Context–Aware Systems

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INTRODUCTION

Fixed mobile convergence is presently one of the crucial strategic issues in the telecommunications industry. It is about connecting the mobile phone network with the fixed-line infrastructure. With the convergence between the mobile and fixed-line networks, telecommunications operators can offer services to users irrespective of their location, access technology, or terminal.

The development of hybrid mobile devices is bringing significant impact on the next generation of mobile services that can be rolled out by mobile operators. One of the visions for the future of telecommunication is for conventional services such as voice call to be integrated with data services like e-mail, Web, and instant messaging. As all these new technologies evolve, more and more efforts will be made to integrate new devices and services. New markets for services and devices will be created in this converged environment. Services become personalized when they are tailored to the context and adapted to changing situation.

A context-aware network system is designed to allow for customization and application creation, while at the same time ensuring that application operation is compatible not just with the preferences of the individual user, but with the expressed preferences of the enterprise or those which own the networks. In a converged world, an extended personalization concept is required. The aspects covered include user preferences, location, time, network, and terminal; these must be integrated and the relationships between these aspects must be taken into consideration to design business models. Next-generation handsets are capable of a combination of services available on a personal digital assistant (PDA), mobile phone, radio, television, and even remote control. This kind of information and communications technology and mobile services together form one of the most promising business fields in the near future.

The voice average revenue per user (ARPU) is declining, the competition is getting fiercer, and voice over Internet protocol (VoIP) is entering the market with aggressive pricing strategies. Fixed mobile convergence should help in this context by providing converged services to both consumer and small-business users. For telecommunication companies it is now crucial to attempt to identify concrete applications and services for commercial offerings based on fixed mobile convergence which go beyond the current hype. Market scenarios and business models for such fixed mobile convergence solutions will be required and are therefore valuable for future strategy decisions.

This article examines market aspects, user requirements, and usage scenarios to come up with a roadmap and suggestions on how to deal with this matter.

CURRENT AND FUTURE TRENDS

In the past, user movement has often implied interruption of service. With the advent of pocket-size computers and wireless communication, services can be accessed without interruption while the entity using the services is moving (Floch, Hallsteinsen, Lie, & Myrhaug, 2001). There is a strong need for seamless access. Convergence has been taking place for years now. A study performed by the European Commission (1997) defines convergence as allowing both traditional and new communication services, whether voice data, sound, or pictures to be provided over many different networks. An excellent example of convergence in the telecommunications industry is the IP multimedia subsystem (IMS).

Similar to other emerging industries, fixed mobile convergence is characterized by a continuously changing and complex environment, which creates uncertainties at technology, demand, and strategy levels (Porter, 1980). Porter (1980) asserts that it is possible to generalize about processes that drive industry evolution, even though their speed and direction vary. According to Ollila, Kronzell, Bakos, and Weisner (2003), these processes are of different types and are related to:

- market behavior;
- industry innovation;
- cost changes;
- uncertainty reduction; and
- external forces, such as government policy and structural change in adjacent industries.

Each evolutionary process recognizes strategic key issues for the companies within the industry, and their effects

are usually illustrated as either positive or negative from an industry development viewpoint. For example, uncertainty reduction is an evolutionary process that leads to an increased diffusion of successful strategies among companies and the entry of new types of companies into the industry. Both of these effects are believed to contribute to industry development with regards to the fixed mobile convergence value Web.

The technological uncertainties are usually caused by fast technological development and the battles for establishing standards, which are common in the beginning stages of the lifecycle of a specific industry as a result of a technological innovation (Camponovo, 2002). Concerning demand, regardless of the generalized consensus about the huge potential of fixed mobile convergence, there are many uncertainties about what services will be developed, whether the users are ready to pay for them, and the level and timeframe of their adoption (Camponovo, 2002).

While the wireless industry is often cited as an example of a rapidly changing sector, the period from 2001-2005 could (in some respects) be regarded as relatively stable (Brydon, Heath, & Pow, 2006). Mobile operators have made the vast majority of their service revenue from simple voice telephony and text messaging, while their value chain has remained largely undisturbed (Brydon et al., 2006). However, new services, alternative technologies, and an evolving competitive landscape mean that the possibility of substantial industry change over the course of the next five to 10 years cannot be discounted (Brydon et al., 2006).

The telecommunication industry has experienced several waves of changes from the introduction of wired telephony to wireless telephony, and it is currently heading towards fixed-mobile convergence. Users become more demanding: a "user-centric" and not "network-centric" approach is needed.
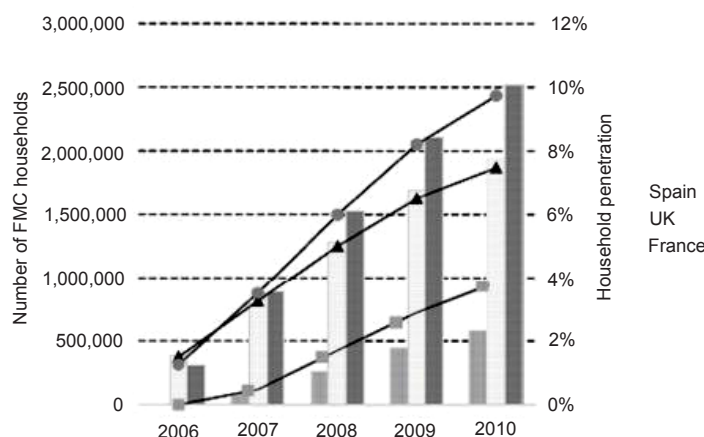
According to Hellwig (2006), many fixed operators lose their market dominance and merge units (fixed and mobile). New technologies and new actors (e.g., VoIP, Wi-Fi operators) coming into the picture are driving the adoption of fixed mobile convergence. The formation of new roles in the communication industry—including brokers, aggregators, alliances, and cooperation—have further pushed the stakeholders to take aggressive strategies to gain competitive advantage.

However, since new roles have been introduced, it is unclear how the market acceptance in the near future will be. Existing business models might not be applicable in the new business environment. The lack of terminal devices at the moment also hinders the diffusion.

In markets where there are high levels of fixed-mobile substitution and where broadband penetration and wireless local area network (WLAN) diffusion in the home are accelerating, it is most likely that consumers will be drawn to fixed mobile convergence, provided the cost savings and added convenience of carrying one device are apparent to the consumer (McQuire, 2005). According to the Yankee Group (2005), almost one-third of users make more calls within the home using their mobile phone than their landline. The trend is stronger among younger respondents. Figure 1 shows the number of fixed mobile convergence households in Spain, the UK, and France from 2006 to 2010.

The increasing need for a personal communication device that can connect to any type of network—a mobile network, IP network, or even public switched telephone network (PSTN)—and that supports all voice and text-based communication services drives the development of context-aware systems. The primary objective of the system is to facilitate acquisition, translation, and representation of context information in a structured and extensible form, in order to enable the development and enhancement of functionality of network

Figure 1. Number of fixed mobile convergence households in Spain, the UK, and France 2006-2010 (Hellwig, 2006)

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