

# U-commerce Is Here, Are We Ready?

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**Abstract.** *Ubiquitous networks which can be accessed at any time from any place and using a range of devices are base of new kind of commerce. Commerce that offers unique and personalized service to every customer individually using ubiquitous networks is called u-commerce. U-commerce is abbreviation that stands for ubiquitous commerce, also called ubicomp or ultimate commerce or pervasive computing. U-commerce is combination of e-commerce, m-commerce, television, voice and silent commerce. It can be seen as extension of current types of commerce, but not as their replacement. Main u-commerce characteristics are described using the four u-constructs: ubiquity, universality, uniqueness, and unison. Although u-commerce brings many benefits the principal obstacle to u-commerce development and adoption are customer concerns for their privacy protection.*

**Keywords.** U-commerce, ubicomp, privacy concerns, personalizatized service, personalization-privacy paradox

## 1 Introduction

A number of authors in order to explain what u-commerce stands for are quoting Mark Weiser's article "The computer for 21<sup>st</sup> century" [4], [9], [12], [13]. It is commonly acknowledged that Weiser [17] established foundation of u-commerce development describing how is Mrs. Sal spending her day at work and at home. Weiser has predicted two decades ago that computers and new technologies will be part in all segments of our lives. U-commerce goal is to make individual's life simplified by using digital

environment which is pervasive, could be customized to individual's needs and response to his needs [13]. In that respect various versions of u-commerce systems have been developed which have been experimentally implemented in homes, hospitals and public sector facilities. However it has been recognized that development and implementation of the systems which will indeed "understand" an individual's behavior, moods and intentions is hard [12]. There are a number of u-commerce systems, most of them are not applicable in real life but are rather implemented in a laboratory environment.

U-commerce systems are based on delivering personalized service to their customers. Delivering of personalized, improved and differentiated service depends on detecting customer's characteristics and preferences. In u-commerce environment obtaining customer's personal information that are stored on his mobile device, (e.g. PDA or cell phone) becomes easier. However, growing capability of collecting, storing and using personal information raises customer's privacy concerns. The customer is facing with the personalization-privacy dilemma. In order to perform interaction successfully customer must provide some personal information, but in doing so he is at risk that disclosed information will be used for another purposes beyond his knowledge.

Privacy is not a now problem but u-commerce introduces new privacy issue: timely and accurate location data can be collected about u-commerce customers. Apart of social, economic or legal issue that are connected to u-commerce development and adoption, customer's privacy concerns are identified as the major obstacle.

The remaining of this paper is organized as follows. Section 2 presents definition and components

of u-commerce. In Section 3 u-commerce characteristics are described, and Section 4 is focused on personalization-privacy paradox. Conclusion is given in Section 5.

## 2 U-commerce

At the beginning of this chapter u-commerce will be defined. U-commerce will be described through its major components.

### 2.1 U-commerce definition

U-commerce stand for world in which customer (user) can approach to any network from any place and in any time by using various technology devices in order to get unique and personalized service [16].

U-commerce could be defined as usage of ubiquitous networks in order to achieve personalized and continues communication between companies and their clients. This approach is creating added value to traditional business transactions [15].

Technology is the enabler for u-commerce, it relates physical and digital world. Every real life object has its representation in digital world [6]. U-commerce could be described as combination of e-commerce, wireless business, e-business through iDTV channel (inter-active digital television channel), and voice telephony business (*voice commerce*) and so called silent commerce. This combination enables interaction and transaction anywhere and everywhere without online connection [2]. Watson and Junglas [16] are arguing that u-commerce is opening new era in e-business, starting with e-commerce and continuing with m-commerce. Like m-commerce didn't replace e-commerce (e-business), u-commerce will not replace m-commerce.

U-commerce is faced with several challenges [13]:

1. *Scalability* – further development in u-commerce will include more and more customers (users), applications, hardware devices and interaction between them. For any increase in number of users and devices, further development in applications will be needed. If it would be possible that basic application logics and standard architecture could be achieved, scalability issue would be solved. Applications are usually installed and distributed with communication devices. Each device manufacturer is developing own applications, therefore standardization would be a goal in the future. Increase in number of communication devices worldwide makes installation and implementation of specific applicable software impossible.
2. *Heterogeneity* – if standard and compatible u-commerce environment would not be achieved, heterogeneity becomes an issue. However heterogeneity issue becomes a huge problem

with software applications. Increase in types of devices opens new challenge because every new device type asks for new application development.

