Mobile Services in the Age of IT Convergence: A Framework for Discovery of Opportunities

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Abstract. While indisputable is the evidence of technology convergence that blur industry boundaries and of the growth of demand for services that match the increasingly advanced and enabling mobile technologies, a comprehensive and systematic perspective is still lacking that can facilitate conceptualization of value creation opportunities stemming from the various IT convergences for mobile services. This paper provides such a framework by way of constructing taxonomy of mobile services, and attempts to show the efficacy of the proposed framework by applying it to services in traditionally non-IT industries.

Keywords: IT convergence, Mobility-connectivity dichotomy, Taxonomy, Mobile services, Value creation.

1 Introduction

Historically speaking, technology has always been associated with positive notions such as progress, enablement, and optimism. In competitive environments, the role played by technology tends to receive even keener attention. Firms that can harness disruptive technologies will secure competitive advantages, especially when such disruptions pose serious challenges to all players in the affected industry. However, every technology becomes obsolete over time as it reaches the end of its life cycle, and parts of the technology will be commoditized after having raised the bar for the competition, benefitting the general public as a result. Along the way, any competitive advantages gained through the technology will become unsustainable. It is also noteworthy that the pace of developing new technologies has gotten faster in recent years, giving rise to a suspicion that laggards will fall further behind unless serious strategic leapfrogging efforts are exerted.

Information technology (IT) is such a technology, and has witnessed significant innovations that subsequently underwent rapid commoditization. Without question, the influence of IT has reached all corners of modern society. As such, one of the most glaring trends of IT is its relentless expansion to other territories beyond the traditional functional area of information systems (IS). Commonly referred to as *IT convergence*, this phenomenon is a manifestation of a growing tendency to amalgamate IT and other technologies to provide desired functionality in various

domains [1]. The capability of IT to effortlessly gather and transmit digital information at an increasingly higher speed, particularly using ubiquitous wireless networks, is enabling businesses to provide value-creating services, e.g., automobile navigation support, location-based marketing and mobile alerts, micropayments using mobile devices, and real-time delivery confirmations for parcel services. Due to the ever-increasing accessibility to wireless networks, such mobile services are escalating both the expectations of the general public and the service provider's competence.

While the innovations in mobile technologies are impressive, both mobile service providers and mobile service consumes can further benefit from a comprehensive and systematic framework that conceptualizes untapped value-creation opportunities which stem from the various IT convergences. In this paper, we propose such a framework, and show its efficacy by illustrating how it can be applied to non-IT fields where new mobile services can germinate and grow rapidly.

2 IT Convergence

Hackin *et al.* [2] observe that information and communication technologies (ICT) provide a fertile ground to cultivate a theory that explains how certain technologies evolve into an innovative new technology that eventually blurs industry boundaries. Noting the sequential nature of convergence-induced innovations, they describe the process as consisting of the convergences in (i) knowledge domains, (ii) technologies, (iii) applications, and (iv) industries, in that particular order, which can be represented by a process depicted as **Fig. 1,**

Fig. 1. Coevolutions and convergences that form an innovation process (adopted from [2]).

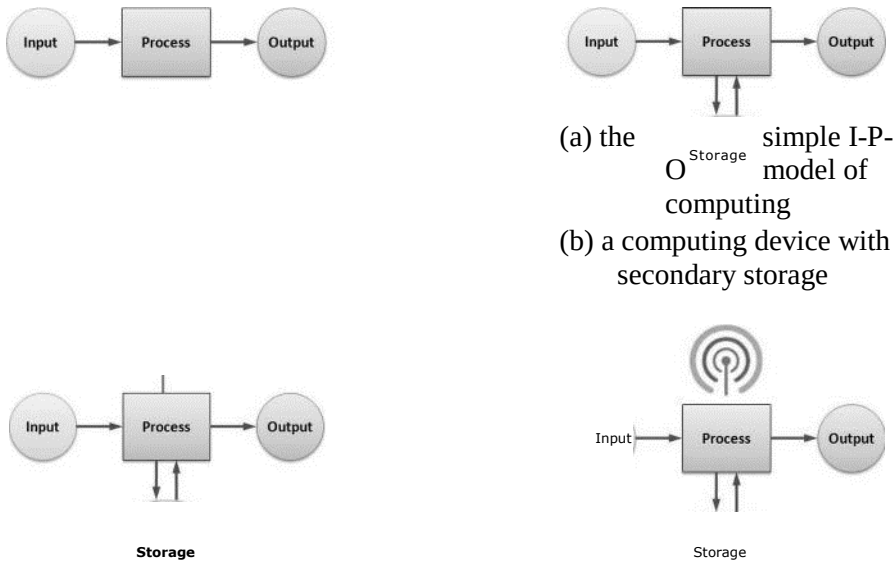
Technology convergence in general, IT convergence in particular, can be viewed as a subset or a special case of the innovation process proposed by Hackin *et al.* [2]. It is important to note at this point that IT has a distinct and unique quality that separates it from all other technologies. That is, IT is grounded in the capability to handle *digitized* contents. It can collect, store, organize, verify, query and retrieve, edit, update, and disseminate digital information. Value-creation opportunities abound whenever service can be enhanced by taking advantage of this digital nature of the information handling capability. As the society and its members become increasingly mobile, while at the same time their accessibility to the wireless networks keeps up with the mobility, such opportunities will multiply.

