SMART SERVICE COORDINATION AND MANAGEMENT OF DIGITAL SPACE AND SOME CASES

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Abstract. *Rapid development of ubiquitous technologies has made it possible to change traditional service spaces into intelligent service spaces, which gives interactive and responsive experiences to people. Such space includes smart home, museum, shop, exhibition space, conference room and so on. In this paper, we present a smart design procedure, framework and solutions to design, implement and manage the intelligent space. Our procedure considers the characteristics of digital space consisting of space, information and program. We developed operation platform called UbiTools and using the platform, successfully constructed smart coordination systems in various digital spaces.*
Keywords: Ubiquitous platform, Smart coordination, Digital space

1. **Motivation.** With the rapid development of embedded system, distributed and mobile computing technologies, more and more intelligent space are established around us, such as smart meeting room, smart home, intelligent museum, and digital library. Meanwhile, ubiquitous computing technology has received an intensive interest in the past years to realize the intelligent space [1]. Ubiquitous technology aims at providing any intelligent services at anytime, anywhere with the integration of machine and human through internet and other communication technologies.

The technology has consistently evolved and produced M2M (Machine to Machine) and IoT (Internet of Things) nowadays. IoT can be defined as hyper-connected network environments, in which information is produced and shared via wire and/or wireless network connecting every things including human [2]. As we can see hyper cycle of digital business technologies presented by Gartner group in 2014, the technology is one of the most interesting and promising technologies (Figure 1).

To keep up with global technology trends, Korea government established ICT wave strategy in 2013 to advance Korea ICT industry and proposed 5 core fields (contents, platform, network, device, security) and 10 main technologies including IoT platform, intelligent software, context aware device and so on [3,4]. Among the technologies, we can classify IoT platforms like Table 1, and this paper is related to common and application service platform.

Whatever it is called as ubiquitous platform or IoT platform, any platforms which provide valuable services to human through automatic and intelligent connection of machine to machine and machine to human can be, so called, smart service platform. Y. Yoon
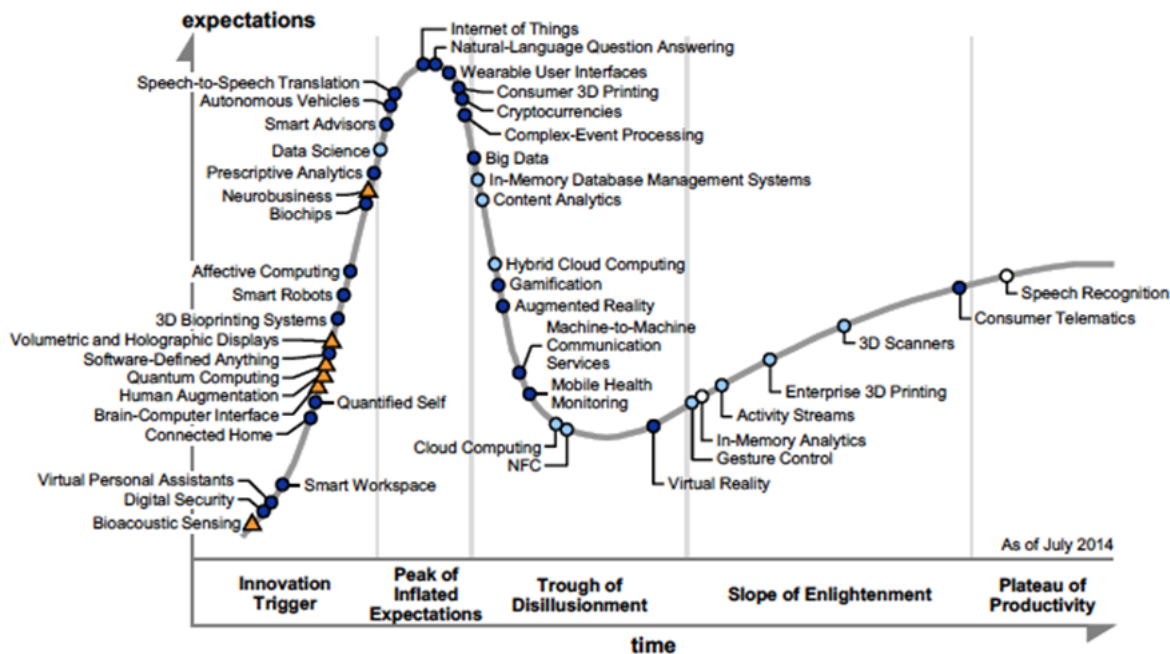
FIGURE 1. Technology hyper cycle (Gartner, 2014)

