Ubiquitous Music:
A Computer Science Approach

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ABSTRACT

Ubimus is a research field that merges Ubicomp and music and studies the influence of ubiquitous devices and applications in Music. This field has been explored by musicians and social scientists around the world helped by a countless number of computer scientists. Nevertheless, it is not easy to a novice computer scientist understand Ubimus concepts and specially how to take part of this research field. Based on this, the authors present in this paper a point of view of Ubimus associating fields in computer science and hardware and software definitions and suggestions to be explored with Ubimus.

Keywords: Computer Science, Ubiquitous Computing, Ubiquitous Music

1. INTRODUCTION

Ubiquitous computing (Ubicomp) is computing everywhere, anywhere (Langheinrich, 2001) anytime (Coroama et al., 2004) and also computing in anything and everything (Greenfield, 2006). Is is also called Invisible computing (Borriello, 2008), Calm technology (Weiser and Brown, 1997), Pervasive computing (Satyanarayanan, 2001) (Kurkovsky, 2007), Everyware (Greenfield, 2006) and Everyday computing (Abowd and Mynatt, 2000). Ubicomp also meets Wearable computing and has as predecessors Distributed Systems and Mobile computing (Lyytinen and Yoo, 2002) (Satyanarayanan, 2001).

Despite the different names, Ubicomp is a way to see computers where several devices typically have to work together to perform a particular task creating smart environments (Coroama et al., 2004) or intelligent environments (Brumitt et al., 2000). It would permit interaction of any format, any location and any device through computers in any form: laptop, mobile, tablets and, why not, refrigerators and cars. A principle of ubiquitous computing is to vanish computers into the background (Langheinrich et al., 2002).

Defining Ubicomp and trying to foresee a world with ubiquitous computers, Weiser mentioned that multimedia may be out of Ubicomp concepts because "multimedia tries to grab attention, the opposite of the ubiquitous computing ideal of invisibility" (Weiser, 1993). At his point,

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maybe Weiser could not predict the growth of MP3 and ubiquitous technology. Increasingly, we are seeing computational systems incorporating sensors such as microphones and headphones (Bellotti and Sellen, 1993) and transforming daily devices into music devices. The popularity of Ubicomp with the evolution of musical devices and new forms of music making brought this concept to arts within a field called Ubiquitous Music (Ubimus) (Keller et al., 2009).

Ubimus concepts and motivations, defined by Keller (Keller et al., 2009), include to merge sound sources and music interfaces with the environment. Ubimus research implies that just the ubiquitous existence of multimedia technology or shareable multimedia formats are not enough to guarantee applications in music Previous research and efforts from the Ubiquitous Music Group include several discussion involving collective creation (Ferraz and Keller, 2014), interaction aesthetics (Keller et al., 2014), methodologies for creativity-centered software design (Lima et al., 2012), open issues in current musical practices (Keller et al., 2011) and other relevant aspects of social and musical dimensions.

Beyond the musical and social discussion in Ubimus, we believe that computer scientists can also take part of this research field to contribute with Ubimus research. Thus, this paper tries to serve as an introductory proposal for Computer Science research into Ubimus issues. The aim of this paper is to stimulate discussion in the interdisciplinary borderland surrounding ubiquitous computing and music.

The remainder of this paper is organized as follows: Section 2 presents concepts, features and challenges on Ubicomp, Section 3 presents the points of view of Ubimus targeting Computer Scientists and Section 4 presents the Conclusion.

2. UBICOMP

Ubimus concept, proposed by Mark Weiser in 90's (Weiser, 1999), presented a future of hardware and software so ubiquitous that no one notices their presence. More than two decades passed since Weiser's first paper and Ubicomp seems to be a reality. Nowadays (2014), people use their TV sets or cellphone without considering them as computers (Rauterberg, 1999).

Ubicomp, in technical terms, lays on a wide range of research topics of Computer Science like Computer Networks and Internet, Distributed Systems and Distributed computing, Middleware, Operating system, Mobile computing, protocols and networking, Sensor networks, Microprocessors, User interfaces (UI) and Human-Computer Interaction (HCI), Location and positioning computing, new materials and Artificial intelligence (Kurkovsky, 2007) (Weiser, 1993) (Satyanarayanan, 2001), as depicted on Figure 1.

Ubicomp merges all these research fields in Computer Science and brings new concepts, features and challenges due to the kind of computational devices able to be ubiquitous.

2.1. Ubicomp Concepts

The explicit goal of ubiquitous computing is to have a significant impact on all aspects of the existence of every human being in our society, by means of a revolutionary transformation of everyday life (Langheinrich et al., 2002).

The primal concept of Ubicomp is unlimited access computing capabilities (Davis, 2002) in every activity and every place. The every-place concept can be seen as every location where one can be and also on every device, from offices to laps and then to pockets and the body (Lyytinen and Yoo, 2002). To be everywhere, ubiquitous technology needs to be cheap and strongly connected (Weiser, 1999). The shared information should be used depending on the context, creating a context-aware1[1] smart environment (Abowd and Mynatt, 2000).

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