3 A Simplified Anatomy of Mobile Services

To adequately appreciate the opportunities of mobile services crossing over various non-IT industries, let us consider the nature of digital information processing systems.

3.1 Computing Devices in a Digital Network

As shown in **Fig. 2** below, computing devices were designed to handle digital input data so that ultimately certain output could be generated in the form of on-screen display or printed reports. As long as the input was validly digitized, consistent output would obtain. This was the basic premise of the I-P-O model of computing, which is depicted as **Fig. 2(a).**



(a) the simple I-P-O model of computing

(b) a computing device with secondary storage

(c) a computer as a node in a local area network

(d) a mobile device

Fig. 2. Computing device in historical perspective.

This view of computing, or information processing, mechanism was augmented by introducing secondary storages. This expanded view is depicted as **Fig. 2(b).** Either manually or automatically, input data is captured, processed, and stored. Likewise, either by queries or through programmed trigger mechanisms, stored data is retrieved, processed, and presented as output. As long as the data integrity is insured, the desired output will be generated and satisfy the decision maker's needs. Up to this point, each computing device is considered digitally isolated from other information sources, dubbed a 'stand-alone' computer.

Once such stand-alone machines are connected a network, as shown in **Fig. 2(c),** it no longer has to be self-sufficient. A device can now be a node in the network, e.g., a local area network (LAN), and tap into the network's various resources ranging from other sensors in the network that function as input devices, to network printers, and to servers for applications or a database. Although each node could function perfectly as a stand-alone device, its reliance on the network resources grew. The client-server architecture propelled this progression. In addition, the internet changed the nature of computer networks because information flow was no longer confined to the LAN.

3.2 Mobile Devices

Shown in **Fig.2 (d)** is an extension of the view of a computing device as part of a LAN, where the device is part of a wireless network. We can call it a mobile device.

Traditionally a mobile device could be either a mobile phone as a node in a wide area network (WAN), or part of a wireless local area network (LAN) such as a laptop computer near an access point, or a Bluetooth device as a member of a personal area network (PAN). A mobile device works just like a fixed node in a LAN except that the user is no longer tied town to an office and can access network resources, local or internet, while in motion.

3.3 Mobility-Connectivity Dichotomy

In the traditional sense of computing, *mobility* and *connectivity* were in dichotomy. However, recent progresses in wireless data communication technologies have shown that computing devices can be mobile while still connected to a network, although a certain level of trade-off is still expected, such as data transmission speed, access range, size of input and output devices on a mobile device, and the like.

Along with the advancement of IT, particularly wireless technologies, one can expect the complete breakdown of the mobility-connectivity dichotomy. From a network's point of view, a device connected to the network can be an input device, an output device, or both. As an input device, a node captures data and it can store the captured data on a network server. As an output device, it can query and receive report. A mobile device that is a member of a wireless network can accomplish this while in motion without compromising either mobility or connectivity, and this prospect is a prerequisite to a platform for uncompromised mobile services.

4 Taxonomy of Mobile Services

Mobile services that are already available and those that are yet to be realized can be classified as one of four types according to the taxonomy of mobile services described below. Like other services that have been conceptualized in the literature, mobile services are treated from the perspective of what value is created or what additional benefits are delivered. Since this view is married to the functionality of service, its discussion can become domain specific. To disentangle such a predisposition, and to

enhance our understanding of potential mobile services that cross the boundaries of industries, we propose domain-independent and generic taxonomy based on the two dimensions of *motive of digital connectivity* and *mobile entity.*

In providing mobile services, the motive of digital connectivity can be either (i) to facilitate the data capture for various activities and transactions whereby the mobile device is used for or as an input device, or (ii) to provide the report in response to the request or query to satisfy the desire of the mobile user to be informed. The 'data capture' motive may require an infrastructure such as sensor networks since the value creation mechanism relies on convenience and efficiency. The 'report generation' motive may require applications that can process searches and queries, and display the output to fit the mobile device.