TABLE 1. IoT platform classification [5,6]

Category	Functions	Major platforms
Device platform	· Open H/W platform, device OS and service platform	· Arduino, Rasberry Pi, Beagle Board, ioBridge iota, ARM mbed
Common platform	· Connection, control, management among heterogeneous devices	· ThingsSquare, Thingsworx, Xively, ioBridge
Application platform	· Data processing and 3rd party integration for application service	· Axeda, Digi Device Cloud and so on
Intelligent platform	· Big data processing, data mining and semantics	· SENSEI project, IOT-A project and so on
Platform standard	· Platform standard for requirement, architecture, protocol and so on	· one M2M project, OIC (Open Interconnect Consortium)

et al. defined the role of smart platform as a base infrastructure enabling real time processing, intelligence, convergence and two way communication services. The role requires various platforms like knowledge processing, contents processing, service and context platform, and various functions like smart pulling (collecting context information including user behaviors in real time), intelligent inferencing based on the information, producing customized services based on the inference and smartly pushing the service to users [7].

To tackle the problem, we considered characteristics of digital space and implemented management platform called UbiTools. Using the platform, we could construct smart coordination systems to cope with the characteristics of various digital spaces. Digital space requiring smart service can be made up of not only space architecture but also available information and marketing program. Therefore, to effectively realize smart service in digital space, smart coordination among space, information and program should be designed, implemented and managed [8].

The remainder of this paper is organized as follows. Section 2 presents smart service design procedure and core solutions, and Section 3 describes various application cases of the proposed system. Finally, Section 4 offers conclusions.

2. **Smart Service Coordination.**

2.1. **Service design procedure and framework.** To realize smart service in digital space, first of all, we should consider available services and choose promising services among them. Such smart service consulting involves analyzing service space, space user and space value, and designing smart services to guarantee to maximize user conveniences, profit of shop manager, and value of the space site. Smart service consulting follows the steps consisting of analysis, planning and feasibility study [8].

· Analysis: environmental analysis of application site, value analysis to gain from the service, space analysis to supply service, user analysis to utilize the service and collection of basic information to derive smart services specific to the space.

· Planning: based on the analysis information, deriving smart service group applicable to the space and setting applicability priority to each service. The priority is determined according to SSD/SVD (Service-Space Deployment/Service-Value Deployment) developed by Ubidus corporation. After setting up priorities, design standard platform based smart service scenario, hardware, software and contents for each service.

· Feasibility study: after smart service design, performing technological feasibility evaluation for each service and economical analysis for service operation. Through this study, we can estimate how the smart services contribute to the operation of the space.

Also, we devised smart service delivery framework like Figure 3. Smart service delivery framework consists of management for service information administration, platform for service information delivery, and interface for connecting among smart service media.

· Management: supplying API (Application Programming Interface) and SDK (Standard Development Kit) to extend services by the integration of 3rd party vendors. UbiTools manager is for controlling UbiTools platform, UbiTools Show module is for administrator and Big data manager is for real-timely processing large data being collected.
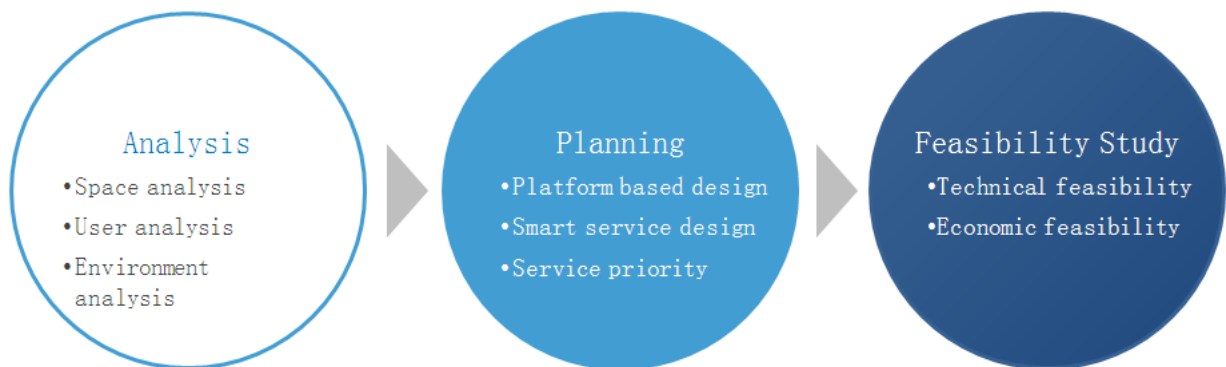

