

Context Desktop Technology

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We are now conducting research and development on a service platform which vertically integrates smart devices and the cloud, so as to provide adequate information and services to humans. Recently, we have developed Context Desktop technology which selects and delivers the minimum services to smart devices depending on the human situation. In this paper, we describe the concept and structure of Context Desktop and its applications. Context Desktop automatically provides optimal applications to smart devices and changes the available application sets on these devices based on real-world data sensed with the devices or ambient sensors. This technology frees users from having to set up applications in advance, and thus enables them to utilize smart devices, when and wherever needed.

1. Introduction

Fujitsu Laboratories aims to realize Human-Centric Computing, a new technology paradigm centered on humans in which information and communications technology (ICT) systems assist humans rather than requiring humans to adapt themselves to ICT systems, and information and services suited for a given situation, time and person are provided in a natural manner.^{1), 2)}

Figure 1 shows the service images realized by Human-Centric Computing. People are now living while moving around various places in the real world. Necessary information and services differ depending on the person, place and time and at present users themselves consciously and actively access appropriate information and services. Human-Centric Computing gains an understanding of the situation of a particular user and provides information and services that suit that situation.

Recently, smart devices such as smartphones and tablets and mobile broadband have been rapidly spreading, and this means an environment is emerging where various services (applications [apps] and content) can be made available to users via smart devices anytime and anywhere. It is also becoming possible to obtain information about various situations of users

through different types of sensors mounted on smart devices.

In addition, as smart devices become popular, enormous numbers of apps are being developed and deployed in the cloud to be available for use. Smartphones are also now beginning to support apps for business use.

2. Issues with use of services

As described above, people move around various places in the real world in their everyday lives. This means that for them to use apps and content in accordance with the particular circumstances of the place and time, the users themselves are required to search for appropriate apps and content from among an enormous number, and install them in their devices. For business use, an administrator in an IT division must install the necessary business apps in devices in advance, which is troublesome and takes time. For actual use, even if apps are installed in advance, users must find and start the most suitable one out of the many apps in the devices and it is difficult to efficiently use apps and content. From the perspective of security, apps and content including business information should desirably be used only when required and should not be loaded or saved in devices otherwise. Preinstalling

them gives rise to the risk that business information will be unintentionally shown to others and the risk that information could be leaked if the smart device is lost or stolen.

3. Developed technology

To resolve these issues, we have developed Context Desktop technology based on the concept described in **Figure 2**.³⁾⁻⁵⁾ Virtual places corresponding to the circumstances of a user in the real world are

defined, and in such places various services in the cloud and existing business services are narrowed down and deployed in accordance with the user's circumstances. Specifically, the virtual places are represented as desktops on smart devices with apps and content deployed and the desktops are switched according to the circumstances of the user.

This technology allows users to utilize smart devices when and where necessary without needing to install apps and content in advance. For example,

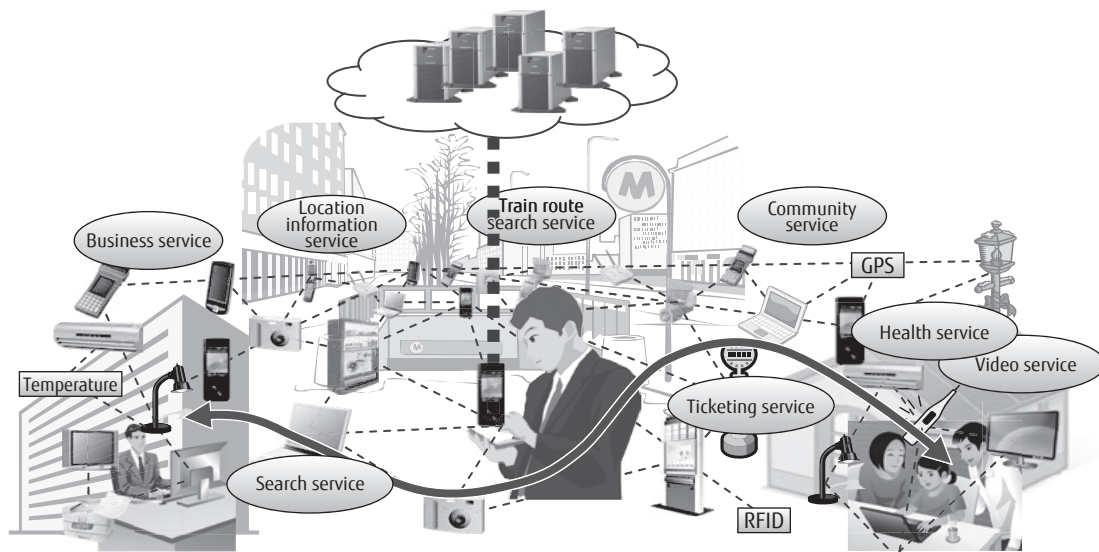


Figure 1
Image of Human-Centric services.

