

Driving the Citizen-Oriented Information on the Electronic Highway

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Abstract This paper outlines the design and ongoing development of the Citizen Information Network (CIN) which shall make the information available to meet the growing demands from citizens in the information age for better orientation about services by public administration and self-organized initiatives as well as for better communication among citizens about community affairs. Multimedia technology offers new opportunities, but there are complex problems to solve, in particular with regard to data structure and data logistics, and interactive user-interface design for casual users. The CIN enables users to get information made of text, photo, picture, voice, and video elements in a multimedia kiosk, to search the demanded actual information via a full-text retrieval from the frequently updated database. Original features of the approach of Bremen concern a public-private partnership and cost-sharing between a tourist and a citizen information system as well as a technical open client server architecture. The creation of such a system is a software development process and an organization development process at the same time. [*] *Keywords* Citizen-oriented information, network, multimedia

1: Introduction

Public access information booths or kiosk systems are becoming an important part of local information infrastructure (see [3]). Recently a representative of IBM mentioned that almost 75% of all pilot project are not continued to a permanent and large scale system. [**] The two main problems are the quality of information content and the organization of data logistics.

Public information service systems tend to follow one of two basic organizational models:

- the owner model, i.e. one organization builds and runs an information system containing information about the activities of this organization. This information is made available online and/or via dedicated terminals which belong to the same organization. Examples are airline or railroad information systems on airports or

stations, tourist information systems, library systems, etc.;

- the market-place model, i.e. a commercial organization offers a network with servers, online access and public terminals to everybody who wants to put information into the system. Examples range from local city information systems and bulletin board systems to German nationwide videotex or worldwide CompuServe and Internet.

Both models have severe disadvantages. The owner model is very expensive and can be run only by big organizations and even then will not reach a high degree of availability at all those places where people might need the information. The market-place model lacks a structure of content and quality control and therefore is not suitable for lay people and everyday information.

Therefore there is a need for a third model which combines the advantages of both approaches: structure and high quality of content with high availability and sharing of resources by a technically open network. Such a network, however, is not only a technical one, but an organizational and economic one as well; it is a socio-technical network with characteristics of an infrastructure. On the level of a local community one might call it the local information infrastructure.

Creating such a citizen information network raises several questions in order to balance the relationship between the application of new technology, the shaping of the content and organizational system development. Crucial questions are:

- Which organizations have an interest in providing information electronically?
- Which information do diverse groups of users want?
- Where are the proper places for public terminals to make this information available?
- What are the different input/output media and interface forms which fit for different user groups and access environments?

