On the Design of Personal & Communal Large Information Scale Appliances

Daniel M. Russell[1], Rich Gossweiler[1]

[1] IBM Almaden Research Center, 650 Harry Rd, San José, CA, USA, 95120
{Daniel2@us.IBM.com, Rich@RichGossweiler.com}

Abstract. As large displays become less expensive and more common throughout our working environments, we believe they will become pervasive, much as telephones were the ubiquitous communication devices of the previous generation. When large displays are coupled to an authentication device (e.g., a badge reader) and put on a network, they permit very rapid personal content access. The BlueBoard project explores the design of large displays that can be used as temporary personal access points to personalized content, yet also be used as display surfaces for small groups of people who want to easily share content between themselves. We've developed several design points that make BlueBoards simple for individual and small group use – (1) p-cons to refer to a person for information access and exchange, (2) assuring users that information displayed on a BlueBoard is truly transient, (3) providing a basic set of tools for immediate walk-up use, and (4) giving the BlueBoard a sense of where it's located for contextually appropriate information display.

1 Introduction

Displays are rapidly growing less expensive. While large displays (greater than 1m on the diagonal) are more slowly descending the price curves, it's now apparent that they too are becoming ubiquitous in many environments. [1,3,6,7,8,9,10] A recent trip (January, 2001) through the Frankfurt, Germany airport showed more than 100 large displays scattered throughout the concourses as information displays.

While kiosks have been popular items as information displays for some time, they have often suffered from an inability to act as general purpose access devices. Generally speaking, kiosks are placed in a space to sell a product or to push a particular set of information.

But when a kiosk has a simple personal authentication devices (e.g., biometric or badge readers), and is placed on a relatively high-speed network, the nature of the device changes in a fundamental way. No longer is it just a dispenser of canned information, but the kiosk + personal identification device becomes a new thing – a *large information scale appliance (LISA).*

While an information appliance is typically a small, personal device, there's no reason to not consider large devices scattered ubiquitously throughout an environment as information appliances as well. While the relatively high cost of large displays has worked against this kind of deployment, it is becoming clear that the cost is dropping quickly (and will continue), making a new kind of use possible in the near term future.

But large, shared, communal information appliances in the workplace operate under a substantially different set of assumptions than small, personal appliances. One of the chief advantages of Personal Digital Assistants (PDAs) is that they're easy and fast to use. On the other hand, they have several disadvantages: they are small and (to date) usually not on a network. As a consequence, some kinds of common work practices (e.g., looking at large, complex images, making drawings, sharing working documents) aren't practical with PDAs.

Fig. 1. The BlueBoard is a Large Scale Information Appliance offering fast access to personal information with tools for collaboration and small groups of people working side-by-side. The display has a touch screen overlay and a badge reader on the right corner for person identification. Network access is assumed.

1.1 An example: BlueBoard

We've recently built a LISA that combines a large 1.3 meter plasma display (XGA) with a touch screen and a badge reader for personal identification. In ordinary use, the BlueBoard is intended for both very fast personal use (walk up, check your calendar, walk away – all within 5 seconds), and for small group collaborative use (a small number of people stand around the BlueBoard to sketch ideas, pull up information from their personal space, compare notes, share content).

In our design, a BlueBoard has no keyboard or mouse. While this seems restrictive, our goal is not to have BlueBoards become just another personal computer – it is consciously designed to support lightweight, fast encounters and simple spontaneous

collaborative meetings. We do not believe that providing full keyboard capability (and corresponding security control problems) works to the BlueBoard's advantage.

A BlueBoard is a simple device: it is a specialized display + badge reader connected to a computer running a client-side application to provide simple access to information. Again: It's not *supposed* to be a general purpose computer that runs any and all applications, but instead, a conduit to personal information that's available via HTTP connections.

Fig. 2. A typical BlueBoard personal display. This kind of content is set up by each user as their "home content." Content displayed on the BlueBoard can be shared with another person by dragging the content (window, image, URL) to their p-con. Here, Rich is showing his home page calendar to Daniel and Alison.

Swiping your badge brings up personal -- in our setup, it's an HID brand reader connected to the serial port [5]. Badge information is sent to a Badge Server database that authenticates the user, handing back a URL to that person's personal content. A "personal icon," or *p-con*, is created on the BlueBoard display off on the side in the tools area. Note that the "home page" is not immediately displayed, but becomes available only by explicilty touching one's p-con.