3. *Integration* – integration of communication devices in unique platform will be very complex. Servers are challenged to support thousands of clients; increasing number of new devices connected to the server will rapidly exhaust server's capacity. A solution could be clustering of servers. Integration of devices various types on unique platform affects reliability and quality of service, invisibility and security of the whole network.
4. *Invisibility* – human intervention on invisible systems is needed only in the case if predictable reaction of managed environment is not achieved. Human interventions can be reduced with continues environment learning cycle in a way that automatic adjustment is achieved without abortion of user's focus.
5. *Perception: context-awareness* – u-commerce includes also devices which are aware of the context. Perception or context-awareness involves issues such as location perception, uncertain modeling, data processing in real time and integration of data which entered by multiple touch-points.
6. *Smartness: context management* – since a system can be aware of current context, it has to be able to use the perception efficiently. Smartness includes accurate data processing enabled either with intelligent control system or interaction between devices and users.

### 2.2 Components of u-commerce

E-commerce and m-commerce enabling technologies integration we are defining as u-commerce. However beside known technologies, u-commerce is including new ones which are in development phase. According to some authors u-commerce is integrating five types of business models [2]:

1. *Traditional e-commerce* – usage of Internet for both communication and business transactions;
2. *Wireless commerce* – usage of mobile and wireless devices for both communication and business transactions;
3. *Voice commerce* – usage of voice digitalization such as voice recognition, voice identification and voice-to-speech (voice-to-text) transmission;
4. *Television commerce* – usage of iDTV;
5. *Silent commerce* – radio frequency identifier - RFID usage in order to achieve intelligent and interactive communication between users.

Rogers [12] is arguing that within u-commerce could be identified following research fields: context-aware computing, ambient and ubiquitous intelligence, recording/tracking and monitoring. *Context aware computing* includes individual's

movement or action or location identification in order to collect information which can be used in further processing. This is including RFID technologies, satellite and GPS technologies. *Ambient and ubiquitous intelligence* is based on knowledge and research achievements in the field of artificial intelligence which can be implemented on things and objects in order to achieve “smart behavior” (door which is opening when someone approaches, TV which is turning – on and turning – off when someone enters the room, etc). *Recording, tracking and monitoring* has been mostly used to support older people, physically or mentally disabled persons who need to be surveyed.

According to Saha and Mukherjee [13] u-commerce model or *pervasive computing model*, as they call it, has four components:

1. *Device*:
  - a) traditional periphery devices such as – keyboard, mouse, speakers;
  - b) wireless mobile devices – pagers, mobile phones, handhelds;
  - c) smart devices – intelligent applications, devices with sensors;
2. *Pervasive networking* – current networks need to be adapted in order to be integrated in the environment;
3. *Pervasive middleware* – pervasive computing demands middleware which will be used as interface between network and applications which are used in user’s device;
4. *Pervasive applications* – *pervasive computing* is focused on the environment. Network and middleware functioning will depends on the application which is installed on user’s device.

### 3 U-commerce characteristics

Some authors have defined, in the very beginnings of u-commerce development, its major characteristic. Watson et al. [15] are forecasting in 2002 what would be the implementation areas and which benefits would enable u-commerce. These authors are defining four major characteristics of u-commerce (4Us):

1. *Ubiquitous*;
2. *Universal*;
3. *Unique*;
4. *Unision*.

*Ubiquitous* means that connected and networked computers will be very soon everywhere. Microprocessors and network connectors will be part of all users’ devices: from refrigerators and wash machines to the building and traffic signs. Ubiquity of computer chips means that they are everywhere and nowhere, while they will be invisible.

*Universality* of u-commerce will enable users to access the Internet at any place and any time. Mobile device for instance acquired in USA will not work for the time in Europe and vice versa.

