A Cloud-Based Environment for Collaborative Resources Management

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ABSTRACT

The interaction between users and digital devices has deeply changed in the last decades. In particular, the so called desktop metaphor relied on assumptions which have been modified by the rise of new paradigms, such as Web 2.0 and Cloud Computing. This paper discusses the limits of the desktop metaphor and proposes a new interaction model, TablePlusPlus (T++), aimed at providing Web and Cloud users with interaction mechanisms fulfilling their needs, i.e., the possibility of handling activity contexts, collaborating with other users, and homogeneously managing heterogeneous objects. T++ tables provide a context-based environment which enables a homogeneous treatment of heterogeneous content items, enhanced by a table-level annotation mechanism supporting an abstract view over resources, which is missing in standard current desktop and collaborative environments. In order to evaluate the effectiveness of the proposed model, this work developed a prototype and tested it in two controlled experiments, whose results are definitely encouraging.

Keywords: Activity Workspaces, Cloud-based Collaboration, Cloud Applications, Cloud Human Services, Human-Computer Interaction

1. INTRODUCTION

The interaction between users and personal computers had one of its major milestones in the 80s, with the wide spread marketing of systems equipped with user interfaces based on the so called desktop metaphor (Kaptelinin & Czerwinski, 2007a). The desktop metaphor is based on the idea that applications and documents can be managed within a “space” organized as a desktop, coupled with a storage system based on the concept of folders containing files. Moreover, the desktop metaphor is characterized by the possibility of representing active applications as overlapping windows, usually referred to by small icons (Kaptelinin & Czerwinski, 2007a).

The desktop metaphor (Smith et al., 1982) was conceived for individual users of stand-alone personal computers, mainly to support...
them in running applications and storing/retrieving documents. Then, the 90s brought the Internet and the Web: users started using Web browsers to navigate Web sites and to store bookmarks, as well as email, chats and forums to interact with other users. Later on, at the beginning of the new millennium, the so called Web 2.0 (O’Reilly, 2007) further modified the way people interact with computers. Web sites became much more interactive and stand-alone applications were replaced by Web-based services; users were encouraged to participate in content creation on the Web through blogs, wikis, tagging systems, and to collaborate by means of social networks and Web-based collaborative tools. Last but not least, service access became ubiquitous, services are available in an anywhere and anytime modality, and can be accessed by a variety of devices, like laptops, tablets, and smart phones. The recent development of the cloud computing paradigm (Creeger, 2003) is the last step in this direction, further supporting information and knowledge sharing on the Net and offering the possibility of storing documents, data, and resources in the Cloud.

All these changes definitely modified (a) the user role, who is not an “individual user” anymore, but is “dipped” into a fluid community of users; (b) applications, which are not stand-alone programs running on local machines, but Web/Cloud-based services; (c) file storage and retrieval, which has been replaced by the need of handling many heterogeneous types of “objects” (not only files, but emails, posts, events, bookmarks, contacts, etc.); (d) the personal computer itself, which evolved in a range of personal mobile devices. However, the desktop metaphor is still there. There have been many proposals, in the research literature, to go beyond it, in order to face the challenges posed by the various aspects of the just mentioned evolution; see (Kaptelinin & Czerwinski, 2007b) and Related Work Section of this paper. But, so far, none of them has been able to stand out and actually replace the desktop metaphor.

In this paper, we present TablePlusPlus (T++), a model which aims at fulfilling the needs raised by the sketched scenario. Differently from many of the alternative approaches proposed so far (and discussed in Section Related Work), we do not consider the desktop metaphor as “old stuff” tout-court, to be thrown away as a whole, but we think that it must be deeply “remodeled”, to support the new ways in which users carry on their activities, by managing heterogeneous “objects” and collaborating with other people. The main goal of T++ is to “glue” many of the most convincing proposals aimed at improving or replacing the desktop metaphor and to offer an environment that provides an abstract and homogeneous view over resources and tasks. Moreover, our model is not aimed at immediately replacing the current system user interfaces, by implementing radical architectural changes in desktops and existing software applications, since probably such an approach would be doomed to fail. Instead, we propose a deep revision of the main concepts belonging to the desktop paradigm, which can be implemented on top of the existing architectures (operating systems, file systems, browsers, and so on). Obviously, a more radical approach is possible, and our model could be adopted to completely replace existing interaction mechanisms; however, in the perspective of a more gradual paradigm shift, and to demonstrate its effectiveness, we implemented it on top of the existing, underlying layers.

In the rest of the paper, we will present in more details the background and the motivations of our approach, by discussing the main related work (Section Related Work) and presenting the results of a pre-design questionnaire (Section Pre-Design Survey); we will then describe TablePlusPlus (T++): in particular, the user interaction model based on the concept of “table”, and the architecture of the software prototype supporting it (Section TablePlusPlus). Moreover, we will present an evaluation experiment we performed in order to provide some evidence of the effectiveness of the approach (Section Evaluation). We will conclude the paper by discussing open issues and future developments (Section Conclusion).
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