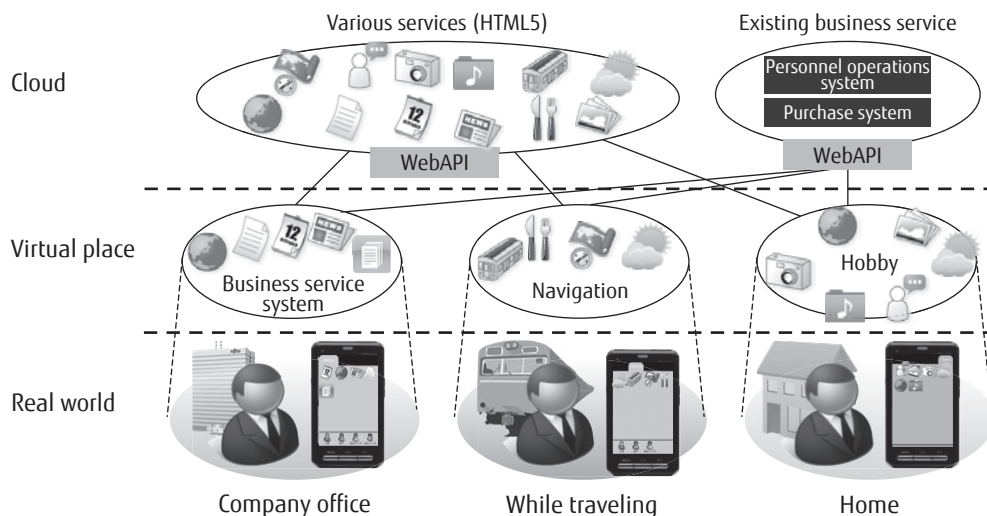


Figure 2
Concept of Context Desktop.

users taking part in a conference can immediately view related materials simply by taking their smart devices to the conference room, and the device then shows them the necessary apps and content. It is not necessary to install apps and users can immediately do what they want to do. It is also possible to have the related files automatically deleted when the user walks out of the conference room.

Figure 3 shows the architecture that realizes Context Desktop. It is composed of two parts: execution control and development environment.

The execution control includes app management that stores and manages apps and context control that switches between contexts according to the place event from the location management.

In the development environment, apps for business purposes are developed and conditions (such as person, place and time) of delivery of apps and content are defined.

By using this architecture, service developers simply develop services to be provided (apps and content), describe the place definition in location management and specify the delivery conditions of apps and content (context definition). Then it can switch between desktops on smart devices on which the minimum required apps and content are deployed according to the user's situation. It is also possible to push and automatically execute apps if specified.

4. Operation of Context Desktop

Figure 4 shows the structure and operation of Context Desktop. The following describes the flow of operation based on the figure.

- 1) In the location management, real-world data are obtained from devices, environment sensors, and such like so as to identify the place, and the place information is sent to the context switch. [Figure 4 (a)]
- 2) The context switch determines the service (app/content) to be delivered based on the context definition and requests the app packaging server to make a package of the service. [Figure 4 (b)]
- 3) The app packaging server encrypts the app and returns the uniform resource identifier (URI) of the storage location where the packaged app is stored. [Figure 4 (c) and (d)]
- 4) The context switch pushes the app information/desktop switch information via the push server. [Figure 4 (e) and (f)]
- 5) The push client on the device receives the pushed information and dispatches it to the desktop management. [Figure 4 (g)]
- 6) For switch information, the desktop management switches to the specified desktop. For app information, it downloads the app and deploys it on the specified desktop. It also automatically runs the app if specified. [Figure 4 (h)]

The Context definition defines the place information and corresponding group of services. Conditions

