



User-provided multimedia content distribution architecture in mobile and ubiquitous communication networks[☆]

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ABSTRACT

The network convergence of wired, wireless, and mobile systems creates a ubiquitous network environment where modern networking devices feature multiple networking interfaces and can connect to different networks simultaneously. Mobile users in ubiquitous networks expect to access information services anytime, and from anywhere. This paper presents a mobile content sharing scenario in which a networked device can discover neighboring devices and share multimedia content in a convenient, networked manner. This ideal scenario differs from the traditional usage which requires the tedious manual operations of connection setup and file transfer. To achieve this goal, this study proposes a user-provided multimedia content distribution architecture for a mobile and ubiquitous network environment. The proposed architecture integrates several specific mechanisms, including device discovery, asynchronous content delivery, secure access control, and virtual file system. This design addresses several inherent limitations in wireless and mobile networks, and enables mobile users to transfer media content in a secure, mobile, and energy-saving way. The proof-of-concept prototype and performance evaluation in this study confirm that the proposed architecture not only provides better user experience, but also achieves a lightweight design without compromising performance.

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1. Introduction

Recent advances in network communication technologies and mobile handheld devices (MHDs)¹ have provided users with a ubiquitous network environment, enabling access to numerous information services at any time and from anywhere. Many modern MHDs have at least dual or triple network connectivity modules—for example, mobile phones may have 3G, Wi-Fi, and Bluetooth. Since the device can attach to multiple networks simultaneously, it can run different network services concurrently in different networks. Combining these network services might lead to further collaborative network services (Moriya et al., 2007; Ohnishi et al., 2007). This area remains the topic of future research.

Users with MHDs, a.k.a. mobile users, now access Internet and Web services much like they used to on desktop computers. In addition to downloading Internet files and media content, MHDs upload user-created multimedia content. In fact, many MHDs

include a digital still camera, audio recording capabilities, and audio/video (A/V) processing modules, with which users can conveniently and effectively take pictures, record audio sounds, or shoot video clips. Using external storage space, MHDs can store a large volume of media content. Therefore, it seems natural and inevitable that people will exchange, share, and publish media content among various networked devices in social communities (Belimpasakis et al., 2008; Hu et al., 2008).

The convergence of fixed, wireless and mobile network systems has created a new playground for ubiquitous content applications and services. Figure 1 illustrates that multiple wireless networks often surround an MHD: GSM, 3G, 3.5G, WiMAX, Wi-Fi, and Bluetooth PAN. An MHD with multiple networking interfaces can connect to different networks simultaneously. As a result of this improved user experience, mobile users now expect to access information services anytime and anywhere. Accordingly, enabling user-provided multimedia content sharing across wireless and mobile-networked devices in a ubiquitous network environment is an interesting possibility in mobile applications. Section 1.1 describes the ideation of a novel mobile multimedia content sharing scenario. Section 1.2 describes the proposed architecture and development to realize this design.

1.1. Ideation and scenario

Consider the evolution of wireless broadband network systems, such as IEEE 802.11a/g/n, UMTS, LTE, and WiMAX.

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¹ An MHD, such as mobile phone, personal digital assistant, mobile Internet device, or ultra mobile PC, is the major product concept of portable information devices. Without loss of generality, we use this term to implicitly represent all types of wireless and mobile-networked devices.