Clearly, such content needs to be created by the user. It's important to note that the BlueBoard system is not yet-another attempt to solve the web-site authoring problem, but rather simply presents information that is created in a separate step, linking high-value information to web content.

We are currently working towards a simplified BlueBoard content authoring tool, one that provides very simple templates to link personal content to the BlueBoard server.

Content linking is a much simpler solution than original content creation. Especially since so much content already exists, our solution of simply coalescing content into a single point of access actually simplifies many problems of data scattered everywhere over the network.

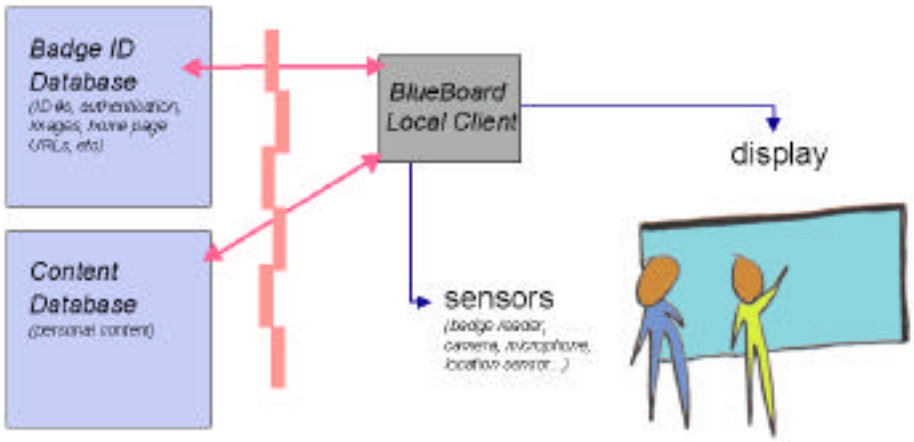

Fig. 3. A BlueBoard links backend content (on a webserver) with presentation on the large plasma display with touchscreen and badge reader. The badge ID is sent off for authentication, returning either an "unknown user" error, or an authenticated set of URLs in the Content Database. The effect is that a user "logs in" by simply swiping their badge at the display, getting rapid access to their content.

2 Information Appliance Design for Personal vs. Communal Uses

There's an inherent design tension in LISAs: they are good for group work with peers standing shoulder-to-shoulder, working together. But they are also very handy for rapid personal, one-person information access. Unlike other information appliances, a LISA must support both single users and multiple users. It needs to work for a single person walking up to the BlueBoard to check their calendar, and it needs to work for small groups of people working together. Consequently, there are two very different sets of overall goals: design the LISA for individual information access, and design the LISA for multiple people using the display at the same time.

We have come to recognize that several design points need to be satisfied to balance these competing design goals.

2.1 Representing an Individual: P-cons for fast access & sharing

When more than one person is using the device, the device needs to know whose content is being viewed. There also needs to be a way to easily share content among the users who are all using the board at the same time.

The *p-con* is just an image of the person representing that person's content. When a badge is swiped, a person's p-con appears in the p-con dock on the right side of the display (see Figure 2). When more than person is at the board, all of their p-cons show up on the display (currently up to six).

The p-con becomes the rapid access point for personal content. A user sets up their content ahead of time, linking items such as calendars, presentations, continually updated information (stock quotes, project status, etc.) to the home page. Then, once badged in to the BlueBoard, a finger touch on the p-con brings up the first page of their content.

The p-con is also the way to share information between simultaneous users. If one user is showing a slide from their content or an especially interesting web page, a drag-and-drop movement from the page to a p-con will deposit a copy of that content in the p-con. When the p-con's person badges out (leaves the BlueBoard session), the contents of the p-con is e-mailed to them. In this way, sharing information is extremely simple – when you see something you like, just drag it to the p-con and the content is shared.

Since all content shown on the BlueBoard is some variant of a web page, dragging an individual item (e.g., a block of text or a picture) just copies that item into the person's temporary p-con buffer. To make a copy of the entire page, the user will drag from a "whole page" handle (the title bar) to the p-con.

In essence, the p-con stores content until the user badges out. At badge out time, the contents of the p-con buffer are packed up into an email message and sent off to the p-con owner's email space.