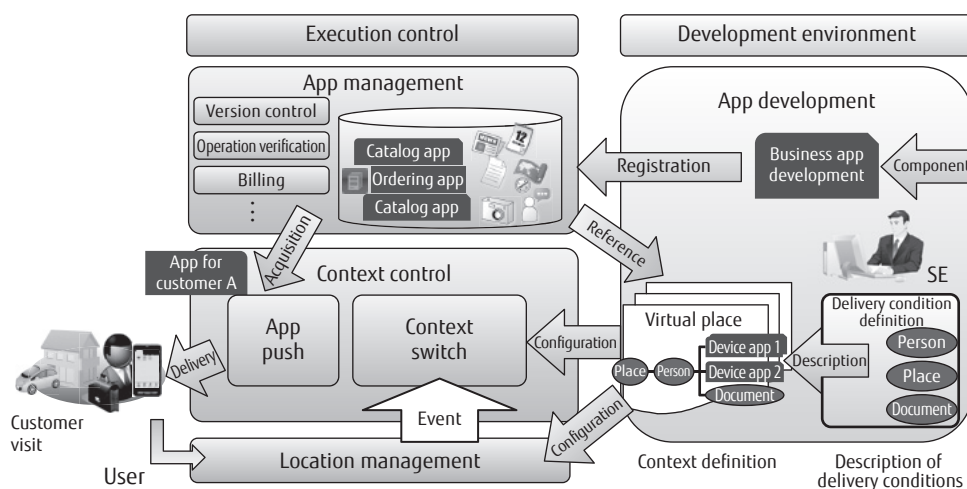


Figure 3
Architecture to realize Context Desktop.

such as the person, time and entrance to and exit from a place can be specified, although it is not shown in the figure for the purpose of simplification. By changing the context definitions, location-aware services in accordance with various situations can be promptly realized.

An example of app delivery according to the place is shown in **Figure 5**. The screen on the left is a desktop that is shown while the user is outside. The one in the middle is a screen indicating a business app for the conference room pushed as a result of the device detecting that the user has entered a conference room. The one on the right is a screen showing the business app for conferencing that is automatically executed. In this way, desktops on the smart device are switched according to the situation of the person so that the appropriate app is automatically executed.

At present, to enhance Context Desktop for business use, we are developing technology that will deliver services in the intranet to a device connected to the Internet⁶⁾ and technology that will separate personal and business data on the smart device in accordance with the situation.⁷⁾

5. Examples of application

These technologies make it easier to construct an integrated system that connects smart devices with the cloud services via a wireless network and that switches

between services in a timely manner according to the locations and circumstances of users that change moment by moment without having to be aware of device and communication layers.

The following shows a conceptual image of an application. In hospitals, when a nurse enters a hospital room, information about the patient and necessary treatments can be shown on a smart device to improve the efficiency and reliability of nursing operations (**Figure 6**).

In addition, a mobile work environment can be provided in which only business apps can be used at company offices, and business data and customer

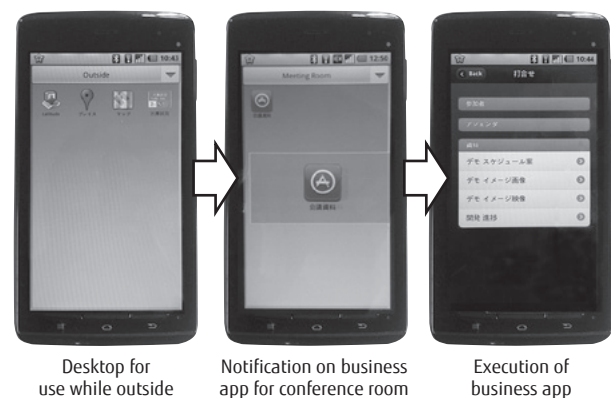


Figure 5
Example of desktop switch and automatic execution of app.

