Architecture Framework for Higher-Level Activity Support Using Multiple Functional Workspaces on the Desktop

Olaf Grebner

SAP Research
Vincenz-Priessnitz-Str. 1
76131 Karlsruhe
olaf.grebner@sap.com

Abstract: Today's desktop systems face two major drawbacks in supporting the KWer. First, on workspace-level there is insufficient support for a KWer's higher-level activities. Second, on information level, the KWer's personal information is scattered across the desktop and its applications. We analyze that state-of-the-art research suggests using multiple functional workspaces and recommends an underlying common abstract information model. However, research hasn't yet shown an integrated architecture for realizing multiple workspaces on such a common abstract information model. We present an architecture framework for realizing higher-level activity support using multiple functional workspaces on the desktop and position it as alternative to current desktops. We propose to base these functional-oriented workspaces on a common personal information model which itself is maintained as service. Using the Nepomuk [1]Social Semantic Desktop as example for a service-oriented desktop architecture, our approach represents an evolutionary architecture in contrast to more radical, but not commercially implemented research approaches.

1 Introduction

From a personal perspective, KWer's like researchers or project managers conduct *higher-level activities* [MZ07] to achieve individual goals as part of their daily work. A KWer's activities are highly variable and typically are in the KWer's to-do list.

KWers use *integrated digital work environments*, i.e., workspaces, to support the execution of their activities, today mainly *desktop systems*. Integrated digital work environments are "environments based on a coherent set of principles supporting a coordinated use of tools and resources across various tasks and contexts." [KC07, p. 7].

However, today's desktop systems face two major drawbacks in the KWer support. First, on workspace-level there is *insufficient support for a KWer's higher-level activities*. Today's commercial desktop systems are "still designed primarily for document management" [RT07, p. 277]. Applications running on the desktop provide specialized

[1] The presented work is part of the Integrated Projects Nepomuk and Mature funded by the E.C.

functionalities suitable for different low-level tasks. However, it is up to each individual KWer to get results satisfying an activity out of the combination of available documents and desktop applications. Second, on information level, the KWer's *personal information is scattered across the desktop* and its applications [Jo08]. *Personal information* is the information an individual KWer manages for herself and deals with in the activities. Moran refers to this as the *personal information cloud*, i.e., "the "working set" of information that is relevant to the individual and his work" [MZ07, p. 338]. Current desktop systems and applications don't represent the personal information cloud in a unified form as the KWer expects it. E.g., an email client folder containing emails has for the KWer no visible connection to a file system folder containing documents despite dealing with the same topic. This scattered personal information in application information silos "intensifies the cognitive load" [RT07, p. 275]. In addition, the KWer regards the personal information as "one single body of information" [RT07, p. 275].

Addressing these issues, we present an architecture framework for *functional workspaces on a common personal information model*. We propose to use a unified representation of the KWer's personal information cloud for the common abstract information model. Using the semantic desktop Nepomuk [Gr07] as example for a service-oriented desktop architecture, we realize an *evolutionary architecture* to transition current desktop workspaces to the proposed multiple functional workspaces without disrupting investments made so far.

The remaining paper is structured as follows. We analyze current state-of-the-art research approaches and point out the open issue of a missing integrated architecture. Then, we present our architecture for functional workspaces on a common personal information model. We conclude with a summary and outlook to further research.

2 State-Of-The-Art and Open Issues

Human-computer-interaction (HCI) research has started to address these two problems by on the one hand *proposing multiple functional workspaces* targeted each at a specific type of a KWer's activities instead of following a single workspace with the desktop metaphor [MZ07]. Each of these functional workspaces supports a particular type of the KWer's activities, e.g., managing tasks or conducting meetings. Looking at the involved information, each functional workspace represents a different perspective on the same KWer's personal information and focuses on corresponding foundational concept like, e.g., tasks, time or people [RT07]. The architectural implication is that these functional workspaces base on a common abstract information model [RT07], see figure 1 left. On the other hand, several approaches have been presented to *unify the KWer's personal information* in the workspaces. For example, Boardman [KB07] demonstrates the workspace-level connection of personal information entities across desktop applications by connecting corresponding file system folders and email client folders.

