Changes to Ubiquitous Devices Brought by Cloud Computing

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In general, the greater the use of cloud computing, the lower the computing power needed by client devices. This leads to an increased degree of freedom in design, generating expectations of ubiquitous devices that are optimized to suit the particular way they are used. Tablet PCs are one example of such devices, and various types have been released in recent years, reflecting usage scenarios that are unthinkable with conventional personal computers (PCs). Fujitsu is also planning to release new ubiquitous devices, and with them, it intends to provide added value and to contribute to a Human-Centric Society by implementing new technologies that take advantage of cloud computing.

1. Introduction

The use of cloud computing and cloud services has become increasingly popular in recent years as network transmission speeds continue to climb. Cloud services can provide equivalent or better usability than personal computers (PCs) or other client terminals that perform data storage and processing locally. In some cases, a cloud service can even provide an operating system (OS) via a browser. Easing the burden of data storage and processing on the client-terminal side provides more freedom in the size and thermal design of the terminal itself, and as the application of such terminals widens, customer requests with respect to these terminals are changing as well.

In response to this trend, Fujitsu has undertaken the development of novel ubiquitous devices applicable to cloud services.

This paper presents key ubiquitous devices from Fujitsu for this new computing era, discusses the motivation behind their development, and introduces a new security technology associated with these devices.

2. New tablet PCs for new applications

The iPad, released by Apple Inc. in the spring of 2010, has become a topic of discussion throughout the world. A number of companies subsequently announced "tablet" (or "slate") PCs based on Google's Android OS. This response to the iPad is still evolving.

Fujitsu has actually been developing and selling tablet PCs for corporate use since 1991, and these devices have been well received in North America and Europe. Today, tablet PCs have become popular among consumers first and foremost because they are easy to carry around and because their intuitive, touch-based user interface (UI) makes them easy to operate. It is also considered that tablet PCs make it easy to use cloud services as doorways to individual applications, thereby increasing their appeal. Additionally, the value of tablet PCs as a new tool in the corporate world beyond the framework of personal use is becoming clear. Their use is beginning to expand from traditional applications centered about the PC to new fields and applications such as terminals

acting as service portals, as terminals providing sightseeing information, and as viewers for on-site medical care. Fujitsu has announced new Windows-based tablet PCs (**Figure 1**) to cover these markets.[1),2)] These tablet PCs are optimized for the corporate user, enabling the customer's existing assets to be used unchanged and providing a high level of security. With these products leading the way, Fujitsu plans to roll out a variety of tablet PCs incorporating Fujitsu's advanced communications technologies, including devices based on the Android OS.

Fujitsu feels that it can offer its customers new value by positioning these tablet PCs as front-end devices linked to integrated services like Fujitsu's Life Cycle Management (LCM), which provides cloud services and operation and maintenance services for a monthly fee.

3. Ubiquitous devices optimized for specific applications

The market for tablet PCs is expanding, and their use for business applications is growing as users find them easy to carry around and operate as mentioned above. Indeed, the shape of these devices makes their use as a viewer dominant over other uses. Nevertheless, customers say that there are times when they need to use their device to input a large amount of text and other times when they would like to use their device simply as a tablet (viewer). In short, there have been many requests for a device that incorporates both functions. As one example of responding to this need, we here introduce a convertible-type tablet PC developed by Fujitsu for sales use. The "Handy-Ai" (**Figure 2**), being deployed by Asahi Mutual Life Insurance Company, is a sales-oriented terminal that can support a variety of customer scenarios by virtue of its rotatable screen. Furthermore, it can be used both as a traditional tablet and as a PC supporting keyboard input.[3)]

While the use of tablet PCs having the usual shape is expanding, there is also a demand for ubiquitous front-end devices having a variety of shapes optimized for specific types of business tasks and applications. Studies need to be made on devices incorporating diverse ideas, such as PCs that can fit into a shirt pocket and be carried anywhere and tablet PCs having a shape optimized for reading. Plus, in addition to shape considerations, the use of advanced "color electronic paper,"[4),5)] an original technology developed by Fujitsu Laboratories, should lead to novel devices in a class of their own.

4. Ubiquitous devices and security

Devices that can be taken anywhere like smartphones are increasing in number, and

(a) Original "DL Pad" device for The Dai-ichi Life Insurance Company

(b) STYLISTIC Q550

Figure 1
Fujitsu's tablet PCs.