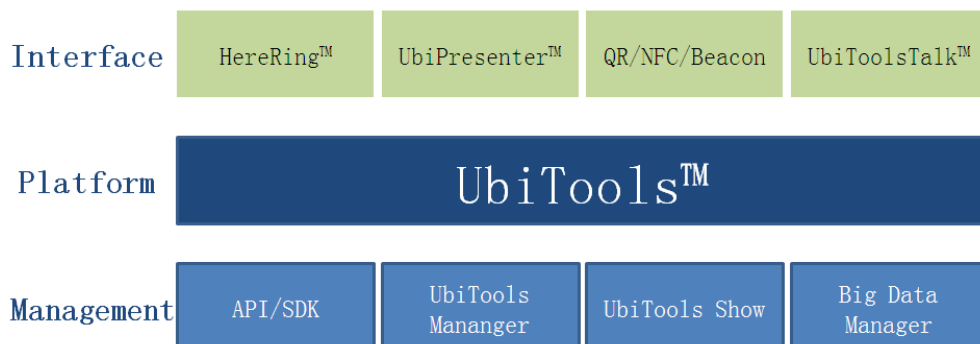FIGURE 2. Smart service design procedure

FIGURE 3. Smart service delivery framework

· Platform: core technology for implementing smart service. Receive smart service data, process rule based event and deliver accurate information.

· Interface: supplying multi information channel for users. HereRing is for smart phone application reading sensor and code, UbiPresenter is for cloud service based presentation technology, and UbiTools Talk is for communication between space and personal smart media.

2.2. **UbiTools Core.** UbiTools Core is an integration platform to support system management and operation in digital space as a core technology for implementing smart service. UbiTools Core monitors status information of various equipments (PC, projector, media and so on) and supports for administrator to retrieve such information. Administrator remotely controls the power of media, inquires media status information through remote control function, and upon service trouble sends the error information using PC, SMS, email. UbiTools core supports that a few persons can stably manage digital space through the function of media management, remote administration and deployment of contents and software, contents scheduling and so on [9].