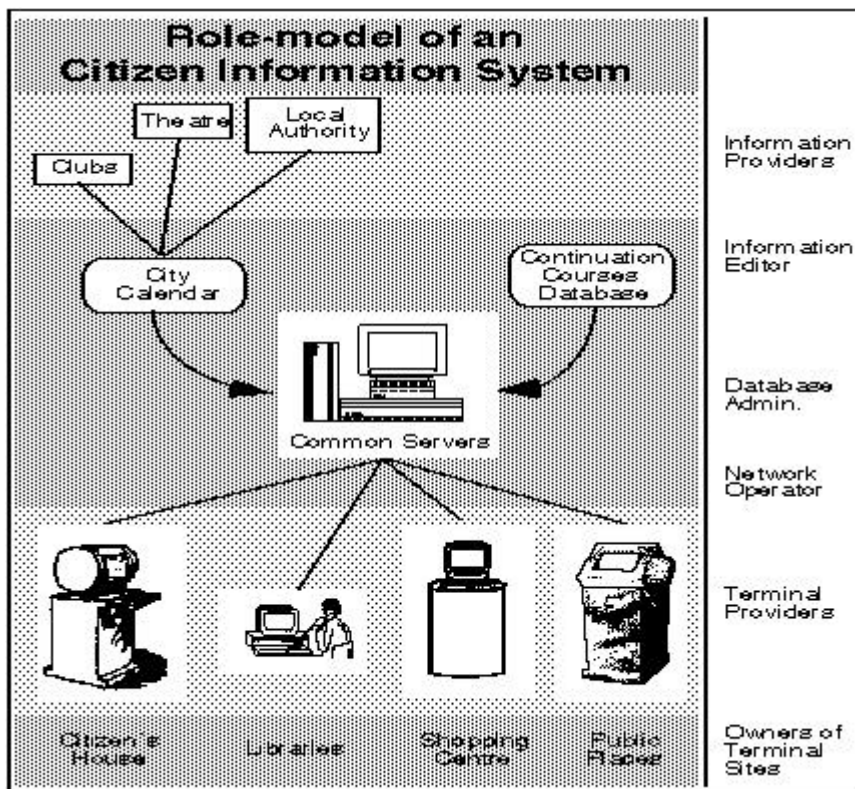


Fig. 1. Role model of a cooperative network

This paper describes our experience in developing the Bremen Citizen Information Network based on the network model. The goal of this CIN is to provide easily accessible information about public affairs to the resident's home, to public buildings such as libraries and to public places as well. By developing a prototypical system, we were successful in establishing a cooperative socio-technical network, with a lot of public and private partners, which allows learning a lot with regard to future multimedia services.

First, the strategies of organizing and establishing this cooperative network are highlighted in this paper. This is followed by a description of the system's functionality and the interactive multimedia user-interface. Then our efforts in prototype development and the experiences made are illustrated and the relationship between developing prototypes and establishing a stable running large system are pointed out. Finally the public-private partnership for cost-sharing and the technical open client-server architecture are described as particular features of the Bremen approach.

2: The cooperative network approach

2.1: The role model of a cooperative network

Today everybody talks about multimedia, stressing the possibilities of manipulation of audio and video signals and the advance in data compression. But most applications of multimedia technology still are demoversions. To become a media in an institutional sense such as newspapers or radio programs, more than technology is needed. A newspaper is more than typesetting and printing technology. There is the editorial staff, gathering information from press agencies which have their correspondents all over the

world. There is the advertisement department and much more.

With regard to the established media, different roles have emerged which are necessary for building and running an information service. For the new electronic multimedia services we still need to define those roles which might constitute a medium in the institutional sense. In a citizen information system we have at least six different roles:

- the role of information providers is to provide data resource, such as the program of the cinema, the theatre program, the schedule of clubs, and the activities of the local authorities;
- the role of the information editor is to check this information, put it under appropriate headings, assign keywords, etc.;
- the role of the database administrator is to convert these data into a form that can be accessed by different frontends;
- the role of the network operator is to manage a common server and a network with different access technologies;
- the role of the terminal providers is to present the data using different interfaces on distributed clients networked with the common server;
- the role of owners of terminal sites is to manage the availability of the terminal equipment of the public terminals in places such as the citizen's house, the city libraries, shopping centres, etc.

