

# A task-based approach to data and context management in a virtual personal server space.

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**Abstract.** This paper presents our vision for an activity based pervasive computing system based on a virtual personal server space. Our target demographic is a group of elder computer users. Using collaborative interfaces technologies; we focus on reminiscence activities for their use in promoting social and intellectual fitness. Current computer applications while designed for single use are not suitable for multi-user, multi-device and multi-modal interaction. Our proposed architecture (middleware) consists of three planes of service (data, context and activity). The context plane mediates access to various services (depending on the current user activity) while optimizing data access around simple activity models.

## 1 Introduction

Our research aims to substitute the classical desktop interface with invisible and ambient interfaces that allow individuals or groups to engage in reminiscence oriented group or individual activities. Our own user studies have identified a broad range of currently used simple technologies and physical objects that stir and support these activities [7]. Rather than focus on specific “applications” our work is taking an activity based approach. We envisage our system being used by individuals or groups moving between the available modalities, across different devices to input, access and manage digital content in process of reminiscence activities [4] [5]. Our goal is to develop new technologies that will be used naturally by incorporating systems such as memory collection, meta-data specification, pen-paper control, voice control, large screen touch-based interfaces, haptic and ambient feedback.

To support such natural environments we have developed our virtual personal server space architecture. The server space incorporates two main planes, the context and data planes, in support of activities. The data plane manages synchronisation, caching, migration, and security as the individual moves through different network topologies. The context plane, as is traditional in pervasive computing, manages device character-

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istics, profiles, service availability, modalities and learning. In practice, the current activity dictates that these services be offered from devices when decoupled from the network but may use services residing in the nearby computing environment as they become available.

## 2 Motivation

It is envisaged that in the future, people will be carrying devices which are capable of interacting with pervasive computing environments [6], namely environments instrumented with sensors, numerous I/O devices, compute engines, controllers and actuators [1][3][4]. The major features of this type of pervasive computing environments are:

- The personal devices users carry, which we refer to as virtual personal servers, consist of a collection of local and possibly remote devices
- The personal servers will range from a simple ID wireless drive, USB key, mobile phone, PDA and up to systems akin to the Intel personal server
- The personal servers will act alone or in unison to allow an individual use the information they carry
- They are likely to have no classical user interfaces, but some limited computational power, storage capabilities and network connectivity

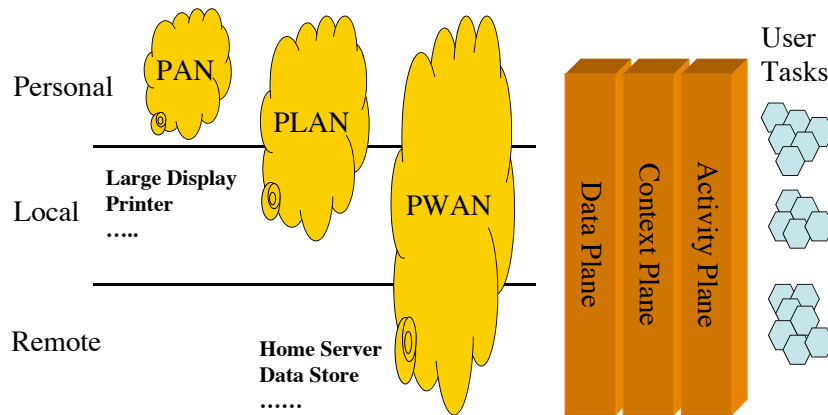


Fig. 1. Task-aware context and data plane services running on personal server. This controls the available input and output modalities for set of task functions running in the Personal Area Network (PAN) or the Personal Local Area Network (PLAN), respectively.

The remainder of this paper will outline the technical focus of the project and illustrate the type of intended use of our model through an example.

## 2 Middleware (Vision for support in Pervasive Computing)

We have defined a single management plane, which has the responsibility of organising, synchronising and maintaining the information over the different available devices in the overall data storage system. Users interact with the system through a simple and well-defined API that allows them to put objects (during a particular activity) into storage and to retrieve objects from storage, according to a defined activity. When adding objects to the data storage, users have the option of indicating the importance of the object, which in turn affects where the object will be stored in the system. This way, increasing importance will translate to increased accessibility and possibly also increased replication. By including the notion of activity modeling into our data plane specification, we can decouple the various applications from the actual data accessed and instead associate it with a rich context model, encoded as an activity model.



**Fig. 2.** Data and context planes transcend the current network topology. Data stored while in a PAN is synchronised when a PWAN becomes available or to a data store in a PLAN for performance reasons. Context plane manages, computing context, user context, physical context and time context, for activity and multi-modal interface support.