However, an *architecture that brings together functional workspaces on a common information model is still missing* yet. Research so far only has outlined that multiple workspaces can base on a common information model, demonstrated separately the fea-

sibility of required concepts both on workspace and information model level, but failed so far to show how functional workspaces and a common information model can be brought together. Open questions are, e.g., how multiple workspaces can interact with the common information model, what information must the common abstract information model contain and how is the relation between the common abstract information model and the KWer's personal information cloud? These questions are even more important as commercial integrated, digital work environments only implement continuously small enhancements which conflicts with the so far proposed more radical approaches proposed by HCI research [RT07, p. 289].

3 Functional Workspaces on a Common Personal Information Model

We present an integrated architecture framework for functional workspaces on a common personal information model, see figure 1 right. We use a unified representation of the KWer's personal information cloud for the common abstract information model. First, *functional workspaces* each support a particular type of activity and represent a distinct perspective on the underlying common personal information set. Second, a set of *domain-specific services* handles the access to the common information model from application layer workspaces to enable and system-independent workspace design. This way, the user experience of each workspace can be designed solely relying on the domain and thus completely separate from the underlying system paradigm. Third, the *common abstract information model* represents the KWer's personal information cloud. It is user-owned but formally represented using a set of ontologies. Using the semantic desktop *Nepomuk* [Gr07] as example for a service-oriented desktop architecture, we can access numerous desktop services and thus re-use desktop functionality without replicating it in each workspace. This enables an *evolutionary architecture* to transition current desktop workspaces to the proposed multiple functional workspaces. The semantic desktop Nepomuk provides a service-oriented desktop architecture and services. This includes, e.g., a service implementation managing the common abstract information model as well as other services which the domain-specific services can invoke.

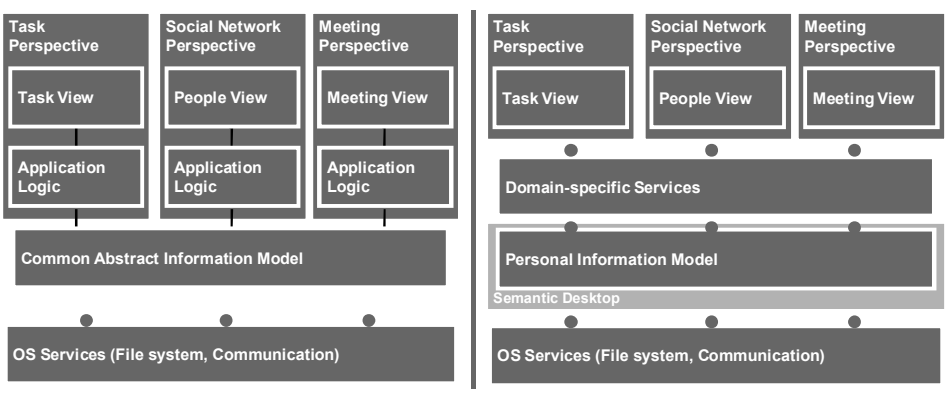

Figure 1: State-Of-The-Art Research (left), Functional Workspaces on Semantic Desktop (right).

3.1 Functional Workspaces

Functional workspaces support KWers in executing their activities. Each functional workspace targets a specific type of activity of the KWer. In particular we implemented three functional perspectives, see Figure 1. Task management [GOR08] enables the KWer to manage to-do lists, prioritize tasks, organize task-related information in the context of tasks and delegate tasks to other persons. Personal social network management enables the KWer to get an overview on personal contacts, see what information is related to particular contact persons, e.g., tasks. Meeting management enables synchronous meeting support and support for writing up the meeting protocol.

Due to the common information model underlying the workspaces, changes to personal information performed in one perspective are immediately visible in other perspectives. For example in the task management workspace, the representations of persons to whom tasks can be delegated are the same ones as used for the persons that the KWer can manage in the personal social network management workspace.

