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# Seamless Interaction between Multiple Devices and Meeting Rooms

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**Abstract**

Meetings often suffer from the inability of participants to be physically present in one room. Moreover, with current networking technologies, meeting environments can be distributed over multiple rooms. The goal of the iConnect project is to provide collaboration services while interconnecting both collocated and remote users. We focus on smooth engagement by allowing participants to share arbitrary data through heterogeneous input devices and displays.

**Keywords**

Meeting rooms, Workspaces, Information sharing

**Introduction**

Meetings are often held in an inefficient way due to high traveling times, inadequate meeting facilities, etc. Moreover, meeting rooms lack convenient ways to integrate the wide variety of devices participants bring along (laptops, PDAs, ...). Many systems try to overcome these issues, yet the combination of distributed, collocated and remote participation is rare. DOLPHIN [1] applies a large interactive display and covers face-to-face meetings as well as work between group members in different locations. TeamRooms [2] tries to mimic the characteristics of a physical team room by allowing remote participants to collaborate in a persistent "network place". Seamless mobile appliance integration can be found in the Interactive Workspaces

Project [3], which focuses on augmenting a dedicated meeting space with large displays and wireless multimodal devices.

The iConnect project envisages the creation of a “connected meeting room”, a virtual meeting room supported by flexible software interfaces, in which the participants can be either collocated or geographically dispersed.

In the next sections, the iConnect meeting room environment is discussed, as well as interaction techniques to facilitate data sharing and manipulation. We conclude with an overview of future work.

### **iConnect Environment**

In our meeting room environment (see Figure 1), we rely on the notion of *shared* and *personal* workspaces [1]. A shared workspace allows multiple users to interact simultaneously with the available data, while personal workspaces are single-user oriented. The combined use of both kinds of workspaces permits to manipulate documents in the multi-user shared space, yet retains the option to view/edit them locally in the user’s personal space without disturbing other users.

The user’s personal workspace (see Figure 1b) is divided into two subspaces: a *private* and *public* space. The private space allows users to locally organize, view and manipulate data. The public space serves as a coupling between the shared and the personal workspaces.

Each participant in an iConnect meeting is represented by an avatar and has its own cursor in the shared view, allowing her/him to resize, position or drag objects,

make annotations or transfer data to and from a personal workspace. Cursors can be operated from the user’s personal device, e.g. from a PDA. In this case, the screen of the PDA is transformed into a touchpad with stylus movements and clicks being mapped on the user’s cursor.

One of the difficulties with multiple cursors on a single display is to determine what cursor belongs to which user. In PebblesDraw [4], this issue is overcome by assigning a unique shape to each cursor that represents the user. Instead of shapes, we attach a miniature of the user’s avatar to her/his cursor, as shown in Figure 1a. We want to exploit the usage of a personal avatar to annotate the user’s current action and state.

### **Multiple Device Drag and Drop**

Computer augmented environments often encompass a wide variety of devices ranging from handholds to wall displays. This requires intuitive techniques to mask the heterogeneity of devices and interchange data between devices or workspaces. In [5], Rekimoto introduced the concept of *hyperdragging*, a direct manipulation technique for moving information across the boundaries of computers and surfaces. Similar concepts are used in our work, where the focus is on device-transparent drag and drop interaction. This interaction method can be used both locally as remotely. The next section outlines a possible scenario of our current implementation: a meeting where drag and drop is used to interchange data between personal and shared workspaces.

#### *Interaction Scenario*

In our setup, a preinstalled computer is attached to a shared, touch-sensitive whiteboard and devices are

interconnected by a wireless network. Bob enters the room and turns on his PDA that contains the PowerPoint presentation he is going to present. As soon as the iConnect software notices his presence, a personal avatar appears on the whiteboard. Bob locates his presentation file on his PDA and drags it to the top of his screen, where he drops it (hyperdragging). This results in the presentation being copied to the shared whiteboard, ready for use in the meeting.

As an attendee to the presentation, Alice is confused about some numbers Bob mentioned. Alice uploads a graph from her PDA to the whiteboard to illustrate her point of view and discusses it with Bob and the other participants. She draws a red circle around the relevant numbers on the graph by using her handheld as a touchpad. The handheld allows her to move her cursor on the whiteboard towards the region of interest and make the annotations. Bob, who is physically standing at the board, drags the graph with a pen over his avatar and drops it there. A copy is sent to his private workspace, where he can review it anytime.

### **Status and Future Work**

In our current implementation, we rely on one shared workspace interconnected with various personal workspaces. We envision to extend the iConnect system with support for distributed meeting rooms, where multiple shared spaces can be linked with each other.