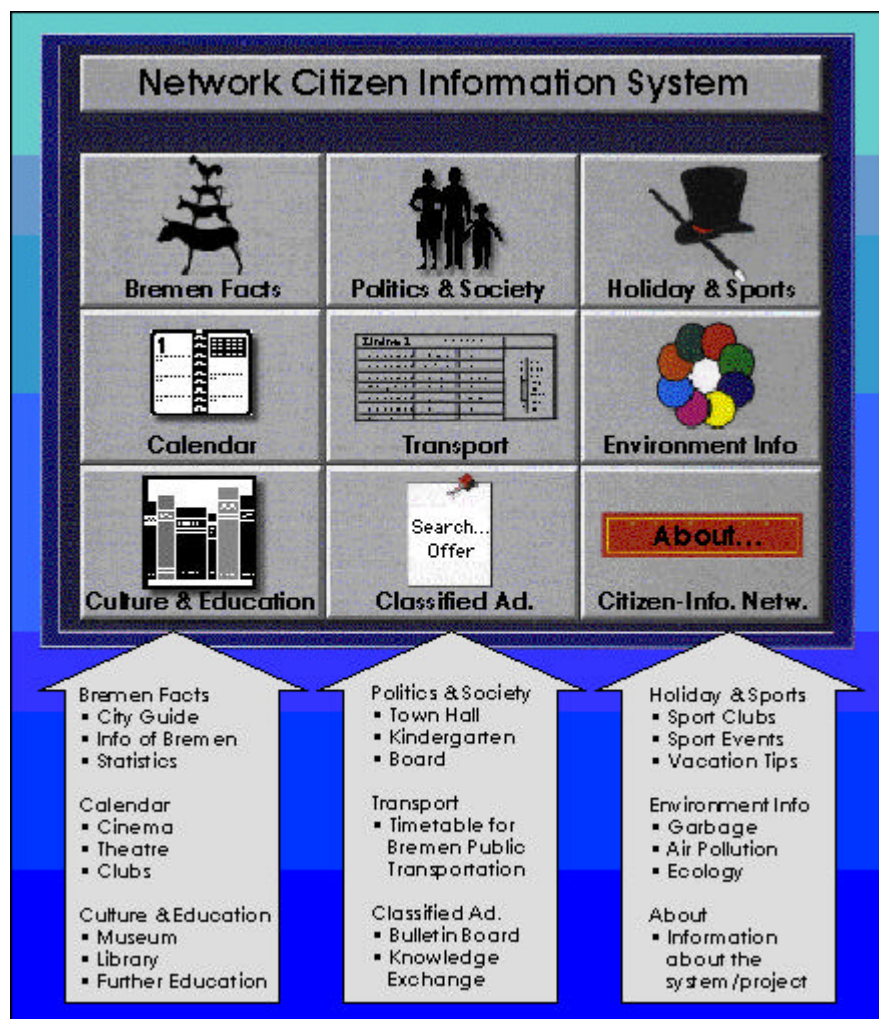


Fig. 2. The content of the CIN

In this first phase of our project, our research group took over most of these roles. In order to find out which information citizens look for at which places, we put three computers (Apple Macintosh) in two libraries and a community center. Then we looked for information providers in the private and public sectors. We collected text files and converted them into hypercard stacks. For example, we got the city calendar from two of Bremen's local magazines. And we got access to a database for continuous education by developing a hypercard interface. We got environment pollution data from municipality offices. For each information provider a separate stack was created. But there was a uniform user interface. The aim of the project in this first phase was to collect as much different information topics as possible in order to find out which of these was used by various users in different locations. In a continuous process we looked which information citizens made use of and asked them for their information needs. At the same time, we tried to find information providers and other organizations to take over certain roles.

2.2: The strategies in the organization development process

To build this cooperative network, several steps had to be accomplished, which enhanced our knowledge about multimedia systems.

- Through investigating, interviewing and discussing with the users we improved the interface and adopted the dialogues to everyday German.
- The system should not only show the interest and view of the people who organized and built it, the important thing is to serve the needs of the citizens. We made a joined effort to understand users' information needs by organizing hearings with interested groups, counting automatically the system access.



Fig. 3. Screenshot from the sportsmodule

- Based on the experience gained from these activities, we shaped the direction of gradually widening the content of the system and furthermore established the partnership with organizations from the private and public sectors to create the cooperative network.
- The development and presentation of the prototype attracted other information providers making use of this test-bed.
- The ultimate goal is to demonstrate the need of building up and maintaining an information infrastructure to local government. By following the network approach, we look for a way to share costs and to make such a system affordable in times where local authorities are short of money. In particular, we tried to find out how the cost of the technical infrastructure and the risks of the prototype development can be shared by private and public organizations.

3: System functionality and its presentation

The information resources must be presented properly to be usable by most of the citizens, even if they have no professional computer experience. The CIN provides various functions for users to obtain the demanded information and knowledge. The interface developed lets most of the initial users access the system without training, and the application of multimedia technology made the system ease of use. Almost eighty percent of the users interviewed answered that the system was very easy or easy to use, regardless of age or gender.

3.1: The content and functionality of the system

The information provided in this system can be divided into three functional types:

- the combination of institution and location, i.e. the user can search for a certain institution, be it a branch of the local authority, a club, a museum, or restaurant, he can read the information provided and have its location shown in a city map.
- events in time, i.e. information about events, be it concerts or lectures, is arranged according to topics as well as dates. Besides full text retrieval according to key words the user can browse through the data day by day;
- matching, i.e. offers and demands e.g. for the exchange of knowledge, hobby partners, buy and sell, can be keyed in and are matched automatically.

For each of these three types several stacks have been created. However, they are based on a few functions. Thus it was quite easy to create new stacks in order to enlarge the range of choices in the first phase of the project.