3.2 Domain-Specific Services

Controlling business logic in the form of *domain-specific services* commonly handles the access to the common information model for the functional workspaces on the application layer. For each major entity of the information model, as for example tasks or people, there are domain-specific services that handle these objects and contain business logic needed to process these items. For example, for tasks there are service methods that create a new task, retrieve tasks by different criteria or methods to delegate a task. As this domain-specific business logic is encapsulated in a service it can be re-used at every workspace or workspace-level application that needs to access an entity of the information model. The domain-specific services' business logic interfaces core workspace services such as storage and communication, i.e., they manage the connection to the operating system. In our implementation they interface the core system services of the semantic desktop like for example a semantic database to read and write the common information model and an indexer for desktop information elements like files and emails.

3.3 Common Abstract Information Model

A *common abstract information model* is at the heart of the architecture. To represent this, we use a unified representation of the KWer's personal information cloud. To enable machine processing by the domain-specific services on it, we use a formalized representation of this model, the Personal Information Model Ontology (PIMO) [Sa07]. This represents the KWer's mental model, i.e., the personal, subjective view on the world, and is fully user-owned. The information entities of the PIMO are the domain-specific entities of the personal information cloud that the KWer deals with during pursuing her activities, i.e., like for example people, tasks, locations, events or topics. The KWer can explicitly interlink the entities with each other which are related in the KWer's view, e.g., because they were helpful for the same task. This way, in the end not every entity is related to every other entity. The KWer can link as well to existing desk-

top information elements, like, e.g., files, emails and bookmarks, to indicate a relation to this information. In addition, the KWer can extend the personal information model to for example categorize existing people into different groups.

4 Summary and Further Research

We have shown an architecture framework for realizing functional workspaces on a unified personal information model. We demonstrated several functional-oriented workspaces that access a common set of personal information. These workspaces' functionality each is aligned along a particular type of higher-level task and features a foundational concept. Through using domain-specific services the workspace user interface solely depends on the information model and thus can be designed independent of the underlying operating system. The personal information model is unified and maintainable through each of the workspaces. Information changed in one workspace is accordingly changed in all other workspaces accessing it.

In further research we will explore a collaboration workspace, i.e., a workspace where an individual KWer can share selected information from the personal information cloud. As well, we will investigate how functional workspaces can benefit from organizational business applications like, e.g., a customer-relationship management application.

References

[GOR08] Grebner, O.; Ong, E. & Riss, U. V.: KASIMIR - Work process embedded task management leveraging the Semantic Desktop. In (Martin Bichler et al., ed.): Proceedings of 'Multikonferenz Wirtschaftsinformatik' MKWI 2008, GITO-Verlag, Berlin, 2008, p. 715-726.

[Gr07] Groza, T. et al.: The Nepomuk project - on the way to the social semantic desktop. In Proceedings of I-Semantics' 07, JUCS, 2007, 201–211.

[Jo08] Jones, W.: Keeping found things found: the study and practice of personal information management. Morgan Kaufmann, Burlington, MA, 2008; p. 370-373.

[KB07] Kaptelinin, V.; Boardman, R.: Toward Integrated Work Environments: Application-Centric versus Workspace-Level Design. In (Kaptelinin, V.; Czerwinski, M. eds.): Beyond the Desktop Metaphor, MIT Press, Cambridge, MA, 2007; p. 295-332.

[KC07] Kaptelinin, V.; Czerwinski, M.: Introduction: The Desktop Metaphor and New Uses of Technology. In (Kaptelinin, V.; Czerwinski, M. eds.): Beyond the Desktop Metaphor, MIT Press, Cambridge, MA, 2007; p. 1-12.

[MZ07] Moran, T. P.; Zhai, S.: Beyond the Desktop Metaphor in Seven Dimensions. In (Kaptelinin, V.; Czerwinski, M. eds.): Beyond the Desktop Metaphor, MIT Press, Cambridge, MA, 2007; p. 335-354.

[RT07] Ravasio, P.; Tscherter, V.: Users' Theories of the Desktop Metaphor, or Why We Should Seek Metaphor-Free Interfaces. In (Kaptelinin, V.; Czerwinski, M. eds.): Beyond the Desktop Metaphor, MIT Press, Cambridge, MA, 2007; p. 265-294.

[Sa07] Sauermann, L.; van Elst, L.; Dengel, A.: Pimo - a framework for representing personal information models. In Proceedings of I-Semantics' 07, JUCS, 2007, 270–277.