

Development of Windows Phone Devices at Fujitsu

● Satoshi Nishimura ● Akinobu Ueda

Fujitsu achieved a world's first in applying the Windows Phone 7.5 as a mobile device platform and marketing a smartphone running this OS. In a smartphone market dominated by iPhone and Android devices, Fujitsu, in addition to developing Android products, began from early on to investigate the development of Windows Phone devices that take advantage of the innovative features of this OS. It is now developing its own smartphones of this type on the basis of a common understanding with Microsoft on policies governing product development and the application of original technologies. In this development, Fujitsu is implementing original specifications on top of Windows Phone while achieving impressive performance, power-saving features, and operations stability (quality). It is satisfying Microsoft requirements and evaluation criteria for smartphone peripheral devices and interfaces and ensuring software stability and the robustness of security measures. This paper describes Fujitsu's approach to developing and expanding a third smartphone platform as an addition to Android and iOS.

1. Introduction

In the current smartphone market, the lineup of products based on the Android platform is expanding rapidly. These products boast high affinity with the Internet and high multimedia performance as well as larger screens, all of which are driving end users away from phones with conventional features.

Against this background, Fujitsu placed the first smartphone in the world to run Windows Phone 7.5 on the Japanese market in August 2011 through KDDI Corporation. Named the "IS12T," this smartphone combines the basic functions provided by Windows Phone 7.5 with compelling functions and features that distinguish this smartphone in the market. These include high-end hardware features such as a 13.2-megapixel camera, 32 GB of built-in memory, and a water-resistant, dust-resistant structure as well as Fujitsu's proprietary audio technology.

The smartphone market is currently dominated by Android and iPhone devices, but there are expectations that Windows Phone will become a third major platform owing to the advantage of being linked with the accumulated assets of the Windows PC platform.

Fujitsu is working to ensure the superiority of Windows Phone technology.

In this paper, we describe specific technical features achieved in the course of developing products running Windows Phone 7.5, explain how the Windows Phone platform differs from the Android platform, and touch upon next-generation Windows Phone products slated for future release.

2. Windows Phone features

The user experience provided by Windows Phone is centered about the service concept of a "hub." With Windows Phone, the user can select People Hub, Pictures Hub, Office Hub, Music+Videos Hub, Games Hub, or Applications Hub depending on what he or she would like to do. Each of these hubs enables the user to access and download all information related to that hub's category from a single screen ("one place") using intuitive operations. These hubs are summarized below.

1) People Hub

People Hub (**Figure 1**) integrates and displays contact information for multiple e-mail accounts such

as Google mail (Gmail) and Outlook.com (formerly Hotmail) and information from social media accounts such as Twitter and Facebook. When the user is checking mail received from friend A, for example, the People Hub will display updated information for that person from Twitter, Facebook, and other social media platforms all on the same screen. The user can therefore obtain the latest information for that friend from various available sources. With conventional services, the only way for a user to check all of the latest information for friend A is to separately open individual applications such as e-mail and Twitter and make the rounds of each. People Hub, in contrast, provides the user with a mechanism to check all information for friend A from one place.



Figure 1
People Hub screenshots.

2) Pictures Hub

Pictures Hub can display photos and videos stored on the smartphone as well as those on a PC and on the Web, all in one place. Photos and videos stored in folders on the smartphone, on a PC (within folders on a Windows machine), and on the Web (Microsoft SkyDrive) are all tied together through an integrated ID called Windows Live ID. This makes it possible to browse one's photo/video collection from a single screen (hub) instead of visiting each photo/video storage location one at a time. Pictures Hub also enables the user to upload photos and videos to a social networking site (SNS) from a single screen.

3) Office Hub

With Office Hub (Figure 2), the user can view and edit Office files and use Office tools like OneNote for taking notes even with photos and audio clips included. This hub handles Office files in such a way that they are always synchronized after an update regardless of where they are stored.