We have consciously avoided overly complex mechanisms such as group management or automatically trying to move the p-con buffer contents into their personal content web. An important goal is that the BlueBoard be usable with a tiny amount of training. Currently, to simplify things, only people present can share content, and sharing is done by logically moving shared material into their email. In a similar vein, we've attempted complex window management schemes for doing split screens, but have not yet been able to devise a way that allows the split screen to be simple to explain and use. It's too easy to become confused between foreground and background. Since an overriding goal is simplicity, we continually return to those roots in making design choices.

2.2 Transient Information Must Be Truly Transient

When a user badges in to the BlueBoard, their content flows to that location. When they badge out, the content stored in the p-con buffer (if any) is emailed to the email address of their choice (pre-specified at BlueBoard user registration time). But equally importantly, any content that was pulled to the BlueBoard from the remote content

server must be purged from the local system to avoid the possibility of compromise by later walk-up users.

To make this assurance, the BlueBoard tracks each content item as it comes into the system, tagging it with its owner's p-con ID. At badge-out time, all such content is explicitly removed (including items in the history list and any cookies that might have been created in the process).

2.3 BlueBoard Knows its Place

A BlueBoard is a relatively static device. Weighing in at somewhat more than 68 kilograms (150 pounds), it is not an easily portable pocket-type device.

When the BlueBoard is not in use, we have found it useful to have it show a loop of content pages that are relevant to the location. In our meeting room setting, the BlueBoard puts up project web pages and other web sites of local interest (such as the IBM home page, the IBM research home page, news sites, etc.). The "attract loop" for page display is driven by a local list of pages that is tailored to the site and time. Pages are shown for a few seconds, then dissolve via an alpha-blend to the next page. When these pages are shown, the touch screen is still active. If a passerby finds the page of particular interest, just touch the screen, and the looping stops, giving full web browser capability. (We discovered that people often couldn't get to the board in time to stop the display. So we added a "back" button in the lower right corner, which works in the way you'd expect.)

We are working towards giving the BlueBoard a better sense of where it's located. Ideally, location information would be determined by a locator beacon (e.g., a in-room BlueTooth device) and then used to determine what pages would be of local interest. (Say, lab project pages would be shown on the lab BlueBoard, while corporate wide interest pages would be shown on the foyer's BlueBoard.)

Similarly, we have done initial tests allowing people in a workgroup to email messages to the BlueBoard attract loop, much as was done in the Lens shared public display at Apple's research lab [6] .

2.4 Tools for Short-term, Rapid Use

Public, shared, communal devices all need to be extremely simple to use and must be intrinsically useful even without special registration. We want people to be able to simply walk up to a BlueBoard and do useful work.

To date we have built a simple toolbar that allows a passerby to gain immediate access to several functions: a whiteboard sketching tool, a calendar and a local map (showing the location of the BlueBoard in context).

These functions continue to be accessible after badging in as well. As with all other content shown on the BlueBoard, this content can be dragged to a p-con for sharing via an email connection.

3 Other Work in This Area

There are many large display projects in the research world. The DynaWall from GMD is a very large wall display with a touch surface [10] that supports people working together on a merged set of SoftBoard displays [9]. The DynaWall explores interesting issues in group work and very large scale interactions, but does not yet afford lightweight walk-up interactions or easy sharing of content.

Similarly, the Interactive Workspaces Project at Stanford [3,9] also emphasizes large, sophisticated display areas for information rich display manipulations. While they've been developing new interaction techniques for large displays, they too do not support simple walk-up, rapid use.

For lightweight information access, there are many professional providers of kiosk systems, relatively few of which offer network service access for general information (as opposed to specialized networks, such as banking networks for ATMs). Other kiosk systems [2,4] provide web services or vision-based person-tracking schemes, but none seem to actually know what users are present, or what their personal information content might be.

5 Summary

Large displays, kiosks, and information appliances are all common. Yet few have tried to be all three at once. The trend towards increasing use of large displays in public spaces creates the opportunity for a new kind of ubiquitous / pervasive device: the *large information scale appliance*; a device that delivers personal information to authenticated, identified users in a kiosk environment.

Designing large information appliances that address the needs of both the individual and the small group is a challenge: one that requires balancing the need to work across a wide variety of user populations, work for a number of simultaneous users, while operating in a variety of locations and uses.

Our goal in the BlueBoard project has been to provide very rapid access to personal content while providing the easy-to-use functions of an information appliance supporting both communal and personal use. The important difference between BlueBoard and other kiosk systems is the design of the use experience for a kiosk that knows who is using it while supporting fast access and simple sharing of content.

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