Using Virtual Storage to Provide Ubiquitous Mobile Access to Personal Information

Jeffrey Kennedy and Janet Wesson
Department of Computing Sciences
P.O. Box 77000, Nelson Mandela Metropolitan University, Port Elizabeth, 6031
Tel: +27 41 503 2247, Fax: +27 41 503 2831
Email: Jeffrey.Kennedy@nmmu.ac.za, Janet.Wesson@nmmu.ac.za

Abstract-Personal Information Management (PIM) is intended to support people's activities through the maintenance of personal information. Information is gathered all the time, and can be gathered by various devices. The problem is that the information is fragmented across multiple devices and the lack of accessibility of that information across multiple devices. There has been a growth in the capabilities of mobile devices, as well as a growth in the number of devices owned by one person. This exacerbates the problem of having information spread over multiple devices. A possible solution to these issues is the use of virtual storage, where all of the users' information is stored in one location and can be accessed via multiple devices. Virtual storage also provides the possibility of providing ubiquitous access to the user's information in a mobile context, by having the information accessible to the user from any of his devices without having to download or copy the information from one device to another. This research is aimed at determining the effectiveness of using virtual storage to support ubiquitous access to personal information in a mobile context.

Index Terms—Personal Information Management, Ubiquitous Computing, Virtual Storage, Mobile Devices

I. INTRODUCTION

In our information age, people use a lot of different applications, collect data such as documents, emails, bookmarks to websites and other resources, and utilise personal information management (PIM) tools [1]. The types of information we gather and manage are different, making a single management system for this information extremely difficult [2].

Research has shown that employing multiple devices improves access to information and computation, but it requires managing information and activities across many devices, each with different limitations. Managing personal information is a significant issue for a single device, with multiple devices further exacerbating this issue [2, 3].

Storage virtualisation is the process of abstracting physical storage into a set of logical storage devices called a virtual disk that can be used by applications [4]. The functionality that virtual storage offers provides us with the opportunity to use virtual storage to support ubiquitous access to personal information.

The term *ubiquitous* means being or seeming to be everywhere at the same time; i.e. omnipresent. Ubiquitous computing is a new genre of computing, where computers become a helpful but invisible force, assisting the user in meeting his needs without the users' direct request for assistance [5]. Ubiquitous access therefore can be described as being able to access your personal information from anywhere.

The aim of this paper is to investigate the requirements for mobile PIM and to determine how virtual storage can support ubiquitous access to personal information. Section II covers related work in the fields of PIM, mobile technologies and virtual storage. Section III sets out the requirements for a mobile PIM prototype and Section IV provides the conclusion and suggestions for future work.

II. RELATED WORK

A. Personal Information Management

PIM is intended to support the activities people perform to organize their daily lives through the acquisition, maintenance, retrieval, and sharing of information [6]. To gain a better understanding of what PIM is, we need to understand what personal information (PI) is. Personal information (or personal content) is data targeted at human access, including individual data objects and combinations and collections thereof. [7]. Data objects are the different types of information that need to be managed, such as emails, web pages, web links ,media (e.g. images, video files, audio files), calendar information, references, and general files (such as Word, Excel, etc.) [1, 8].

B. Mobile Technologies

Personal mobile devices such as smart phones, tablets, netbooks and other handheld devices have become widely used in our everyday lives. We use them to process and display multimedia data such as music, images and videos, as well as data files such as emails and documents [9].

Organising data and having access to the relevant information is particularly important in a mobile scenario. However, organizing information on mobile devices is more difficult when compared to a desktop setting. This is mostly due to the fact that mobile devices have limitations in network bandwidth, storage capacities, displays and input capabilities [1]. In recent years there has been a large growth in the capabilities of mobile devices such as smart phones and tablets, which allow for access to the users' personal information at any time and from any place [10]. Users increasingly own, and use, multiple computing devices, from desktop computers, to laptops, tablets, consoles and mobile phones. In such an environment, data availability is an important issue, as users want to access their personal data everywhere, independently of their current machine or location [11].

C. Virtual Storage

Storage virtualisation refers to the process of abstracting physical storage into a set of logical storage devices from a single physical storage resource called virtual disks that can

be used by applications [4]. Two types of virtual storage have been investigated so far, namely storage area networks (SANs) and cloud storage. SANs are a common approach for storing data, which combines storage devices into a network which is connected to Local Area Networks (LANs) and/or dedicated servers [12].The issue with SANs is that the information is still located on external storage devices, which are separate from the servers, as well as the devices themselves. The main advantage of using cloud storage is that the user is provided with anytime, anywhere data access [13]. One disadvantage of using cloud storage, however, is that it is not for free, and costs for storage of data as well as the transfer of data will have to be incurred Another disadvantage of using cloud storage is that an Internet connection is required to access your information

III. Requirements Analysis

A. Functional Requirements

To determine the requirements for mobile PIM that uses virtual storage to support ubiquitous access to personal information, several PIM systems were investigated to determine the functional requirements. These requirements were established as:

- Having a central data storage unit, which allows for access to the users' personal information via multiple devices such as mobile phones, tablets, laptops and desktop computers;
- Information should be accessed from anywhere and at any time; and
- Information access should be seamless, in that the information is already on the devices without having to be downloaded/copied onto the device.

B. Prototype

A prototype will be designed in order to have users test the effectiveness of the solution. The prototype will consist of mostly underlying backbone code, which will handle the maintenance of the information on the devices and the virtual storage system. A small GUI component may be implemented.

C. Evaluation

The effectiveness, efficiency and user acceptance of the mobile PIM prototype will be determined by means of a user study. Data will be collected by means of logging, surveys and questionnaires

IV. Conclusion & Future Work

This paper identified the need for personal information to be accessed via multiple devices in a ubiquitous manner. Using a type of virtual storage was identified as a possible approach to support mobile PIM. The concepts of PI, PIM, virtual storage and ubiquitous access to PI were explained, and the requirements for a mobile PIM prototype were identified.

In future work, a prototype will be developed using virtual storage to facilitate ubiquitous access to PI in a mobile context from multiple devices. The prototype will serve as a proof of concept and an empirical evaluation will be conducted using the prototype to determine if virtual storage can effectively support ubiquitous mobile access to PI.

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Jeffrey Kennedy received his BSc Honours degree in Computer Science in 2011 from the Nelson Mandela Metropolitan University. He is presently studying towards his Master of Science degree in Computer Science at the same institution.