4) Music+Videos Hub

Music+Videos Hub (Figure 3) enables the user to view and play back photos and videos captured with the smartphone, to play back music files and podcasts, and to listen to FM radio. By synchronizing the smartphone with a PC (Windows or Mac OS machine) running Microsoft's Zune client software, this hub enables the user to manage from a single screen a music/video usage and playback environment that is always up-to-date.



Figure 2
Office Hub.

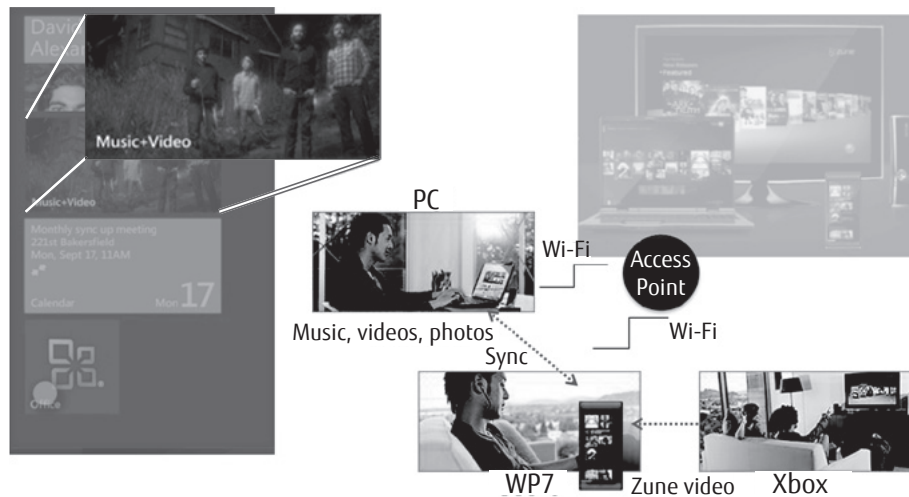


Figure 3
Music+Videos Hub.

5) Games Hub

Games Hub enables the user to connect to Microsoft's Xbox Live and play games and to use Xbox 360 games too.

6) Applications Hub

Applications Hub acts as a gateway to Microsoft's application (app) store called Marketplace.

3. Development of Windows Phone devices

Mobile devices running Windows Phone must be developed in conformance with Microsoft's "chassis specification" specifying hardware requirements. This specification stipulates requirements and performance targets in relation to the chipsets supported by the OS and the peripheral-device functions that the smartphone must have.

Only Qualcomm chipsets have so far been supported. In the time between completing development of a Windows Phone OS and releasing it to device makers, Microsoft performs thorough testing by combining the OS with basic chipset software provided in the form of a board support package (BSP). This process ensures that Windows Phone functions are complete and stable, which means that a device maker can concentrate its resources on developing features and functions that will differentiate its smartphone products from those of competitors.

Windows Phone is based on a globally common

set of specifications that include support for 50 languages, including Japanese. Microsoft provides the OS and Adaptation Kit (a set of standard Microsoft applications) in binary form to makers. Development work at a maker is therefore limited to hardware-related drivers (which can be developed in either kernel space or user space depending on the application) and to applications and middleware running on top of the OS.

What this means is that a device maker cannot independently extend or replace OS internal operations or functions of standard applications. However, as reflected by the support provided for 50 languages, Windows Phone has been developed for mobile phone operators doing business throughout the world, and for this reason, Microsoft allows makers to customize some OS operations and standard applications. A device maker can therefore support a variety of services while satisfying common specifications by setting the menu items and initial parameter values supported by the destination mobile phone operator at the time of factory shipment.

Turning to the Windows Phone user interface (UI), Microsoft has placed the highest priority on achieving a stress-free user experience by providing intuitive operations that anyone can perform.

Up until now, most mobile phones and smartphone menu items like "Save" and "Quit" have been expressed in text form. Windows Phone, in contrast, adopts a text-free design, making use of universal

design symbols. This is similar to the way major subway systems in the world, such as those in the United Kingdom, France, and Japan, use specific colors and symbols to make their information and guidance displays easy to understand regardless of language or age group. This is why Windows Phone is said to have a "Metro" UI. Additionally, a Windows Phone user may arrange application "tiles" as desired on the home screen. Specifically, each tile may be fixed somewhere on the screen as if attaching it with a pushpin, and each application can be called by simply tapping its tile.

