A Novel Conceptual Model for Accessing Distributed Data and Applications, as well as Devices

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Abstract: As data and services are increasingly distributed in the network, rather than stored in a fixed location, one can imagine a scenario in which the Personal Computer, intended as a static workstation, is really disappearing. In such a scenario, users' interactions are going to be mediated by ad-hoc connected devices, whose specific functionalities enable people to interact with data and services in different ways. If this vision holds true, a personal mobile device can potentially serve the function of portable access point to data, services and devices. This implies that a novel conceptual model for interaction needs to be designed, as well as its user interface. This position paper aims at raising a discussion around this topic.

1 Problem Statement and Research Questions

Technologies such as NFC, Bluetooth, and RFID allow for the simple connection of multiple devices in the vicinity of the user. Devices can have different specific functionalities: Thus, ad hoc interactive stations can be assembled, like in an orchestra with different instruments and players. In such a scenario, one can expect the personal mobile device to become the initiator and director of the ensemble. By connecting, for example, a screen and a keyboard through the mobile, one can create a temporary interaction space, which extends the capabilities of each device as stand alone.

At the same time, as mobile internet becomes available and affordable, the mobile device can play as personal access point to private and shared data, as well as applications, which are stored in the network. The conceptual model of Web 2.0, where aggregation of content is possible and simplified (and thus democratized), is already quite different from the type of hierarchical structure imposed by the PC operating systems: In the PC, data virtually have a spatial location and the allocation of access rights is tailored to a single user. In such a scenario, the traditional conceptual model of the Personal Computer looses its validity for a number of reasons: First, the association of data to a physical location such as the PC hard disk does not make sense any longer.

Second, depending on the ensemble of devices, interaction functionalities can be very diverse, (e.g., is there a direct touch display, a physical keyboard, a shared large display, or multiple displays, possibly with different sizes and/or orientations?). Finally, the hierarchical structure we are used to in the PC environment looses its validity because content is differently aggregated and accessed. Taking these premises into account raises a number of issues in terms of interface design for mobile devices:

- how to convey a conceptual model which is graspable for users in such a new interaction paradigm, in which fixed and real physical locations become loose, in favour of more flexible interactive spaces?

- if the mobile device becomes an access point to other devices as well as services and data, how does this affect its semantic and functional meaning?

We think that these issues open several research questions and an interesting design space, which we would be happy to discuss in the workshop. In order to structure the design space, we can start considering the different aspects of the mobile device which are affected by such paradigm shift. In the table, we distinguish three different layers, i.e. *physical artefact*, *user interface*, and *functional meaning* of the mobile device, and propose different, non exclusive approaches for each of them, partially referring to existing work.

Mobile Device		
Physical artefact	*Screen User Interface*	*Functional meaning*
The device is a handle for navigation: its manipulation vocabulary in the physical space has an input on the digital one (see [Ru07] for a good review of similar approaches). The device is a token, or container, used for transferring content from a context to another one.	The device UI displays data and peripheral devices, and allows for manipulation of them. The device UI allows for extension of interaction beyond screen boundaries (e.g., through gestures one can shift data from the mobile to other screens). The device UI allows for a different visualization of data displayed in the surrounding (be that physical or digital artefacts, e.g. [SK06]).	Communication device. Access point to data which are stored in the network. Activator/controller of devices. Lens/Filter of data which are embedded/displayed in the environment.

Fig. 1: Layers of interface design of a mobile device, with possible approaches

References

[Ru07] Rukzio, E.: Physical Mobile Interactions: Mobile Devices as Pervasive Mediators for Interactions with the Real World. Dissertation, LMU München.
[SK06] Schöning, J.; Krüger, A.; Müller, H.: Interaction of Mobile Camera Devices with Physical Maps. Pervasive 2006: Adjunct Proceedings of the 4th International Conference on Pervasive Computing.