Context as foundation for a semantic desktop

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Context as Foundation for a Semantic Desktop

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Abstract. Adoption of semantic web technologies and principles presents an opportunity to change the conceptual model of desktop computing. Moving from a traditional position where the desktop is largely tied to a specific computational device, a semantic desktop could exist as a broad, networked space defined relative to the user. In this position paper we argue that personal, computing, and knowledge contexts are the appropriate means by which to define and shape the desktop space, and that collectively they provide the foundation for novel functionality in a semantic desktop.

1 Introduction

The traditional conceptual model of desktop computing is no longer applicable. In a heavily networked world, the distinction between a desktop as realised by an operating system running on local hardware, and the web as something separate and external, is false. What makes the desktop unique is not the location of execution of its underlying code, but its role as a space that is largely under the control of one individual; a personal domain that in some way reflects or represents their world.

Consequently, developers of a semantic desktop face a choice between simply applying semantic web principles to a traditional desktop environment whilst retaining the same conceptual model, or using the power of these technologies to enable a more ecologically valid interaction paradigm that emphasizes the person, the tasks they perform, and the context in which they do so, irrespective of where the code is executed. Whilst both approaches may bring benefits, we advocate the second. In this position paper we will discuss how that context may be defined, represented, and used in pursuit of this aim.

Ubiquitous computing literature has largely defined context in terms of computing resources, the user's location, and the identity of people around them [1]. Our conceptualization of a semantic desktop requires a broader view to be taken if this greater ecological validity is to be achieved. In the following sections we will identify three facets of context (personal, computing, and knowledge) and the interactions between them, whilst also examining how each may be represented and utilised in a semantic desktop, and what novel features this may provide.

2 Personal context

Reminiscent of a phenomenological view of context [2], personal context encompasses properties of the individual as they exist in the world, which may influence a task being performed but are not specific or unique to it. In [3] the authors identify several such properties, including a person's *social context* (social networks they are part of), their *preferences* (values or opinions held), *resources* they have available for performing a task (such as time or attention), and their *location*. Inevitably these factors interact, such as one's location in a busy office reducing the attention available for performing a task.

In terms of semantic representation, social networks and nodes within them can be represented with vocabularies such as FOAF [4] and SWAP Personal Information Markup [5]. Representing the resources available for performing a task may be informed by work in the field of instant messaging, regarding how to describe presence and availability (e.g. online, low attention, do not disturb). Personal preferences might be described using multiple domain-specific vocabularies (such as the Vegetarian Ontology [6]) or through a generic ontology of preference which could be applied to any domain. Vocabularies such as Basic Geo [7] can be used to express latitude and longitude locations in a machine-readable way. However, to meaningfully represent the individual's location this will need to be complemented by ontologies of place and space that describe locations in terms of their function, significance, and interrelations.

At present these personal context factors, if represented or used at all within a desktop environment, are done so on a per-application basis, adding unnecessary cognitive overhead to the performance of tasks. For example, a user may have to maintain separate contacts lists in their email and instant messaging applications, or may have to state their location when searching the web for local restaurants and again when booking a flight.

The ability to create personal context widgets to represent and manage this context information and make it available across tasks is a key benefit of a semantic desktop over a conventional one. We hypothesise that this provides a more realistic cognitive model to the user, where the factors and entities that characterise their world are captured in one place rather than distributed piecemeal or not represented at all. A trend towards integrating applications that share a social component can be seen in Chandler [8], and this should be welcomed as long as the focus remains on integrating contextual information and providing services on top of this.

3 Computing context

In the ubiquitous computing literature, resources such as network connectivity [9], applications available, and characteristics of the device being used are seen as key aspects of context. These factors should be represented and utilised in a semantic desktop as they may impact on how a task is performed, and they do reflect aspects of the user's world. This may be achieved using CC/PP profiles [10], which provide a means to describe the capability of a device and preferences about how it is used, and

may be extensible to describe factors such as the network connectivity available at any one time.

An ontology of application types that describes their capabilities in functional terms (e.g. *ImageManipulator*, *MessageHandler*) could be populated with those applications available to any particular computing environment (whether they are implemented at the local machine or the *webtop* level).