*Uniqueness* is standing for unique, personalized approach in delivery of goods and services from business to customers. Customer will get all needed information depending on time, location and current role (parent, tourist, and employee) as well as all benefits/special requirements which he has specified to supplier or supplier learned from previous communication.

*Unision* stands for the integration of different communication systems in one system with one interface with customer. If customer have desk top computer, lap-top computer, mobile phone and PDA, unision will enable any change (egg. address) in one of devices will be registered in all others.

Table 1. Four u-commerce components and its characteristics

Source: Watson, R.T., Junglas, I.A., The u-constructs: four information drives, Communications of the AIS, Vol 17, pp. 586

U-constructs	Characteristics of u-commerce
Ubiquity	Reachability + Accessibility + Portability
Uniqueness	Localization + Identification + Portability
Universality	Mobile networks + Mobile devices
Unision	Mobile applications + Data synchronization

U-commerce components and characteristics are shown in Table 1, in which u-constructs could be considered as higher ranked and its characteristics as lower ranked [16]. Ubiquity encompasses reachability, accessibility and portability. According to ubiquity component u-commerce user can access to network at any place and any time. Accessibility and reachability are components which ensure request for “any time”, and portability ensure request for “any place”.

Reachability is u-commerce component which enables 24 hours access if the user has mobile phone turned-on and within reach of network. Portability means that device can be moved form one place to other. Portability is meaning also that mobile device can be moved and be ready to work all the time.

Uniqueness is including localization, identification and portability, and enables that person or thing can be digitally described. Localization means that a person or a thing can be localized by current position. Identification enables than an individual with own needs and preferences can be recognized by the information which has been developed during previous (historic) business relationship (customer experience).

Universality is enabling universal usage, multi-functionality and interoperability. Mobile phones should work in any network in order that a user can access to any computer network regardless its characteristics. In one mobile phone device should be

integrated functionalities of various mobile devices like cell-phones, handhelds mpp players, etc.

Unision encompasses data integration by the implementation of different applications and devices in order to enable a user to reach own information regardless which device is he using.

Watson and Junglas [16] are considering u-components as information drives. They are seeing ubiquity as a driver which enables “access to information unconstrained by time and space”, uniqueness as a driver which enables to know “precisely the characteristics and location of a person or entity”, universality as driver which enables to overcome “the friction of information systems’ incompatibilities”. Unision is a driver for “information consistency”.

Published researches are considering functionalities of enabling technologies in u-commerce evaluation. These evaluations have considered factors like performance, utility and usability. However further researches should take in consideration non-functional aspects, such as: relation between technologies and ethical issues, relation between technologies and social groups, applicability of technologies in certain situation and understanding how technology is working [11]. A major goal of u-commerce is to increase benefits to customers (users) and to create new added value to delivered services.

Four major factors are influencing value-added in u-commerce (Accenture quote [2]):

1. Location;
2. Voice;
3. Warnings;
4. Security.

U-commerce applications are offering certain services or goods to the customers based on physical location or individual personal characteristic learned through historic business relationship. Mobile phone user interface has been upgraded with new voice technologies such as voice-to-speech functionality. U-commerce warning functionality is notifying users on important information. All benefits that u-commerce offers imply personal security issue and privacy issue.

## 4 Personalization and privacy paradox

Personalization is major differentiator of u-commerce compared to other e-business. Personalization is a process of identification and recognition of customer specific need and expectations to which companies are customizing its offerings. Within u-commerce concept, personalization is going deeply towards each customer. A company is offering to individual customer’s products and services which this particular customer wants and expects. In that respect a company has to develop deep knowledge on customer’s needs, habits, work and hobbies. Of course that means that company has to collect as more

as possible private information. Based on this information and customer experience and previous interaction between company and customer, company will be able to offer to the customer needed information, services and products within timeframe which is defined by customer.

Although personalization brings lot of benefits, the most critical disadvantages is the fact that customer must submit own supplier with lot personal information. Relationship between personalization and privacy some authors are defining as “personalization-privacy paradox”.