!! Insert explanation of PAN/PLAN/PWAN!!

## 3 Activities Interfaces

The adaptive interface aspects of this project rely on the pervasive environment to mediate access and control of the available modalities. Thus this work will focus on the seamless interaction with the virtual personal server across a number of devices in a multi-modal multi-device manner. To demonstrate our virtual personal server, we aim to develop a number of example pervasive computing environments using the surrounding computing infrastructure for accessing the virtual personal server. Our

preliminary environment will consist of a pervasive environment that contains, wireless connectivity, local server, RFID reader, shared multi-user touch sensitive input device, gesture recognition and a few personal screens. This prototype pervasive environment will allow a number of individuals to manage multimedia content from their virtual personal servers in a collaborative reminiscence activity.

## **4 Task Based Application Scenarios**

!! Insert text on the Club-home-club activity!!

### **Biographies**

Dr Aaron Quigley is a Senior Research Fellow in the School of Information Technologies University of Sydney. Dr. Quigley was awarded his PhD in Sept 2002. Dr. Quigley commenced his studies at Trinity College Dublin in Ireland and finished his PhD at the University of Newcastle Australia. Since joining the University of Sydney he has developed a pervasive computing laboratory based on a large equipment grant. Along with over 20 publications, he is involved with the supervision of 4 PhD students. Dr. Quigley is now the project leader for two research projects within the Intelligent Environments program. Project Bluestar is a joint project with Telstra Research Laboratories researching a scaleable privacy-centric location aware system by in-door location sniffing. Project Nightingale is a joint project with the National ICT Australia for the development of natural pervasive computing interfaces in a virtual personal server space. His interests include distributed systems, middleware, location-based computing, human computer interaction and pervasive computing.

Dr. Björn Landfeldt (MIEEE MIEICE) is a Senior Lecturer in the School of Information Technologies and Department of Electrical Engineering (University of Sydney). Dr. Landfeldt was awarded his PhD in May 2000. Dr Landfeldt started his studies at KTH in Sweden and finished his PhD at UNSW in Australia. During his studies he was running his own consultant company in parallel within the area of wireless networking. After his graduation, he worked for Ericsson Research Networks and Systems in Stockholm before returning to Australia where he currently holds a position at the University of Sydney. His interests include wireless networks, IP mobility management, QoS, Peer-to-Peer networks, Middleware Architectures and IPv6 migration methods.

David West is a Research Associate with the National ICT Australia and the Smart Internet Technology Research Group in the School of Information Technologies (University of Sydney). David holds a Masters degree in Networks and Distributed Systems from the University of Dublin, Trinity College. Along with graduating at the top of both his postgraduate and undergraduate classes, David is a University Medalist and scholar of the University. His interests include computer vision, ad-hoc networking, mobile computing, human computer interaction and web engineering.

## References

1. Brumitt, B., et. al "EasyLiving: Technologies for Intelligent Environments". In Proc. of 2nd International Symposium on Handheld and Ubiquitous Computing, HUC 2000, pages 12-29, Bristol, UK, September 2000. Springer Verlag.
2. Douglas B. Moran, Adam J. Cheyer, Luc E. Julia, David L. Martin, Sangkyu Park, "Multi-modal User Interfaces in the Open Agent Architecture", Intelligent User Interfaces 1997, pp. 1-9.
3. Edwards K, Grinter R. "At Home with Ubiquitous Computing: Seven Challenges" in Proceedings of UbiComp 2001, LNCS 2201, pp. 256-272, 2001. Springer-Verlag Berlin Heidelberg 2001.
4. Fox, A., Johanson, B., Hanrahan, P. & Winograd, T., (2000), "Integrating information appliances into an interactive workspace", IEEE Computer Graphics & Applications, 20:3, May/June, 54-65.
5. Hindus D, Mainwaring S., Leduc, N, Hagström A.,E, Bayley O "Casablanca: Designing Social Communication Devices for the Home" in Proceedings of CHI'01, Seattle, March 31-April4, 2001, ACM Press
6. Kidd, Cory D., Robert J. Orr, Gregory D. Abowd, Christopher G. Atkeson, Irfan A. Essa, Blair MacIntyre, Elizabeth Mynatt, Thad E. Starner and Wendy Newstetter. "The Aware Home: A Living Laboratory for Ubiquitous Computing Research" In the Proceedings of the Second International Workshop on Cooperative Buildings.
7. Peter Risborg and Aaron Quigley, Nightingale: Reminiscence and Technology - From a user perspective, In the Proceedings of OZeWAI 2003, pp.12-19. December 2003