The Electronic Flea Market

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Abstract

In this paper, we proposed an electronic marketplace, the Electronic Flea Market (EFM), to allow users to buy and sell goods and services to each other. The EFM is based on a client-server model and allows multimedia advertisements. The EFM would bring together diverse mechanisms of advertising in large geographical areas. Unlike the currently proposed electronic markets, such as the FYI Network's ad cable channel, the users would be able to generate ads using their home terminals. The advertisers would be able to use their own creativity and ingenuity in generating their ads. The EFM would also provide a unique active matching service to the user. With the expected volume and overhead costs, the EFM would be affordable and appealing.

1 Introduction

Traditionally, a market has been a meeting place where buyers and sellers of goods and services could seek each other out in order to trade. In modern times, especially with the advent of computer networks, markets are no longer tied to one location. The key to a market is the flow information between buyers and sellers. Since networked computers can be used effectively for this purpose, it is not surprising that many new types of electronic market places are being created. We list several examples below:

1. NASDAQ: This is an electronic marketplace for securities which allows them to be traded at any time of the day.

2. Cross Country Healthcare: This company matches nurses, therapists and other healthcare workers with job opportunities in hospitals and nursing homes all over the US, creating an employment market [1].

3. The National Policy Review, headed by Vice President Gore, has called for the creation of an electronic marketplace for computer products. This marketplace will bring together government agencies and computer products manufacturers [2].

4. The Technology Board of Trade, a commercial startup, proposes to operate an electronic exchange to facilitate trading of intellectual property. [3]

In this paper, we explore the possibility of an "Electronic Flea Market" (EFM). Our goal is to provide an easier and more flexible way for people to buy and sell goods and services from each other. The Electronic Flea Market would be an extension of the existing marketplace currently created by classified advertisements in magazines, newspapers and advertisement digests such as the PennySaver. It would also offer some of the features found in the telephone yellow pages.

Unlike many of the current proposals for interactive home shopping systems, buyers and sellers would operate as equals in the EFM. This is in contrast to most proposed home shopping systems where the number of sellers (expected to be large retailers such as Sears and Macy's) is much smaller than the number of buyers.

We expect the ease and affordability of the EFM to make the buyer-seller ratio more equitable. As the name "Electronic Flea Market" implies, a potpourri of services and products ranging from the small, simple ones to the rare, exotic as well as large retail services will be carried on it.

Currently there is a large volume of classified ads carried in a wide variety of publications, including magazines, national and regional newspapers, and PennySavers. By using a unified, easily accessible, user-friendly advertising mechanism, we hope to capture and enlarge this market.

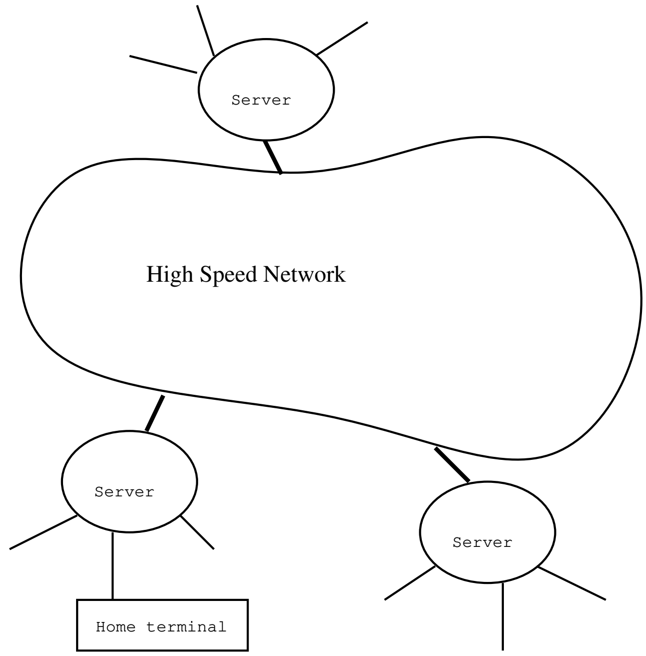

Figure 1: Network structure of the electronic flea market

A major feature of the EFM is that advertisers could create ads with audio clips, still-pictures and video in addition to textual descriptions of the object or service being advertised. The home terminal for the EFM will be capable of digitizing and compressing these inputs as well as playing them back. This functionality is currently available only in high-end personal computers at present but we expect them to become much cheaper in the near future.

The EFM will be implemented as a client-server system. Each server would cover approximately the same number of homes as a telephone central office. We assume that relatively high-bandwidth lines capable of 4 - 6 Mbit/sec will be used to connect home terminals with servers. It currently appears that both telephone and cable TV will be able to provide that bandwidth but it is likely that telephone lines, using a variant of Asymmetric Digital Subscriber Line (ADSL) technology [5], will be the medium of choice as high bandwidth could flow more easily in both directions. We note that this infrastructure could be shared with other applications like video telephony and broadcast reception.