3.2: The GUI

For the whole system, we created a consistent graphic user interface for the casual user. Regardless which stack is chosen, the user will find all control buttons on the right side of the screen and the function buttons on the bottom. The buttons with the same functions can be recognized by the same icon and the same position. After some experiments we chose to use a recorder metaphor for browsing backward and forward (see Fig. 3). The main information window is on the middle left, according to the people's custom to read from left to right. For every object and event users can get the online help, and they can get the immediate reaction from the computer when they activate any event such as the warning and error dialogue windows.

3.3: The multimedia extensions of the system

Users will also find that the system is not boring or dumb, because there exist not only static data types, but also dynamic data, such as time-based video, voice, music data. We use different multimedia technologies in the proper modules according to the user groups and terminal locations. In the citizen's house, where more younger people are using the system, we use music and video data to mix information with entertainment. But in the library - in order not to disturb other readers - the system must not be very noisy, so we use photos to show activities of the sport clubs or the pictures of the objects shown in museums. Examples are:

- the city calendar, which uses QuickTime digital video technology to show the magazine advertisements; users can browse through the movie, looking at a thumbnail sketch of each screen i.e. the movie can be played frame-by-frame;
- the bulletin board provides a button for input edit and play audio messages.

4: Prototype implementation and experiences

The first black & white prototype was created in April 1992 with only five stacks of contents. In the past two years, we have paid much organizing and technical work in enlargening the prototypical system.

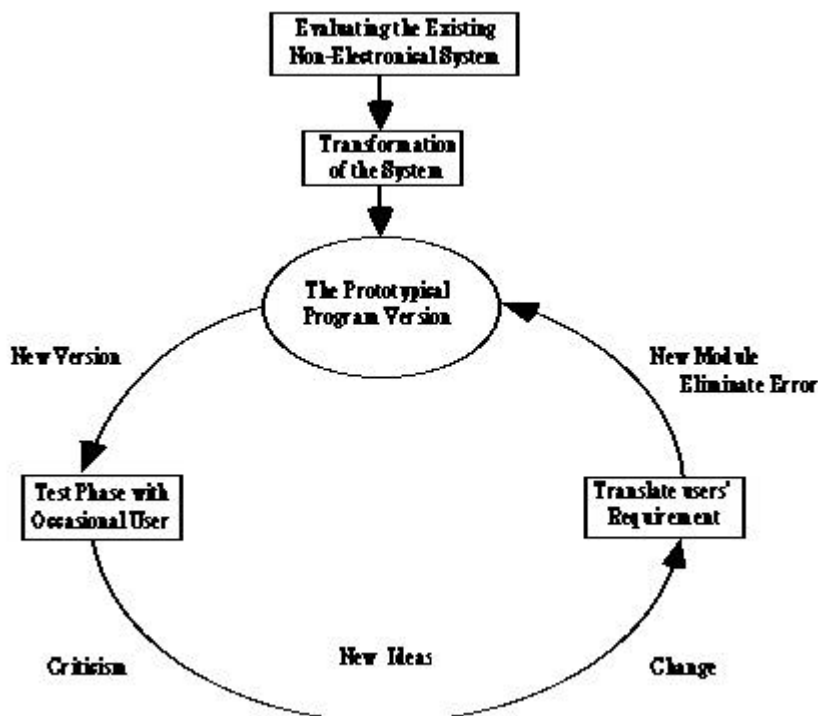


Fig. 4. The prototype developing lifecycle

Through presentations and reports by the local press, more and more information owners became interested in providing information and to discuss possibilities of cooperation. We also collected the feedback from the users via three public terminals. Thus we got new ideas how to widen the content of the system and to improve the functions and the interfaces of the prototype. First we added the information which was mostly demanded by the users, i.e. sports, a city calendar of events and the local bus schedules. It turned out that it was easier to cooperate with the private publishers of a city magazine than with the local authorities. The strategy adopted was to show the usability of the system and the demand of citizens in order to create a pressure on the authorities for providing information for the system.