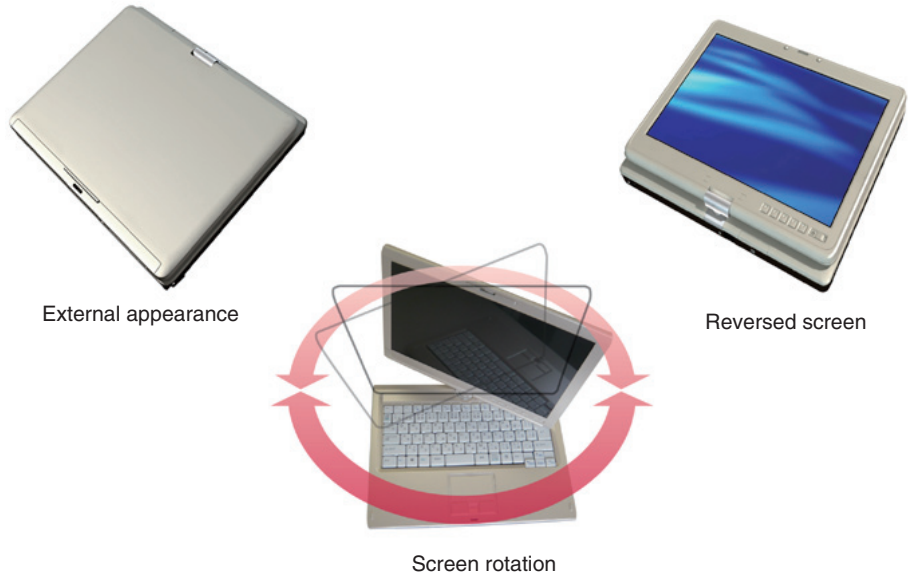


Figure 2
Sales PC for Asahi Mutual Life Insurance Company: Handy-Ai.

the idea of using a personally purchased device not just for personal reasons but for business purposes as well is gaining momentum. In fact, trials are now taking place in the United States and Europe on the use of personal devices (not issued by the company) for business applications. This type of use, however, is always accompanied by the issue of security, which can be broken down into the following two problems. The first is how to protect or erase data within a device after it has been forgotten or lost somewhere or stolen. The second is how to control mixed use when a single device is used for both personal and business reasons, that is, how to prevent confidential corporate documents and data from crossing into the area allocated for personal use. Both of these problems can be solved by the use of cloud services since confidential documents and data would be stored not on the device itself but on the cloud. Fujitsu has been recommending this approach, which would include the use of thin clients, but given the present state of wireless communications networks, the usability of thin clients depends heavily on the strength of the radio signal. It would consequently not be reasonable to expect that all data will make its way onto the cloud. In other words, there are times when confidential documents will remain inside the device, and Fujitsu feels that it has the responsibility of providing devices having robust security measures for such times. One such measure is to erase confidential information as needed using a remote data erasing solution called CLEARSURE (**Figure 3**).[6),7)] A device supporting this function can have its data remotely erased and have itself locked even if its power is turned off. This solution makes for safe and secure mobile operations and efficient business operations.

Next, to prevent the mixing of personal data and business data, Fujitsu proposes the application of virtualization within the user device when operating outside the cloud. This technique creates virtual environments (machines) that make it appear as if separate devices exist within a single physical device so that data for personal use can be stored in one of these virtual devices and that for business use in another. Thus, a user with a single device can be made to feel as if he or she has two devices that can be used separately for different applications, thereby preventing the

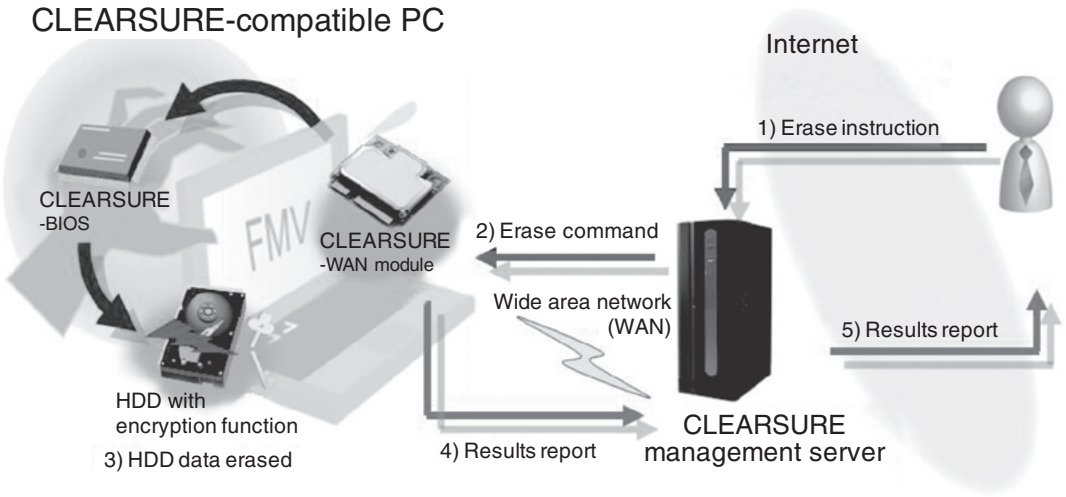
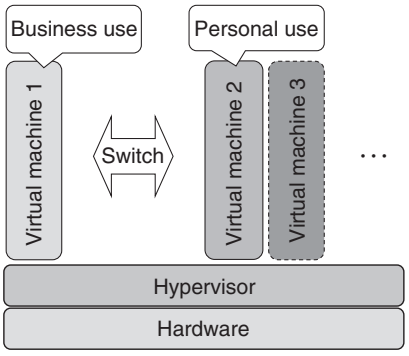