Much importance has also been placed on providing a pleasant sensation when making transitions between menus or when performing finger-based flick operations by providing smooth and slick representations of those actions.

In addition to the above, Fujitsu is designing and developing its Windows Phone devices with an emphasis on crisp, stress-free operations achieved by using a variety of techniques. These include heightening the sense of interaction by tracking finger movement as if the touchscreen was "biting" into the finger, optimizing the response of button operations to eliminate stress, and shortening the phone's power-up/boot time.

Fujitsu's "Super HAKKIRI VOICE (super-clear voice) 3" audio technology and "Milbeaut Mobile image processor"¹⁾ were implemented for the first time as original add-on functions in the IS12T Windows Phone for KDDI.

The Super HAKKIRI VOICE 3 technology makes it easier to hear the other party's voice in a crowded environment. It has been used extensively in Fujitsu's FOMA mobile phones and ARROWS series of Android smartphones.

The Milbeaut Mobile image processor performs quick high-resolution image processing and makes it easy for users to take high-definition still pictures and video using the 13.2-megapixel camera mounted on the IS12T phone.

The most outstanding feature of Windows Phone is that it provides a smooth communication environment for people who want to converse with others using the People Hub or Pictures Hub as a starting point. Yet, as described above, Windows Phone also provides basic functions that are intuitive and easy to use, basic operations that are crisp and pleasant, telephone calling in which voices are easy to hear, and stress-free, high-performance picture taking and video capture.

The IS12T Windows Phone developed by Fujitsu is a highly cloud-oriented smartphone that is thoroughly adept at using cloud services. It can immediately send images captured with the phone to other people via Twitter or share them on SkyDrive.

4. Development tools for Windows Phone apps

Windows Phone apps may be developed by anyone and distributed for worldwide use from the Marketplace app store managed by Microsoft.

Microsoft provides the Windows Phone Software Development Kit (SDK) 7.1 free of charge for developing Windows Phone apps. This SDK includes a complete development environment with all of the tools needed to develop apps, as listed below.

- Microsoft Visual Studio 2010 Express for Windows Phone
- Windows Phone Emulator
- Windows Phone SDK 7.1 Assemblies
- Silverlight 4 SDK and Developer Regression Tests
- Windows Phone SDK 7.1 Extensions for XNA Game Studio 4.0
- Microsoft Expression Blend SDK for Windows Phone 7
- Microsoft Expression Blend SDK for Windows Phone OS 7.1
- WCF Data Services Client for Windows Phone
- Microsoft Advertising SDK for Windows Phone

A Windows Phone app must be described in a development language called Silverlight. A developer can visit the Microsoft Development Network (MSDN) technology portal to learn about various techniques for developing Windows Phone apps, view development samples, and obtain guides for porting apps from iPhone and Android.

The SDK comes bundled with an emulator that can be run on a PC for debugging apps under development. This emulator enables the developer to perform app testing centered about a graphical user interface without having to use an actual device. However, game apps that require communication or sensor functions must be tested on actual equipment.

To distribute apps from Marketplace, a developer must obtain a developer account through a 12-month MSDN subscription. Apps may be created in a free or paid format while advertisements may be embedded in

apps and games. A developer may submit an application for registering an app on the Marketplace from the Windows Phone Dev Center, and a user may directly download a registered app to his or her Windows Phone device from the "Marketplace" menu on the phone.

There are currently more than 100 000 registered apps that can be downloaded from Marketplace,²⁾ and the number has been increasing dramatically since the beginning of 2012. This rapid increase in available apps parallels the transition from Windows Phone 7, which was sold in only limited regions in 2010, to Windows Phone 7.5, which is targeted for sale in about 50 countries.