Personalization-privacy paradox could be evaluated through two views: a) through a company view and b) through a customer view. Company is evaluating this paradox according to total investments in personalization. Personalization investments are high and very often return of investment is on long run. Some researches are showing that because of personalization some companies are loosing own customers. As higher is personalization level, volume of needed information is higher. Higher level of personal information is leading to higher level of privacy damage risk. On one hand there is customer need for the higher level of personalization. On the other hand customer is intending to reduce volume of information which he would be ready to give to the suppliers.

When a customer allows collection of private information, he is representing himself to public. Customer is, like in real life, giving to public definition on himself, defining own identity. Identity could be defined as: physical, social and biographical [7]. Physical identity in digital environment can be created through transformation of physical characteristics of an individual (his body) into biometry with enabling technologies such as: face recognition, voice identification, fingerprints etc. Social identity is based on an individual’s social status and social role. Biographical identity is based on analysis of an individual as his customer experience, preferences, wishes and motives.

Personalization process within u-commerce is collecting information on customers who are memorized in a mobile device (mobile phone, mobile computer, and sensor). However this process increases customer’s concern on the privacy protection issue [1], [7].

As soon as the customers are becoming aware of private information collecting process and of the way this information could be used, they are usually reacting in a way that they want to control volume and quality of private information disclosure. U-commerce technology enables that an individual could be identified in any time and in any place. Within this environment, personalization is much simpler. U-commerce systems could collect lot of information on an individual, who could not be aware of it.

Personalization in u-commerce environment depends on the identification of personal characteristics and preferences of an individual customer, offering him customized products or services. Suppliers are benefiting of value-added products and services which could be offered to the customers based on collected private information.

Personalization within u-commerce has three dimensions: identity, time and location [14]. Identity is based on collected information, which is attached to an individual. U-commerce enables that a service could be delivered to the customer in any time and any place. On the other side customers can benefit on customized products and services. However personalization of services increases customer awareness of the need for the security of private information [1].

U-commerce technologies are offering a promise of intelligent systems which are everywhere and which could be customized to current customers' context. Further system development in such intelligent environment brings two kinds of challenges (a) technology challenges and (b) challenges connected to the people. Technology challenges are involving further research and development of sensors which can be used in u-commerce, interoperability and integration software development, and development connected with ad hoc networks. Research and development of smart home technology development could be rather defined as challenges connected with people. Both challenges groups are involving privacy issue. In that respect privacy issue should not be treated only from technology point of view but as well as from people point of view [12].

Future is connected with research and development in the field of ubiquitous networks, distributed sensing, pervasive computing, ambient intelligence and data mining systems. Privacy issue is telling us that social interaction demands private information disclosure [7].

Privacy issues are getting on importance in u-commerce environment. [10]. On one hand there are factors such as usage of sensors, wireless devices and devices which are improving security, efficiency and simplicity. On the other hand there are discussions on negative implications of u-commerce systems because of possible mismanagement of private information and because of fear of losing control over private information. There is increasing demand for privacy-sensitive ubicomp system. Privacy could be one of major barriers in long term development of u-commerce systems [5], [3]. Some authors are suggesting [8], that private information security would be major factor which can affect ubicomp systems penetration in real world.

## 5 Conclusion

Increasing penetration of computers and networking technologies in private and business environment is leading to the increasing awareness on private information security issue. An individual is, by on-line shopping, on-line payments or on-line learning, leaving behind digital traces (signs). This is generating useful information on an individual's activity and life. Awareness of different information gathering ways is increasing worries on privacy issues.

U-commerce has heritage of the benefits and threats coming from e-commerce and m-commerce. Personalization benefits and privacy damage threats are creating so called "privatization-privacy paradox" that in u-commerce environment represents main obstacle but also main driver for future u-commerce systems development.