However, our view emphasises the desktop as a reflection of the user's world. Consequently, the objects that populate that world and the tasks performed within it are key, with the resources and applications available playing only a secondary, more abstract role. Influenced by aspects of the Xerox 'Star' computing environment [11] we believe that a semantic desktop can enable an interaction paradigm centred on digital objects, their contexts, and associated tasks, in a way that a conventional desktop cannot. By object context we mean factors such as the people or objects depicted in a photograph or the occasion on which it was taken, the person who sent a message, or the organisation who published a document.

Whilst some actions users may wish to perform would be generic to most objects (such as *view*, *share*, *edit*), others may be determined by the object type (such as cropping or resizing an image), or its associated contexts. Awareness of how context manifests itself for different types of object would allow true *context menus* to be implemented, providing access to functionality or services tailored to that specific object. For example, such a menu for an audio file could provide access to other tracks by the same artist, a discography, or current tour dates. Similarly, a context menu for a *message object* might provide access to contact details for the sender, or inferences about how best to contact them in response, based on their current availability.

Ontological descriptions of the types of objects available in a semantic desktop, the actions that may be performed on them, their associated contexts, and the capabilities of applications available to the desktop could enable a semantic registry for the desktop, with reasoning able to determine the best code to execute to perform a particular action or task, rather than requiring an explicit decision from the user.

4 Knowledge context

Whilst a traditional filesystem is concerned with managing files that exist on a local machine, the same limitations do not apply to a semantic desktop. Instead, a semantic filesystem should focus on the management and application of knowledge that supports user tasks wherever it resides, enabling a knowledge-oriented computing environment that adheres to our model of the desktop as a representation one person's world.

Here semantic web technologies can bring great benefits over conventional desktops, firstly through improved knowledge representation, secondly through the ability to reference any resource, irrespective of whether it is a digital object itself or simply a reference to an entity in the real world, and thirdly irrespective of whether it is located locally or remotely.

However, if these abilities are to be maximally exploited in the support of tasks, then we must be able to assess the provenance and validity of knowledge in the system; the knowledge context. Just as conventional filesystems have metadata recording when a file was created and last modified etc., so a semantic filesystem should have knowledge metadata indicating the source of knowledge in the system, its age, whether it has been validated or not, and inferences about its likely trustworthiness. An ontology of knowledge characteristics could define the exact nature of this metadata, populated over time as knowledge is added to the system and evidence is accumulated to qualify, validate or contradict the assertions.

Awareness of knowledge context brings some novel features to a semantic desktop which could support the tasks outlined in [3]. If *locating* a certain piece of knowledge within a semantic desktop, the ability to prioritise results based on inferred trustworthiness could help reduce cognitive overhead. Similarly the user may only wish to *monitor* knowledge within the environment that is recent whilst ignoring older stable items, and knowledge context can enable this. It also provides a foundation for the *evaluating* task, which consists of "determining whether a particular piece of information is true, or assessing a number of alternative options".

5 Interactions between facets of context

Whilst the context facets discussed here have been treated separately there are inevitable interactions between them, and a semantic desktop must facilitate these to provide maximum benefit. For example, how well someone is known to us (personal context, social factor) is likely to effect how much we trust knowledge they share with us (knowledge context). Similarly, in a situation where someone has limited resources for performing a task they may accept knowledge as a solution even if it is from a less trusted source, simply to have reached some solution. These interactions can enable novel features, as shown by the example above where an objects context menu could provide access to the author's contact details and, where permission exists, to their personal context, such as current availability and inferences about how best to contact them.

The extent of these interactions can be illustrated by the task of locating recipes for a dinner party. In this case a semantic desktop could take into account the personal context of the user by excluding certain cuisines they have indicated they don't like, and by prioritising results from the same sources as recipes that have a trusted knowledge context. An object context could be provided by creating links between the semantically annotated recipes and the necessary ingredients as listed in an online shop.

6 Conclusions

A semantic desktop has the potential to introduce a new style of interaction in personal computing that is not feasible with conventional technologies. In this knowledge-based environment, the desktop is defined in relation to the user, not the

hardware, operating system, application, or protocol being used. However, parameters are required to shape this semantic desktop to the individual, and in this paper we have argued that context is an appropriate and powerful basis on which to do so. Whilst each facet of context we have discussed enables different functionality, interactions between them are central to the performance of tasks by the user. A semantic desktop based on the foundation of these facets and their interactions represents a novel and powerful interaction paradigm.

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