The Personal Server:
Personal Content for Situated Displays

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ABSTRACT

The Personal Server is a small, lightweight, and easy-to-use device that supports personal mobile applications. Instead of relying on a small mobile display, the Personal Server enables seamless interaction with situated displays in the nearby environment. The current prototype is supported by emerging storage, processing, and communication technologies. Because it is carried by the user and does not require data to be either hosted in the local infrastructure or retrieved from a remote web-site, it provides a platform that increases users' control over their personal data. Furthermore, it enables additional novel applications, such as a personal location history, that would not be appropriate for the computing infrastructure.

OVERVIEW

The Personal Server (PS) [1] is a system designed to provide access to a user's personal applications and data, stored on their mobile device, through large-screen displays in the infrastructure. The device itself does not have an built-in display, allowing it to exist as a small, yet powerful, mobile device. By providing a flexible platform for personal information access, the PS concept explores issues in personal information control, trade-offs between mobility and situated displays, and environmental customization.

The Personal Server is designed to overcome several shortcomings of current mobile systems, some of which are listed below:

- *Usability* – most mobile devices have a small screen that makes it very difficult and inconvenient to access content. By enabling access through displays located in the nearby environment, the Personal Server allows the use of large screen displays to access one's data without having to carry a bulky laptop around.

Figure 1: Personal Server Prototype

- *Accessibility* – the Personal Server enables quick and easy access from multiple potential access points, not requiring access through the device itself, which may be conveniently and safely located in the user's bag or pocket.

Attention – the Personal Server platform is capable of automatically interacting with local environment on the user's behalf, not requiring them to immediately respond to location-triggered events or notifications.

The underlying concept behind the Personal Server is creating and presenting an individualized digital presence surrounding the user, making it easer to access personal content and also allowing the environment to adapt to personal preferences. A crucial metric in evaluating mobile systems is often ease of use and the user's attention level. By allowing easy access through any nearby convenient display, and not restricting access through a phone or laptop, the Personal Server enables streamlined

ubiquitous interaction and thus ranks very highly with respect to the aforementioned metrics.

The current operational prototype of the Personal Server is an instantiation of the overall concept, and is designed to demonstrate the novel characteristics of the device. Although currently a stand-alone device, in the future the Personal Server may be integrated with other mobile devices such as a cell-phone, laptop, or wristwatch – providing the same functionality without burdening the user with an additional device. Rapid advances in three technology areas directly enable the Personal Server concept:

- *High density storage* – high-density storage technologies, both solid state and magnetic, are increasing at an extremely high rate, doubling approximately every 12 months.
- *Power efficient processing* – both the power efficiency and computational capability of embedded processors is rapidly increasing, enabling smarter and more powerful devices that also have higher battery lifetimes.
- *Short range communication* – emerging short-range wireless standards afford easy, low-power, ubiquitous point-to-point wireless connectivity.

Specifically, the current prototype has an Intel® XScale™ family processor, Bluetooth™ wireless radio, and a compact flash slot for permanent storage. The resulting device is about the size of a deck of cards, and supports a full Linux distribution with up to 4GB of removable storage. As a baseline, it supports web-browser and file-share access, but is also capable of running any compatible client- or server- side application.

Three applications demonstrate the unique capabilities of the Personal Server:

- *Personal data access* – personalized content, such as a photograph collection, music collection, or working documents, can be stored on the Personal Server platform and easily accessed from nearby situated displays.
- *Location collection* – information from short-range beacons in the environment are collected and managed by the device, allowing for location-based services that do not constantly require the user's attention.
- *Environmental customization* – personal preferences, such as music selections or immersive game profiles, can be automatically transferred to the environment, allowing

proactive customization of the immediate vicinity without direct user involvement.

These applications highlight how the Personal Server overcomes the difficulties with current mobile platforms by exploiting three important emerging technology trends. It provides a small, powerful, and non-obtrusive platform for supporting mobile interactions. As technology becomes more ubiquitous, the connection between mobile users and the environment around them will become more important, strengthening the need for personalized mobile systems, such as the Personal Server.

DEMO APPLICATION HIGHLIGHTS

For the conference demonstrations, the three applications mentioned above highlight the Personal Server's core capabilities: personal data access, location collection, and environmental customization. Multiple devices, each carried by, and associated with, a particular individual, provide the personalized content for each of these applications. By exposing the unique data contained on each device, these applications highlight how advances in mobile storage, processing, and communication can be used to enable new types of personal interactions.

For example, Fred's Personal Server may contain pictures from his recent vacation to Japan, a web-page describing him and his general interests, and his personal collection of rare bluegrass music. Additionally, the device could contain detailed research data describing his power and latency measurements of emerging wireless networking protocols. Also, his personal profile may indicate that he loves Thai food, hates coffee, and likes to browse through antique shops.

The personal data stored on Fred's mobile device can be easily accessed through any number of nearby situated displays, allowing convenient access to data without relying on a small-screen display. For example, Fred could walk up to an available display and show his friend a collection of photographs from Japan. Similarly, he could show his other colleague his latest research results. Streamlining this basic interaction through a simple web and file-sharing interface, supports a mobile lifestyle without requiring a bulky mobile platform, such as a laptop

The second application, termed the Ubiquitous Walkabout, receives information from nearby information beacons and other

devices to form a picture of where users travel and who/what they have been around. Data is collected in real-time as the user passes by nearby points of interest, and can be viewed later on a situated display. Because the Personal Server gathers and records the data, users maintain control over their personal information: it allows them to track themselves, but does not require the trust of any third-party or the use of infrastructure such as GPS. Additionally, since the system knows that Fred is partial towards Thai food and antique shops, it will highlight any Thai restaurants or antique stores he regularly walks by, but doesn't notify him about coffee shops.

Finally, the Personal Server provides a platform for customizing the music or audio present in communal spaces. Because of the significant storage capacity, Fred can store a considerable collection of bluegrass music on his device, creating, in essence, a "ubiquitous MP3 warehouse" that makes his music available through music players in the environment. Although his tastes in music are rare, he can listen to his music when he likes, although he is not likely to find his favorite bluegrass playing on the radio. Furthermore, the environment can combine music from other nearby users' to automatically mediate the music played in a particular space, customizing the local experience. This concept is similar to MusicFX [3], except music is sourced off of users personal devices, instead of being provided through a centralized agency.

As an alternative to playing entire songs, the system can play a different short sound chirp or show a representative graphic associated with the participants in the immediate vicinity, served from their mobile devices. For example, one person might choose the sound of a chirping bird, while another, a snare drum hit. This conglomeration of personal media signatures automatically constructs a dynamic environment based on the identity of nearby participants, creating an immediate and dynamic demonstration of environmental adaptation as individual participants come and go.

Current mobile devices already possess many of the technologies necessary to implement a Personal Server, such as processing, storage, and communication. However, accessing stored content through situated displays and other devices has yet to be fully explored. The Personal Server concept provides a platform that

will spur many of these explorations and discussions.

SUMMARY

The Personal Server demo environment consists of several demonstration stations that detect and respond to devices representing individuals. The display stations, either in the form of large public displays or smaller touch-screen displays, will show content served from nearby users' Personal Server devices. At any given time, only a few devices will be in the vicinity of the display station, adapting the local environment to the preferences of nearby individuals.

The individual demonstrations have been selected to highlight personal control over information. Although it relies on public infrastructure to access content stored on the user's mobile device, the Personal Server controls access to personal data, providing a balance between mobile and ubiquitous computing. These demonstrations provide a concrete discussion point for conference attendees to explore ideas surrounding personal information control and access.

REFERENCES

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