To place an ad on the network, the seller would first create a video clip with a camcorder or a still picture with an electronic camera. This would then be transferred, in digitized form, to the computer through a special cable. Textual information would then be added to the ad through the Home Terminal Flea Market software.

The ad, which would consist of video and textual description, would be uploaded to home server of the user. The server will then attempt to find matching advertisements as per the user's specifications. The user can specify how the matching is to be done through attribute and geographic specifications. For example, the user can specify the geographical location of the search, the duration of the advertisement, and a list of attributes describing the service or product.

The system will allow the user to selectively view matched advertisements. When the desired number of matches have been obtained and a transaction has been completed, the user can delete the original advertisement from the system.

The rest of the paper is organized as follows: In the next section, we describe the home terminal and a technique for uniformly describing the goods and services. In section 3, we describe how the servers operate, how they communicate with each other and how matching advertisements are determined. In section 4, we discuss some issues related the economics of the market and EFM system usage is discussed in section 5.

2 Home Terminal Interface

Any customer wishing to use the EFM would call an 800 number to enroll. He/She would receive a package in the mail that would contain the following:

- a diskette with end-user software
- a list of hardware, software, and network connectivity requirements (to be explained later)
- a contract binding the user to the ethical and commercial policy of the service (to be explained later)

2.1 Requirements and policy

We assume that an appropriate two-way high-bandwidth communication line between the user and the server will be available. The customer would be required to have a personal computer with the following capabilities:

- can connect to a electronic camera or camcorder and download digital images
- display video images
- have audio capabilities

We cannot conceive of an electronic method to censor all advertisements for offensive material. Yet, since the potential of such an abuse exists, we must have a means of enforcing the "netiquette" defined by the service. The necessary human intervention shall be a participation between the customers and a network administrator acting as a reviewer. If any violations are found, the advertisement would be removed from the EFM and the advertiser would lose his/her subscription to the service and would be banned from any future use of the service.

2.2 User Interface

The user's interface would be identical for both buyers and sellers. This section will describe the Home Terminal Flea Market Software, specifically the Graphical User Interface (GUI). There will be the following main panels on the GUI: Generate Ad, Match Review, Delete Ad and Consumer's Comments.

2.2.1 Generate Ad Panel

This Panel will be used by both the buyers and the sellers to place advertisements on the Flea Market Network (see Figure 2) . An "Ad Description" subpanel will generate a standardized description of the advertiser's service or product, while allowing complete creative freedom of the user. Thus, a mechanism of matching diverse ads is insured. On opening the panel, the user will be asked to classify whether the advertisement is for a service or product. The advertisement is then further classified according to a high order category such as automobile, book binder or cleaning service, etc. A list of existing categories will be available to the user. (If the user is not satisfied with the existing categories or the attributes associated with any category, he/she can petition the Network Administrator for additions using the Consumer's Comments panel.)

Based on the category specified, a list of attributes is provided by the software. The user is then prompted to enter values for these attributes. This Panel can also be used to specify any text the advertiser wishes to be part of his/her advertisement. The "Ad Geographical Specification" subpanel will enable the user to enter the specific regions he/she is targeting for that particular advertisement. The geographical descriptive will be a set of zipcodes representing the targeted areas of the ad. Again, the user is aided by a detailed map or listing of zipcodes. The user can also enter the duration that he/she wants the ad to be present in the EFN. At the end of the duration, the advertisement will automatically be deleted from the EFN.

To add the video clip to the advertisement, the user just needs to enter the filename of the stored video clip. A review button is provided to enable the advertiser to view the whole advertisement as it will be presented to the a potential buyer/seller. After the advertisement has been composed, the Home Terminal Flea Market Software will forward the advertisement to the local Server.

2.2.2 Match Review Panel

This panel is used by the user to view advertisements retrieved (matches) by the system (see Figure 3). This panel enables the user to browse through the advertisements. Since an advertiser can have more than one advertisement outstanding, the software first pops up a window listing the active advertisements placed by the user. Next to each title, there will be box indicating whether matches have occurred. Double clicking on a particular advertisement will pop up another window which will contain three bits of information: Match Index Value, Ad Key, and Ad title. The match index, explained in more detail in Section 3.1 , indicates on a scale from 1 to x the fit of the match.

The Ad Key is a unique key to identify the advertisement. This value is assigned by the Server software when the advertisement is first created. The Flea Market software can use this key to identify: the advertisement, the server it is stored on, and the submitter of the advertisement. In order to view the complete advertisement, including the audio/video, the user would double click on any of the matched advertisements.