Mobile entity can be either (i) the mobile service provider, or (ii) the mobile service consumer. Business models based on the mobility of service providers using IT have proved to generate competitive advantages for the enterprise through enhancement of customer satisfaction and the efficiency of the workforce. As for enhancing the efficacy of service when the service consumer is the mobile entity, the logic of service science and value co-creation by the customer is a notable phenomenon and has proliferated research outputs since its proposal by Vargo and Lusch [3]. As such, and particularly because the mobile users are the ones to engage and co-create value by virtue of being the active party in the mobile environment, consideration of mobile service consumers seems an adequate construct.

Shown below in Fig. 3 is the taxonomy of mobile services based on the above discussion. Characterization of the four types is self-explanatory, and their detailed descriptions are abbreviated. Thus, a few examples are given without elaboration.

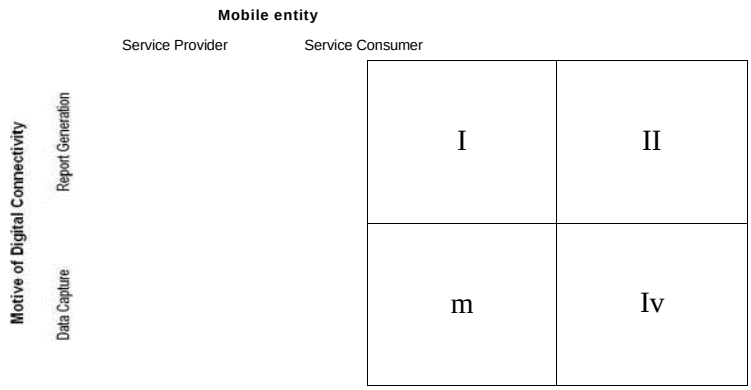


Fig. 3. Taxonomy of Mobile Services

Type I (Service provider is in motion; connectivity is primarily for query/output)

- Nursing informatics bedside applications

Type II (Service consumer is in motion; connectivity is primarily for query/output)

- Online search on a mobile device
- QR code
- Automobile navigation support
- Location-based marketing and mobile alerts

Type III (Service provider is in motion; connectivity is primarily for capturing data)

- Real-time delivery confirmations for parcel services
- Sensor networks for tracking personnel

Type IV (Service consumer is in motion; connectivity is primarily for capturing data)

- Micropayments using mobile devices
- Sensor networks for transactions such as EZ-Pass

5 Illustration and Discussions

The above taxonomy can be applied to an industry where new mobile technologies are being introduced, which is virtually all industries. For an illustration purpose, let us examine healthcare industry as it has shown an increased interest in IT, particularly mobile applications, in the recent past, and there is an on-going development of new amalgamations between medical technology and IT. Especially in hospitals, both the service providing personnel and the service consuming patients and relatives routinely are mobile.

A cursory and non-scientific survey of usage of mobile technologies in hospitals has revealed that a growing number of facilities are equipped with wireless LANs along with RFID sensor networks for strategic applications [4]. Standing out among the various applications are those that correspond to Type III and Type IV of the taxonomy, while Types I and II produce notable applications much more rarely, and suggest that significantly less attention has been given.

Recognizing such patterns is a first step to the discovery of untapped opportunities. Of course, lack of applications of a certain type may be attributed to the natural infeasibility. However, further examination may reveal how to turn the 'current' infeasibility into a 'future' feasibility, which may in fact be overcome if a missing component were to be made available.

The above framework can also be used to juxtapose multiple industries so that different patterns can be exposed, which in turn can raise the follow-up questions of who inter-industry differences could be explained.

References

1. Ganesan, S., Sugumaran, V. Non Functional Requirements for IT Convergence and Infrastructure. First International Conference on Computing, Networks, Systems, and Industrial Engineering, 452-457 (2011)
2. Hacklin, F., Marxt, C., Fahrni, F. Coevolutionary Cycles of Convergence: An Extrapolation from the ICT Industry. Technological Forecasting and Social Change, 76, 723-736 (2009)
3. Vargo, S. L. Lusch, R. F. Evolving to a new dominant logic for marketing. Journal of Marketing, 68, 1-17 (2006)
4. Chung, Q. B., King, N. Tutorial: Positioning and Tracking Technologies in Healthcare - RFID and More. Proceedings of the 13th Americas Conference on Information Systems, Keystone, CO, August 9-12, 2007