## References

- [1.] Brar, A., Kay, J.: **Privacy and security in ubiquitous personalized applications**, available at [http://www.cs.usyd.edu.au/~judy/Homec/Pubs/2005\\_Ajay\\_Brar\\_PEP.pdf](http://www.cs.usyd.edu.au/~judy/Homec/Pubs/2005_Ajay_Brar_PEP.pdf), Accessed: 5<sup>th</sup> May 2009.
- [2.] Galanxhi-Janaqy, H., Nah, F.F-H.: **U-commerce: emerging trends and research issues**, Industrial management & data system, Vol. 104, No. 9, 2004, pp. 744-755.
- [3.] Galanxhi-Janaqy, H., Nah, F.F-H.: **Privacy issues in the era of ubiquitous commerce**, Electronic markets, Vol. 16, No. 3, 2006, pp. 222-232.
- [4.] Hargraves, I: **Ubicomp: fifteen years on, Knowledge, technology & policy**, Vol. 20, Issue 1, 2007, pp. 3-10.
- [5.] Hong, J.I., Ng, J.D., Lederer, S., Landay, J.A.: **Privacy risk models for designing privacy-sensitive ubiquitous computing systems**, Proceedings of the 5<sup>th</sup> conference on Designing interactive systems: processes, practices, methods, and techniques (DIS) 2004, August 1<sup>st</sup>-4<sup>th</sup>, 2004, Cambridge, Massachusetts, USA, pp. 91-100.
- [6.] Konomi, S., Roussos, G.: **Ubiquitous computing in the real world: lessons learnt from large scale RFID deployments**, Personal and Ubiquitous Computing, Vol. 11, No. 7, 2007, pp. 507-521.

- [7.] Lahlou, S.: **Identity, social status, privacy and face-keeping in digital society**, Social science information, Vol. 47, No. 3, 2008, pp. 299-330.
- [8.] Langheinrich, M.: **A privacy awareness system for ubiquitous computing environments**, Proceedings of the 4<sup>th</sup> International conference on ubiquitous computing, Ubicomp 2002, September 29<sup>th</sup> - October 1<sup>st</sup>, 2002, Göteborg, Sweden, pp. 237 – 245.
- [9.] Lehikoinen, J.T., Lehikoinen, J., Huuskonen, P.: **Understanding privacy regulation in ubicomp interactions**, Personal and Ubiquitous Computing, Vol. 12, No. 8, November 2008, pp. 543-553.
- [10.] Palen, L., Dourish, P.: **Unpacking “privacy” for a networked world**, Proceedings of the ACM Conference on Human Factors in Computing Systems, CHI 2003, April 5<sup>th</sup>-10<sup>th</sup>, 2003, Fort Lauderdale, Florida, USA.
- [11.] Poole, E.S., Le Dantec, C.A., Eagan, J.R., Edwards, W.K.: **Reflecting on the invisible: understanding end-user perceptions of ubiquitous computing**, Proceedings of the 10<sup>th</sup> International conference on Ubiquitous computing, UbiComp 2008, September 21<sup>st</sup>-24<sup>th</sup>, 2008, Seoul, Korea, pp. 192-201.
- [12.] Rogers, Y.: **Moving on from Weiser’s vision of calm computing: engaging UbiComp experiences**, Proceedings of 8<sup>th</sup> International Conference Ubicomp 2006, September 17<sup>th</sup>-21<sup>st</sup> 2006, LNCS Vol. 4206, Orange County, CA, USA, pp. 404-421.
- [13.] Saha, D., Mukherjee, A.: **Pervasive computing: a paradigm for the 21st century**, IEEE Computer, Vol. 36, No. 3, March 2003, pp. 25-31.
- [14.] Sheng, H., Nah, F.F-H., Siau, K.: **An experimental study on ubiquitous commerce adoption: impact of personalization and privacy concerns**, Journal of the association for information systems, Vol. 9, No. 6, 2008, pp. 344-374.
- [15.] Watson, R. T., Pitt, L. F., Berthon, P., Zinkhan, G. M.: **U-commerce: expanding the universe of marketing**, Journal of the academy of marketing science, 2002, Vol. 30, No. 4, pp. 332-334.
- [16.] Watson, R.T, Junglas, I.A.: **The u-constructs: four information drives**, Communications of the AIS, Vol 17, pp. 575-592.
- [17.] Weiser, M.: **The Computer for the 21st Century**, Scientific American, September 1991, pp. 94-104.