Note that the matched advertisements are not stored on the user's home terminal.

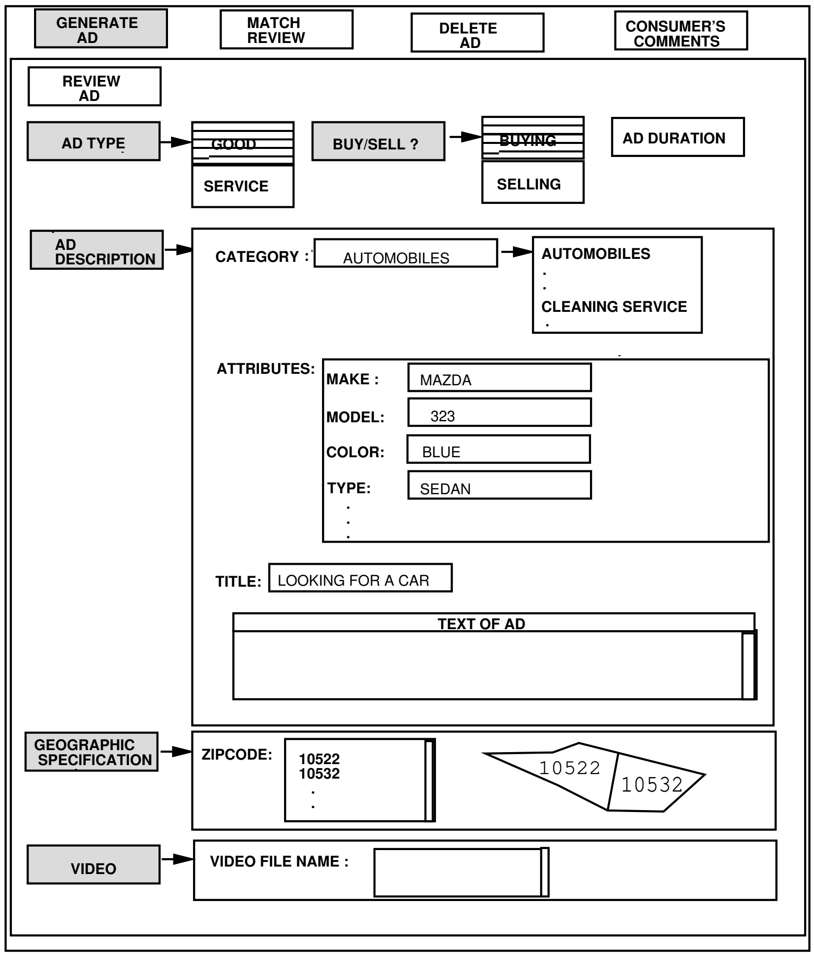

Figure 2: Generating an advertisement

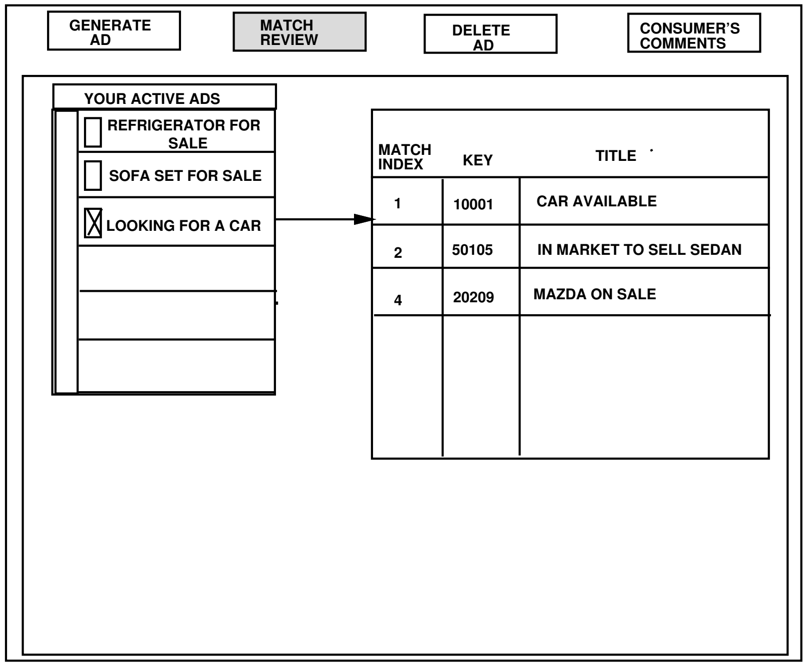

Figure 3: Reviewing Matches

All advertisements will remain on the home server and will be transmitted for display to the user's home computer upon request.