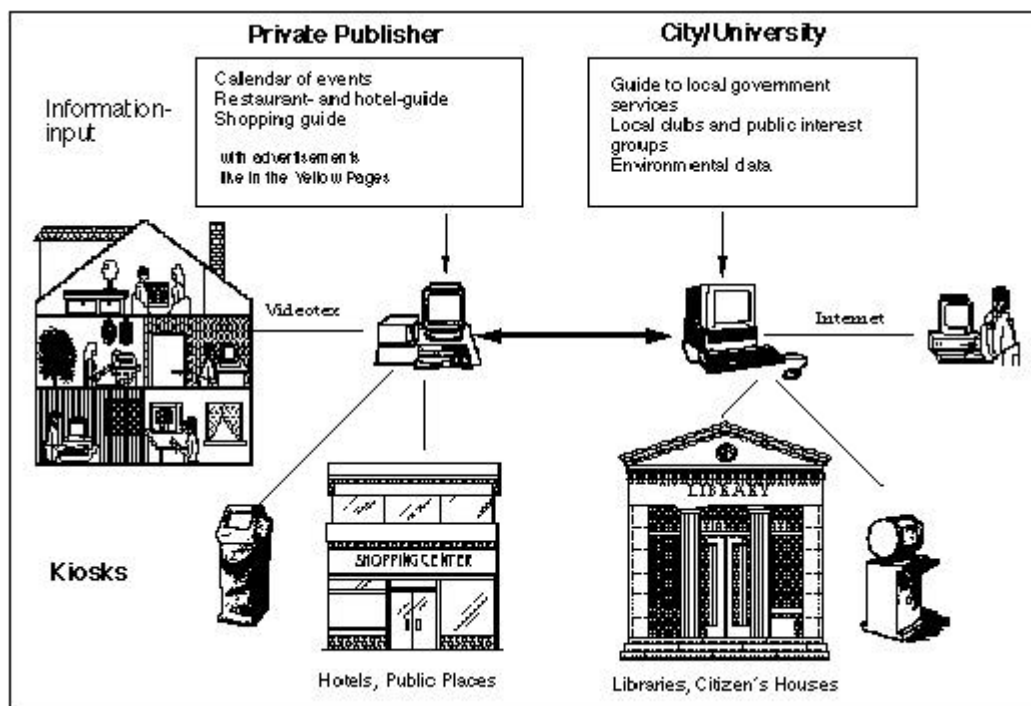


Fig. 5. Dual structure of cost-sharing

We followed an object-oriented approach. For many objects have the same functions. We produced small modules which only realized a limited function to enhance their reusability. We stored them in several class libraries. Prototypes were developed by about thirty students of computer science. There was some fluctuation. But the ever-growing class libraries with fine specifications helped the sequence programmer to understand quickly and to create new applications more easily. The new programs usually had higher quality, because they were based on the well-proven components which were tested and polished repeatedly. The programmers also did not need to be concerned about the lower-level details, instead they only needed to think in terms of behaviour of the objects and user demands.

In the lifecycle of the prototypes, the targets of system development were often changed.

The prototypes were first created on Macintosh using hypercard. But as Macintoshes are not wide-spread in Germany, we also had to develop on IBM platform using Asymmetrix ToolBook. The first prototype generation followed a source-oriented model. We converted the data sets which were delivered by the information providers into hypercard stacks and stored them each under one or more buttons in the system, for example, both magazines, "Bremer" and "Mix", provided their city calendar data and we stored the data sets under these titles. Thus, a user looking for an event had to choose between the two stacks. If he did not find it in the "Bremer", to be sure, he had to look in the other stack as well. This approach made data entry easy, but did not provide a high quality service to the user. An electronic calendar of events has to be complete and up to date. Therefore we are now developing the second generation network which is a database/directory model in a client-server-architecture, which is

described later in chapter 7 of this article.

As expected for a citizen information network, we are facing diverse groups of users with different knowledge, information requirements, and expectation of the system, while in our first prototype generation we laid our emphasis on the consistency of the interface over all the stacks and terminal locations.

However, our analysis of users showed that they also not only differ with respect to computer literacy. They have different expectations for the system. While some know exactly what they want and so expect a straight information retrieval, others prefer to browse around and explore the capabilities of the system. For the second generation, we will provide different interfaces for user groups. For example for tourists we use a marketplace metaphor as menu screen without separate buttons. Users can "open" the door of the town hall or a museum and find the book shelf with sorted catalogues and desks with labeled drawings as submenus. Users can pick up the drawings to look for the demanded photos or video types and "display" them on the screen. Another interface form is for the experienced retrieval users who will just click the multiple pulldown menus to go to the deeper layers of the menus directly.

