hardware development ability

Hardware development is also becoming increasingly open and many global chip vendors provide hardware platforms based on CPUs that run Android OS. To ensure these platforms run quickly and have high-performance operations, the board support packages (BSPs) offered by the chip vendors must be optimally customized to Fujitsu smartphones. For that purpose, we have cooperated with chip vendors in the Global Development Center, which is one of Fujitsu's offices in the USA, to drive joint development in an integrated manner from the initial phase of development to platform development and customization for Fujitsu. This has allowed us to pursue improved development efficiency and a higher degree of completion of platforms (**Figure 6**).

3) Improvement of development efficiency by common development

To develop smartphones that meet diverse needs in a short time and with stable quality, it is essential to

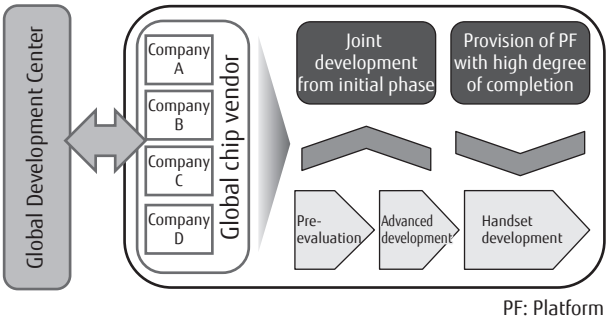

Figure 6
Utilization of Global Development Center.

improve the efficiency of development of hardware and software. For that purpose, we use common hardware except for the carrier-specific wireless block and generic software common to all models. This common hardware contains BSP drivers, Linux kernel and Android block as well as Fujitsu's proprietary application software including HCE functions. We thereby reduce development volume and stabilize quality. On top of this common block, application software for the respective carrier is implemented to minimize the specific development segment and improve development efficiency (**Figure 7**).

5. Approach to manufacturing/ production innovation

To overcome the competition from global vendors, we must have an excellent manufacturing and production ability that compares favorably with that of

overseas original design manufacturing (ODM) vendors while also strengthening our development ability.

To that end, Fujitsu Mobile-phone Products Limited and FUJITSU PERIPHERALS LIMITED, which are manufacturing bases in Japan, are working on establishing the Fujitsu standard production system in order to achieve high efficiency that outstrips overseas ODM vendors (**Figure 8**).

1) Test procedure innovation

We established a test system not affected by the start-up of Android OS or product application operation by running test commands independently from Android OS. This allows testing to be stabilized and the test time to be reduced, improves the yield rate of testing, and improves our production capacity.

2) Automation/robotization

We combine our strengths in design and manufacturing to save labor by, in addition to robotization in the assembly process, developing jigs that allow testing to be automated and improved design standard into that facilitating automation by means of design for manufacturing (DFM).

3) Reinforcement of the ability for trial manufacture/evaluation

We reinforce the automated line by test procedure innovation and automation/robotization to realize improved trial manufacture/evaluation ability. This allows test systems to be built quickly and stably and allows us to vertically start up mass production.

4) Manufacturing/repair standard

We drive automation of manufacturing and improve repair efficiency and reduce lead time by standardizing the results of DFM.

By organically linking the four approaches above and our quick response to variations in market demand by synchronizing manufacturing and the production system, we intend to realize the Fujitsu standard production system as an ideal of manufacturing and production in the future.

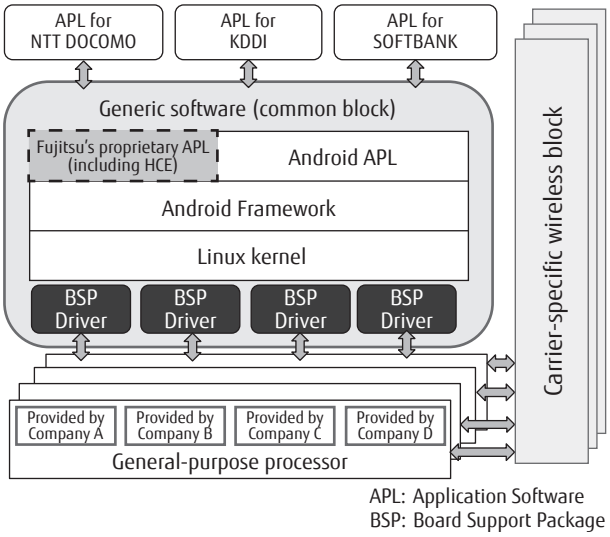

Figure 7
Common development methodology.