Sometimes, ongoing meetings are interrupted and resumed afterwards. The iConnect software should implicitly store the *state* of these meetings, e.g. the documents opened, annotations, etc.

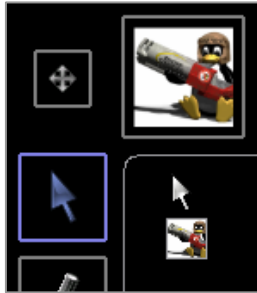
Video conferencing is often used to bridge geographical distances and let remote users participate in a meeting. Currently, the iConnect system can capture and transmit video from webcams. We are also investigating how video can enhance (remote) awareness, e.g. by streaming views of a workspace or by low-bitrate video avatars.

### **Acknowledgements**

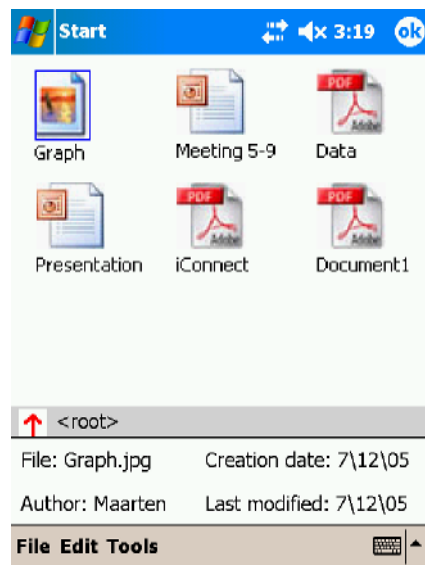
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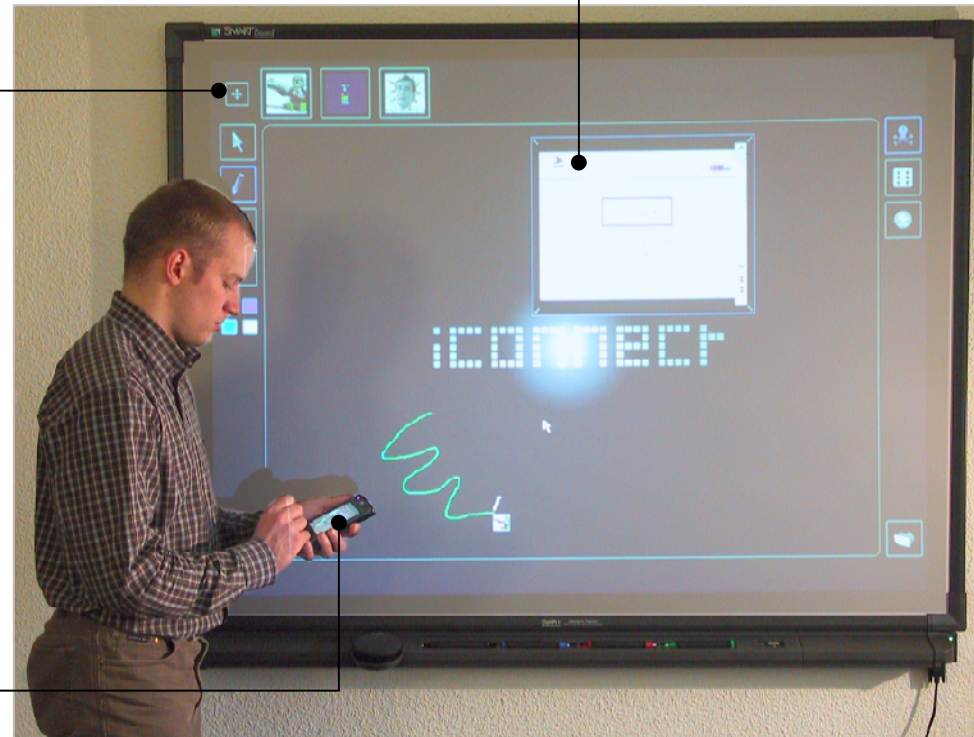


**Figure 1a.** Participants are represented by an avatar and have their personal cursor to interact with data in the shared workspace.



**Figure 1b.** The personal workspace on the user's handheld device allows to organize, view and manipulate data. Here, the private subspace is shown.

PowerPoint presentation with "iConnect annotations".  
Word, Excel, PDF, ... documents can also be displayed on the iConnect workspace.



**Figure 1.** The iConnect shared workspace is projected on a touch-sensitive whiteboard. Users can move objects or draw annotations using pen or finger. Participants can bring along their personal devices to a meeting which are automatically integrated in the environment (without connecting cables, etc). Handhelds/laptops are used as global input device and to share data.