Main function of UbiTools Core is explained in Figure 4 and function architecture is illustrated in Figure 5.
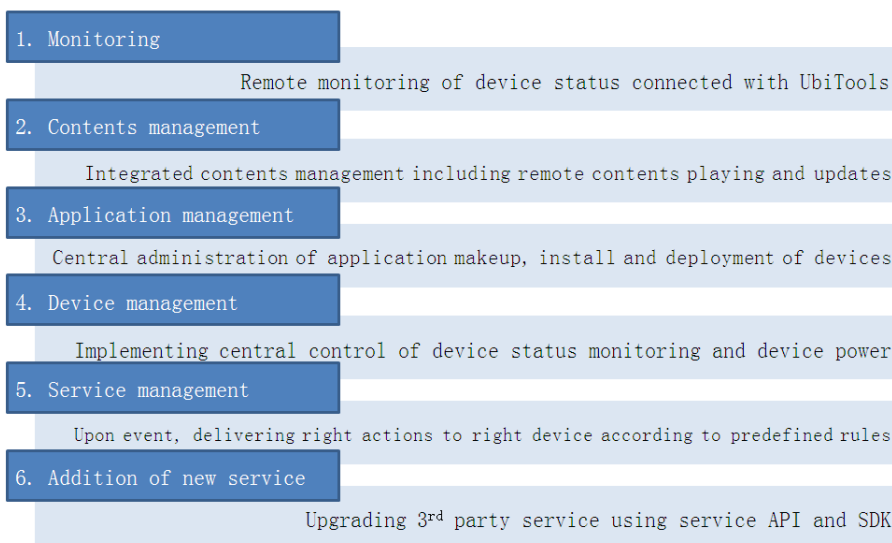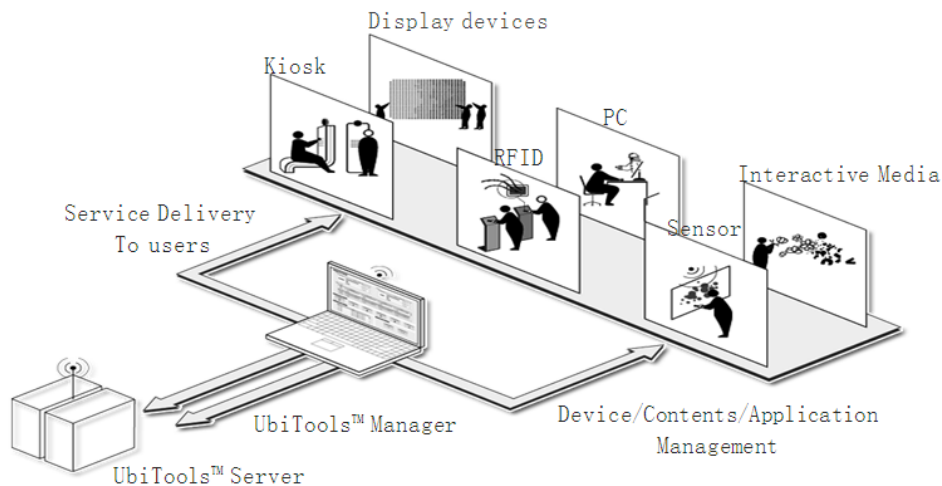

FIGURE 4. UbiTools Core functions

FIGURE 5. UbiTools Core function architecture

3. **Application Cases.** We have a lot of application cases using UbiTools platform and Table 2 shows some major cases implemented recent years.

TABLE 2. Major application cases using UbiTools [8]

Sites	Needs	Solutions
DDP guide sign media operation system (2014)	· Need for a little human resources to operate, manage and monitor 8 kinds of 90 medias in the space	· Providing real-time control system using mobile and implementing service operation system to install new program and contents into every media
Korea History Museum (2013)	· Need for customized viewing guide considering visitors' characteristics including age, nationality	· Implementing integrated mobile application to provide customized voice guide according to visitors' category
SK T.um (2009-2013)	· Need for virtual experience environment of SKT's new present technologies and new IT service in the near future to deliver the company's vision	· Implementing working together experience environment with the connection of various experimental digital media and smart phone · Upgrading individual experience media 4 times since 2009
i-Mirror (2014)	· Need for customer's fitting data in each shop · Need for distinguishing promotion goods, inventory goods and outlet goods	· Providing i-Mirror to take photo of customer's fitting and compare with previous fitting pictures · Providing instant upload function of fitting photo into Weibo and utilizing function of the data for decision making in head office
Yeosu EXPO (2012)	· Need for mobile-specific functions for visitors to enjoy easy IT services	· Developing mobile application to enjoy EXPO including U-Passport and my community, and to reserve exhibition room

For example, DDP business in 2014 implemented remote media monitoring system shown in Table 3.

TABLE 3. DDP guide sign media system [10]

1st level menu	2nd level menu
· Monitoring	· Computer/projector/rack/visual monitoring
· Service Rule	· Rule manager
· Application Management	· Application deployment, deployment status, event/action information and so on
· Contents Management	· Contents management, template management, contents schedule, category and so on
· Scheduling	· Power control schedule, today schedule, rule execution schedule

4. **Conclusions.** Smart service platform requires various functions like smart pulling (collecting context information including user behaviors in real time), intelligent inferencing based on the information, producing customized services based on the inference and smartly pushing the service to users [7]. To tackle the problem, we presented a smart

design procedure, framework and solutions to cope with the problem. Our procedure considers the characteristics of digital space consisting of space, information and program. We developed operation platform called UbiTools and using the platform, successfully constructed smart coordination systems in various digital spaces.

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