In the first prototype generation, the "City Guide" module turned out to be very useful and practical, for the city map is a center nod connecting most of the modules in the system. But the marking of locations has to be done manually for each institution. In order to make this cadastral function generally available for the yellow pages with several thousand addresses, we are now improving this function by using the local authorities' geographical data and connecting them to a digitized city map.

It also turned out that the duties of the owners of the terminal sites had to be extended. They do not only have to take care that paper is in the printer and to clean the screen. As some users key in dirty words or insulting texts into the bulletin board, we first made an automatic filter denying to accept such kind of words.

However, users can easily challenge this filter. Now we provide the owners of the terminal sites with a special password and an easy-to-use function to delete such messages.

5: The generation conflict

The most crucial change from the first to the second generation system was that from a collection of hypercard stacks to an integrated database. Hypercard was chosen in the first phase because it is a convenient tool for rapid prototyping. And our assumption turned out to be right that we only could find out about citizens' information needs by providing them with a wide range of prototypes. However, we did not expect that the change-over to a high-quality and stable type of information system would be so radical as it turned out to be. In the prototyping phase, we only converted data delivered by information providers. But users do not care whether the integration of data is easy or not. They want consistent, complete and up-to-date information. To provide this is quite different from making hypercard stacks. Although the literature on

prototyping speaks of evolutionary approaches, the steps from the first to the second generation turned out to be radical and revolutionary in several respects. Not only had the software basis to be changed from hypertext tools to a standard database technology.

Also the arrangements with the information providers had to be reorganized, and the whole culture of the system development process had to be changed. Instead of making new stacks within some weeks on the computer, now modelling of objects and discussions of common data structures came into the center of development activities. It turned out that the members of the team who had developed the first stacks had developed a high identification with this type of system and a high affiliation to this type of work. To develop data models is a much more analytical and abstract type of work, which requires different skills and quite a different organization culture.

We still maintain that in order to find out about the citizens information needs in the information age one has to adopt a prototyping approach. However, every development team should be aware from the beginning that there will be no smooth change-over to a permanent and stable running system. One has to take into account that almost everything which has been developed in the first phase will have to be thrown away later on. Yet the prototypes have to be developed with a high motivation. It is a social challenge to development teams to cope with these contradictions.

6: Public-private partnership in cost-sharing

Providing comprehensive and up-to-date information at many points of access affords high efforts for collecting and editing the information as well as for running the network with its servers and public access kiosks. In some German cities, private companies establish kiosk-systems and include only information of those restaurants, hotels, and shops which pay for this kind of advertisement.

However, this selection mechanism reduces the value of the information system for its users, because they expect that e.g. a restaurant guide contains all the restaurants to choose from. As additive advertisements like in magazines are not feasible in an interactive medium, advertisement as a funding resource has to be integrated into the content of an information subsystem, like in the Yellow Pages.

This kind of funding is feasible for calendars of cultural events, for restaurant-, hotel- and shopping-guides, but not for citizen-information concerning e.g. local government services or environmental information. As the local government budget is very tight and cannot provide for editing staff as well for a city-wide network, a new model of cost-sharing has been developed.

Those parts of the whole information menu that can be financed by integrated advertisements are given to a private publisher as prime contractor of the city. However, as this company wants to put its kiosks not only in hotels and supermarkets, but on public places, too, there is a chance for local government to share some cost. The right to use public ground is exchanged for the obligation of the private company

to distribute the information provided by the city also via its own terminals.

Thus, the city has only to establish additional kiosks at those places which seem not profitable for the private company. In addition, the private publisher has to provide his information free of charge to all kiosks run by the city.

By this cross-exchange (see figure 5) the content of the system has been enlarged and the cost for the city government can be reduced.

7: Technical aspects of client/server architecture

The existing infobooth systems are mostly proprietary today. It is necessary to use a platform with preemptive multitasking and multiuser capabilities like Unix, OS/2 or Windows NT to allow many users access to the stored informations at the same time.