Figure 3
CLEARSURE concept.

mixing of confidential information or data with personal data. A technology for achieving such virtualization is called "hypervisor," the concept of which is shown in **Figure 4(a)**. A product that is compatible with the XenClient hypervisor from Citrix Systems, Inc. is Fujitsu's Lifebook E780 laptop computer (released as an overseas model only), which is shown in **Figure 4(b)**.



(a) Hypervisor concept

(b) Lifebook E780

Figure 4
Hypervisor concept and implementation example.

5. Toward a Human-Centric Society

Fujitsu is working to achieve a Human-Centric Society as a basic policy. The idea is to build an information and communications technology (ICT) society centered about people to enable them to lead enriching and active lives. This includes the development of ubiquitous front-end devices. A prime example of this endeavor is a free healthcare service from Fujitsu that enables the user to send personal health data to a cloud service from a mobile phone equipped with various types of sensors and to receive health-related advice from the cloud service based on the analysis of that data.[8] This type of mobile phone senses the user's health condition while also acting as a hub to send health data obtained from other health appliances to the cloud service. Thus, by simply having such a mobile phone on his or her person, the user can receive health-related advice from the cloud service without having to be conscious of the underlying process (**Figure 5**). Fujitsu, however, does not wish to stop at simply displaying the results of a cloud service on a ubiquitous device always in contact with the user's body. To further enrich people's lives, it envisions functions for actively sending all sorts

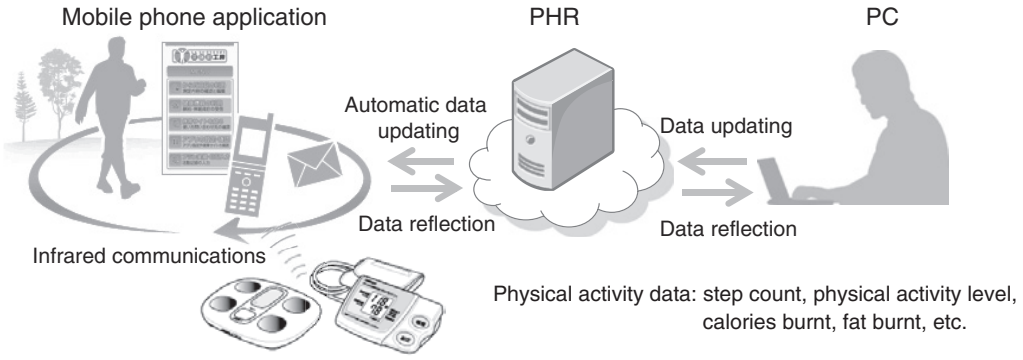


Figure 5
Concept of Fujitsu's free healthcare service.

of user data or data from the user's peripheral environment to the cloud and to present the results of processing that data as a service to the user in a manner appropriate to the processed data. With this in mind, Fujitsu is ahead of other companies in equipping devices with various types of sensors with the aim of providing new value through ubiquitous devices that are closely linked with cloud services.

6. Conclusion

The role of ubiquitous devices is changing due to the forces of cloud computing. From here on, it will no longer be possible to categorize user devices simply as "PCs" or "mobile phones," and the development of many types of ubiquitous devices is anticipated. Fujitsu continues to research and develop new ubiquitous devices in response to this trend, as reflected by the devices introduced in this paper. We would be pleased if Fujitsu's future products in this field likewise attract attention and become popular with our customers.

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