6. For development of new markets

Fujitsu is a comprehensive ICT manufacturer and aims to be a "technology-based, globally integrated service company" with its full-stack strategy encompassing devices and solutions.

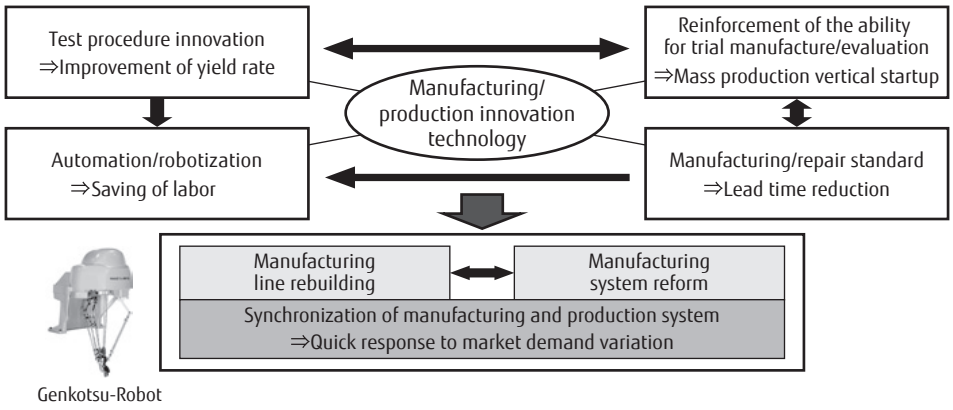

Figure 8
Manufacturing process using Fujitsu standard.

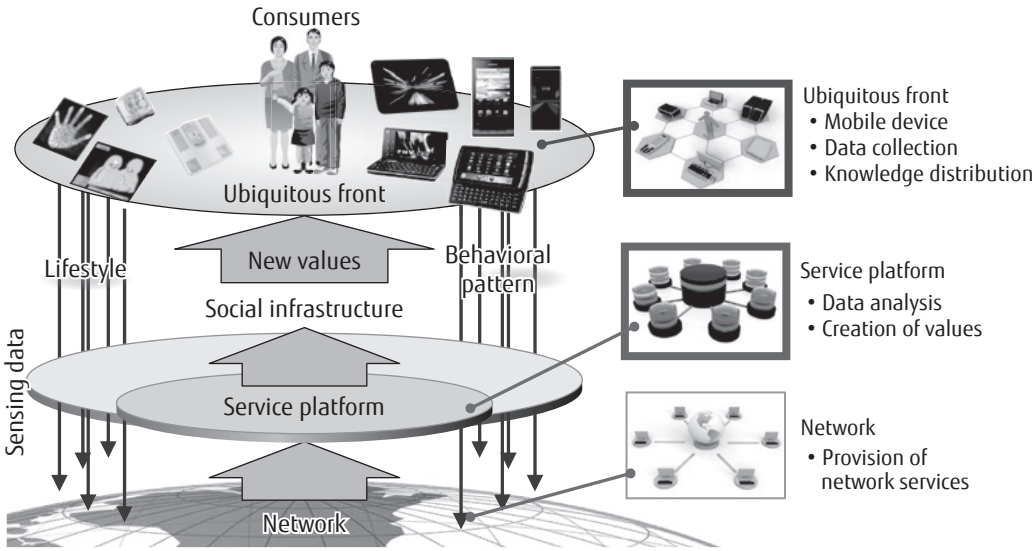

Figure 9
New markets for ubiquitous front.

In this strategy, smartphones are positioned as customers' ubiquitous front and they must continuously offer new values.

To that end, we intend to make use of Fujitsu's proprietary HCE integrated in smartphones and tablets to develop services for consumers and corporations based on Cloud federation, thereby creating new markets. We also plan to use Raku-Raku SMART PHONEs to offer new services targeting digital seniors[note] (**Figure 9**).

7. Conclusion

This paper has presented Fujitsu's smartphone strategy including their features; approaches to improving development efficiency; manufacturing and production innovation; and development of new markets. We are committed to continue working so that we can pursue all possibilities and provide the most user-friendly smartphones in the world that make all customers happy.

note) Seniors who have a flawless command of PCs, mobile phones and smartphones and are actively using the Internet.

References

1) ITmedia: A Complete Comparison of the Latest Smartphones (2011 Winter/Spring Models) Part 3: Comparison of Traffic/Start-up Speed between 35 Models–Which is the "fastest" model? (in Japanese). *http://plusd.itmedia.co.jp/mobile/articles/1203/29/news081.html#l_st_sfc-04.jpg*

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