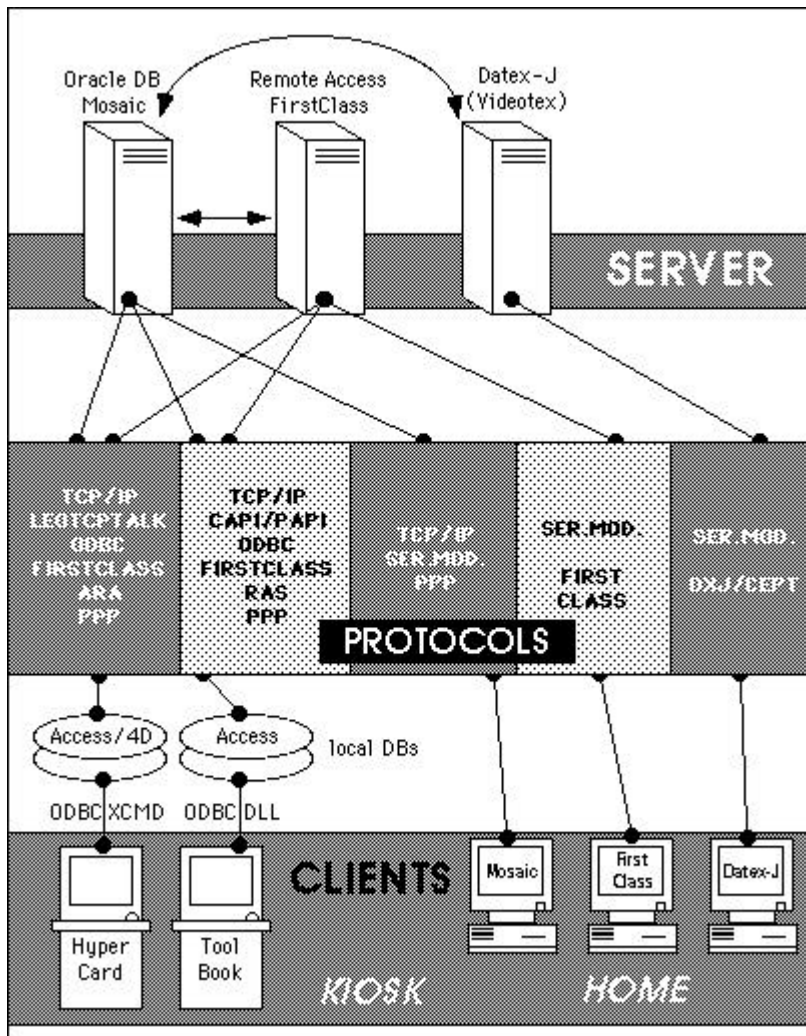


Fig. 6. C/S-Architecture of the CIN

The vendors of commercial products, that are available for the development of kiosk systems, have no interest in producing open architectures in general. Their natural interest is to inhibit free access to increase the sale of their own products. That is the reason, why we did not use a software like Oracle for our clients to prevent the

dependance of communities or institutions that are using our system.

Therefore we decided to develop a technical open structure to allow each user access from home at low costs. The main information management takes place on a Unix platform with the support of the Oracle database. The different clients (Windows and Macintosh) connect via TCP/IP to the Unix server (the communication access happens via Ethernet and ISDN boards or serial modem respectively).

The database interface between local (client) and main database (server) is ODBC, the interface between the frontend software (HyperCard and Toolbook) and the local database is disposed by ODBC-DLLs (Windows) and ODBC-XCMDs (Macintosh).

The client/server network requires beside the realization of the database communication a remote access concept for the kiosk systems. So the installation of the AppleTalkRemoteAccess-package (ARA, Apple) and the RemoteAccessService-Software (RAS, Windows) is inavoidable.

This looks very good at first sight, but in practice the products mentioned above don't work together as expected. We had to solve a lot of problems that happened through the lack of "co-operation" among this heterogenous products. For example the ODBC connection from Macintosh clients to the Oracle database failed for reasons to complex to list here.

Therefore we decided to offer standard retrieval and communication software besides our usual kiosk frontend. For this case the standard communication interfaces are Datex-J clients, BBS clients und PPP clients (see fig. 6).

This is not a purely client/server system in a conventional sense. The data are redundant on each client and on the servers. This is done because of

- the very expensive telecommunication costs here in germany,
- the slow access via telephone cable to large data sets (like videos and sound data) and
- the very low price of harddisk memory nowadays.

The client/server structure is only used for communication among the clients and updating of the clients' data, which is initiated by the server in case of the incoming of very actual data from an information provider.

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