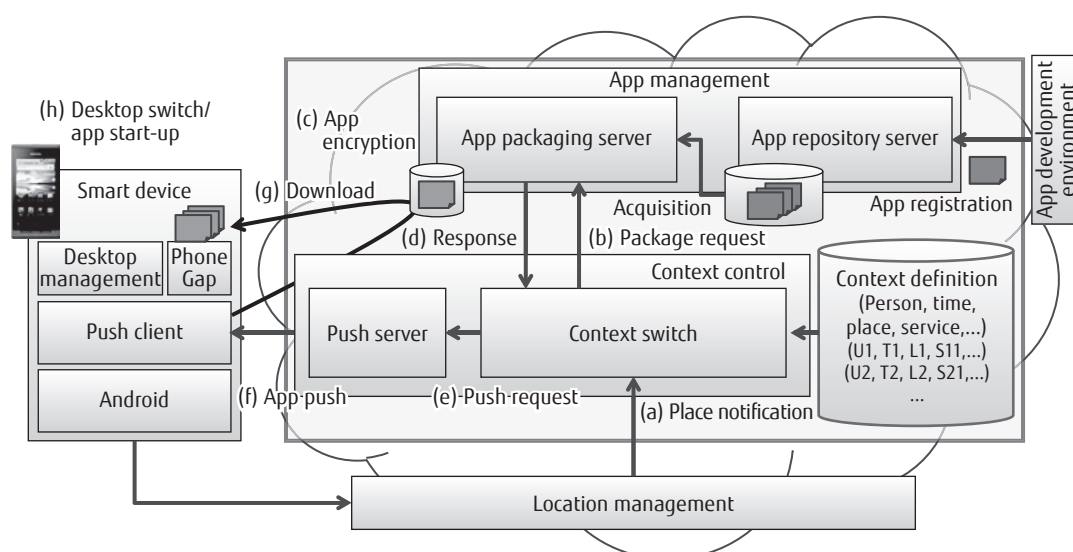


Figure 4
Operation of Context Desktop.

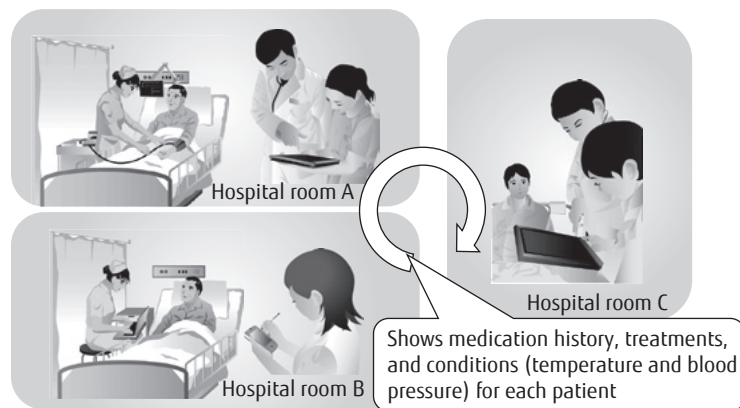


Figure 6
Example of application 1 (patient information sharing on site of medical services).

information are deleted while traveling, and customer data can be accessed on customers' premises (Figure 7).

6. Conclusion

This paper has presented Context Desktop technology which we have developed to realize Human-Centric Computing, a new technology paradigm centered on humans in which ICT systems assist them and information and services are provided according to the situation, time and person in a natural manner.

This technology has allowed service developers to construct location-aware services in short periods of time just by giving simple definitions of places and the relationships between places and services.

In the future, we intend to enhance the technology to produce a service platform that is capable of easily building secure and convenient services. Our aim is to keep in step with the expansion of smart devices and their increasing use for business purposes.

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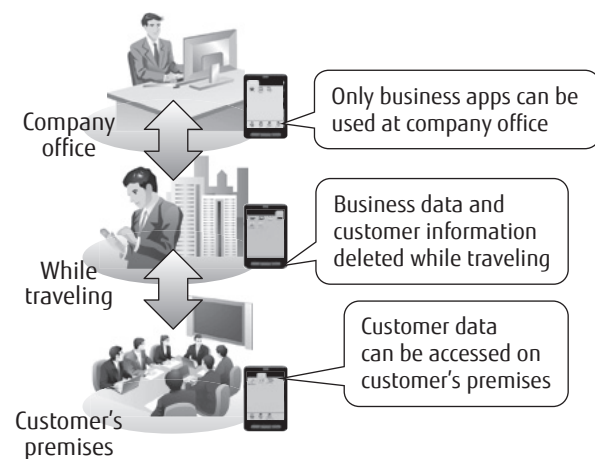


Figure 7
Example of application 2 (business information access control according to situation).

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