Windows Phone apps are linked with users' Windows Live IDs for the sales region of those apps. Among the many apps that can be downloaded with the Windows Live ID for Japan, there is still only about 1000 that have been converted to Japanese, with most of the rest being apps in English. There are therefore a great number of fine, overseas apps that can be easily used by Windows Phone users in Japan, but the stage is set for a genuine expansion of Japanese-language apps.

5. Trends at other companies

Smartphones running Windows Phone can only be developed and sold by device makers allied with Microsoft, and the only Japanese maker currently allied with Microsoft is Fujitsu. Overseas makers that are developing and selling Windows Phone devices include Nokia, Samsung, HTC, Motorola, DELL, and ZTE, and none of them are selling Windows Phone 7.5 devices in Japan as of December 2012.

Among these overseas makers, Nokia is making a major contribution to expanding the Windows Phone market. According to a forecast from International Data Corporation (IDC), an American market research firm, Windows Phone looks to surpass iOS in market share in 2016.³⁾ This is because IDC expects Nokia, with a foothold in emerging markets, to help expand the penetration of Windows Phone especially in China, India, and Indonesia.

6. Future outlook for Windows Phone

The next generation of Windows Phone is expected to represent an evolution in functions and features, far beyond what has come before.

Up to and including release 7.5, Windows Phone has been using Windows CE as its core, embedded OS, with a smartphone-oriented shell and application suite constructed on top of that OS. In this way, it has evolved to its present form, linking basic smartphone functions with Microsoft-provided apps (Office Mobile) and services (Windows Live, Zune, Bing).

The Windows 8 OS, which was released in October 2012, incorporates the Metro design used in Windows Phone 7.5. Furthermore, apps for Windows 8 PCs will be distributed through Microsoft's Marketplace app store in addition to apps for Windows Phone 7.5.

These developments reflect how differences between the PC and Windows Phone OSs are increasingly disappearing in terms of both the user interface and provided services. We expect successors to the Windows Phone 7.5 OS to be increasingly integrated with the PC.

7. Conclusion

Fujitsu was the first mobile-phone maker in the world to develop a Windows Phone 7.5 device. Windows Phone 7.5 is known for its stable and high-speed operation and diverse services called "hubs." Fujitsu has provided an attractive and compelling smartphone by adding a variety of proprietary technologies such as power-saving technology, imaging technology, audio technology, "human-centric" elemental technologies, and water-resistant/low-profile technologies. Fujitsu has also designed this smartphone to support network services specific to a carrier's 3G network, thereby satisfying individual specifications not covered by the worldwide standard specifications of Windows Phone 7.5. This means an even more convenient smartphone product.

A key advantage of Windows Phone is that Microsoft has solidified the foundation of its OS in conjunction with the chip-set maker, which frees up device makers to concentrate their efforts on developing original add-on functions.

Windows Phone is a platform providing worldwide common specifications, a high level of performance, and attractive services. Fujitsu provides new value to this platform by adding commercially appealing, human-centric functions and technologies in which the company excels. Looking forward, Fujitsu plans to monitor worldwide trends in next-generation Windows

Phone devices with an eye to applying popular smartphone features that it has refined for highly demanding domestic users to devices aimed a wide array of overseas users.

References

- 1) S. Komatsu et al.: Milbeaut Image Signal Processing LSI Chip for Mobile Phones. *Fujitsu Sci. Tech. J.*, Vol. 49, No. 1, pp. 17-22 (2013).
- 2) R. Blandford: 100,000 apps published to Windows Phone Marketplace, All About Windows Phone, June 5th, 2012.
http://allaboutwindowsphone.com/news/item/14960_100000_apps_published_to_Windo.php
- 3) IDC: Android Expected to Reach Its Peak This Year as Mobile Phone Shipments Slow, According to IDC, IDC-Press Release, 06 Jun 2012.
<http://www.idc.com/getdoc.jsp?containerId=prUS23523812>



Satoshi Nishimura

Fujitsu Ltd.

Mr. Nishimura is engaged in the coordination of smartphone development.



Akinobu Ueda

Fujitsu Ltd.

Mr. Ueda is engaged in the system integration (SI) of smartphones.