Towards Digital Preservation of Pervasive Device Information

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Abstract
In this paper we describe the importance of preserving personal information, stored on pervasive devices, on a reliable platform. Nowadays, pervasive devices such as mobile phones or personal multimedia players, provide software and hardware capabilities that allow individuals to read and create digital contents. Therefore it is important to provide the ability to archive these contents for later retrieval and use on other platforms. To address this need we introduce a framework that enables users to archive their pervasive device information for long-term preservation.

Keywords
Digital preservation; pervasive computing; personal archive; personal information.

ACM Classification Keywords
H3.2. Information Storage and Retrieval: Information Storage.

General Terms
workshop publication

Introduction
We are using a variety of mobile devices, such as personal multimedia players or personal digital

assistants. The ubiquity and computing capabilities of these pervasive devices make them capable to be a container of important personal information. Pervasive devices such as mobile phones are more vulnerable to loss or damage than desktop computers [9]. Personal information created and stored on pervasive devices includes contact information, audio recordings, digital images, meeting notes, etc. It is therefore crucial to provide the capability for archiving personal information stored on these devices for long-term digital preservation. In this paper we introduce a framework. The implementation of this framework enables users to archive their pervasive device data by changing the format of the data. We use the term "pervasive device" as described above to cover all relevant devices. However, the focus in this paper is on mobile phones, since they are currently the most common type of pervasive devices.

Design Considerations

We identified a number of design considerations that need to be addressed by a tool, which will be used for digital preservation of pervasive device information. These considerations constitute the foundation for the implementation of the prototype.

A Backup Software is Not Enough

There are backup applications for pervasive devices (mostly for mobile phones) available. We believe available backup solutions have some restrictions. For example, to our knowledge these applications are not considering the long-term preservation of the information objects. Further, most applications perform backup manually, which indicates that a user interaction is necessary to perform a backup. Another problem is that backup applications mostly focus on backing up general information on a device such as calendar contents and contact lists. Mobile phones are increasingly becoming portable computers, which means that the device could host other applications such as a health monitoring application that produces valuable information and the user wants to archive it for a long-term period of time.

User Intervention

Performing administration tasks is not desirable by users. In this framework we try to reduce the user intervention as much as possible. It is therefore desirable to run the archiving application 24/7 in the background without any need for user intervention during the archiving process.

Application Performance

Pervasive devices by their very nature are not designed to host large computing applications. Client thickness [8] is one of the major challenges in designing applications for pervasive devices. The archiving application should always run in the background of the device. An application always running in the background should not affect the performance of applications running in the foreground.

Long-term Preservation of the Information

The main goal of this research is to archive pervasive device information in a way that is accessible for a long period of time. Gordon Bell [1] noted that personal information is worth to be kept at least during the owner's life. To solve this problem an archiving application should check the file format of the binary data. In case the data is not a long-term archive-able file format, the archiving application should send the binary file to an appropriate migration service based on the source file format.

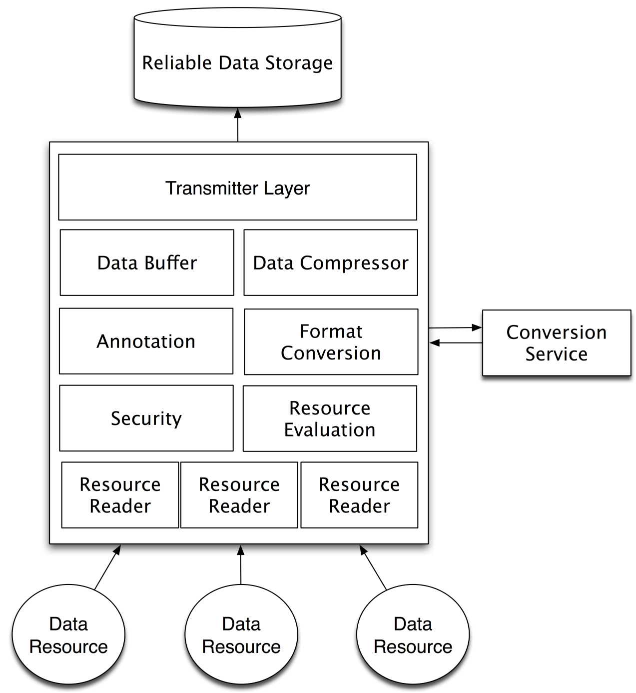

Figure 1. The Framework Architecture

Related Work

Currently digital preservation is mainly being investigated for digital libraries and news media [6] and not for pervasive devices. Only few projects exist that address the preservation of personal information. MyLifeBits [5] provides an approach to preserve life-log information at least during the user's life. iMemex [3] is another approach, which provides a desktop-based PIM (Personal Information Management) system. Thus it also represents a desktop-based life-logging tool. iMemex introduced a data model, which stores data in long-term accessible formats such as XML files.

Framework Architecture

Figure 1. shows the current architecture of the proposed framework. The architecture was inspired by similar efforts in context-aware applications such ContextPhone [7] and MyExperience [4]. Context-aware applications gather information from different sensors and aggregate them based on their usage and functionalities. Most pervasive devices (especially smart phones) are able to connect to a network. Connecting a pervasive device to an external source provide more computing capabilities (calling and external service) and more reliable storage. In the proposed framework the "Resource Reader" will read the information, which is worth to be archived for a long-term period of time. "Data Resource" is the source of information e.g. an audio file of a call content is a data resource, a contact in a contact list is a data resource, etc. Resource readers work independent from each other. Therefore in case a resource failed and the associated resource reader cannot read information from it, this will not affect the functionality of other resources. Another advantage with using multiple resource readers is that it makes the framework flexible to be extended (by adding a new resource).

This framework relies on the network connection of the device. It gathers information from different data resources annotates it and sends it to a "Reliable Storage Media" (RSM). The RSM might be the user's personal computer or an online server. The sending process is executed via the "Transmitter Layer". The "Security" component is used for securing the connection between the device and the RSM.

We introduce the "Data Buffer" to use it as a temporary information holder. Network connection between the pervasive device and the RSM is not always available;

hence, a data buffer will be used to keep data objects temporarily on the device. When the connection becomes available it will hand the data over to the Transmitter Layer to send it to the RSM. In order to reduce disk space usage the information objects that reside within the Data Buffer will be compressed via the "Data Compressor".

Further, we consider the annotation of the personal information objects via an annotation component. Annotating personal information is one of the main challenges in using lifetime personal information stores [2]. The framework sends large processes, which are hard for a mobile device to perform, to an external service. This could be achieved via using Web Services. Web Services will be used to perform file format conversion. The archive unit in this framework is file. In another terms, file will be sent to the RSM, format of the file will be changed to a long-term archive-able format, etc. In the implementation prototype we assume that file conversion is a resource intensive process, therefore we use an external service to convert the file format. "Conversion Service" could be a web service, which receives the file and converts it into an archive-able format, and then returns it to the application. "Format Conversion" contains information about the conversion services and enables the framework to choose the appropriate service.

One drawback of the current framework is the networking issue. Sending a file to an external service or receiving a file from an external service consumes a lot of network bandwidth. On the other hand file conversion process is a large process. After the file gets converted to a desired format "Resource Evaluation" will be used to evaluate if the file conversion is successful or not. In the implemented prototype Resource Evaluation is checking the file format and based on the file format, it reports, whether the conversion is successful or not.

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