2.2.3 Delete Ad Panel

When a user has completed a transaction, he/she can delete the advertisement from the EFM using this panel (see Figure 4). The EFM would only locates matching advertisements; the completion of a transaction leading to the termination of an advertisement is left to the users' discretion. This panel displays a list of advertisements placed by the user enabling the user to delete the appropriate one.

2.2.4 Consumer's Comments Panel

This panel provides a mechanism to draw the EFM Network Administrator's attention to unsavory advertisements or the need for additional categories or attributes in describing a product or service (see Figure 5). To file a complaint against an offensive advertisement, the user inputs the unique key of the advertisements in question and has the opportunity to comment on the advertisement. In order to add a cate-

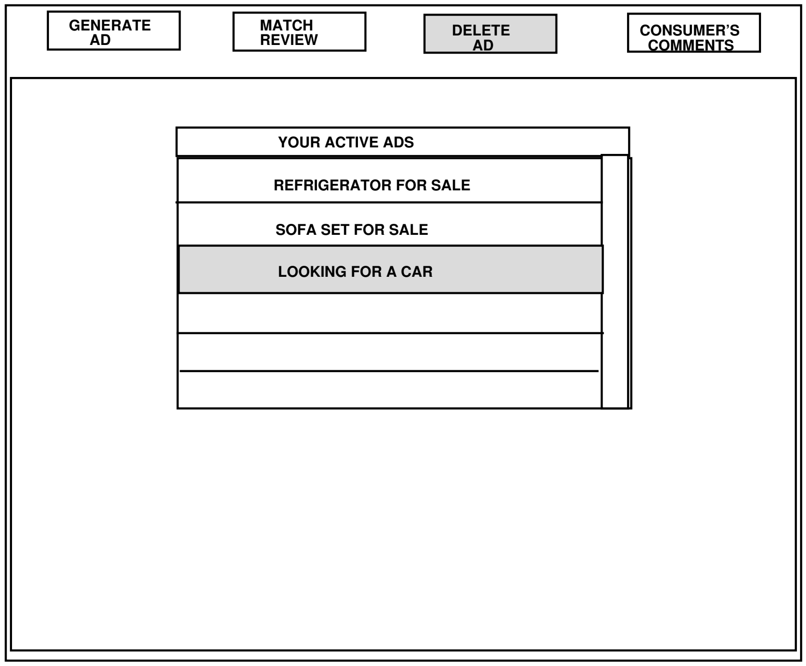

Figure 4: Delete the Advertisement

gory or attribute, the user can use a "Add Category" or "Add Attribute" subpanel respectively and fill in the appropriate information.

3 Servers

In this section, we describe what happens to an advertisement after it reaches the home server of the submitter. The server is the heart of the EFM. Servers performs the following functions:

- Store advertisements submitted by users.
- Send and receive advertisements from other servers.
- Attempt to find matches for advertisements.

Servers are connected to end-users through *ports* and to other servers via high-speed *trunks* An overview of the procedure used by the servers to process advertisements is described below:

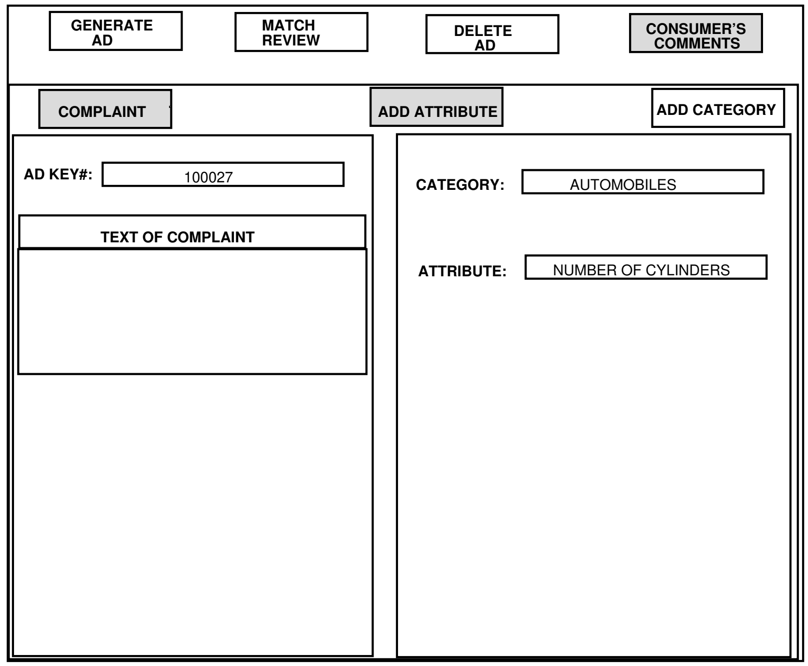

Figure 5: Filing a Complaint

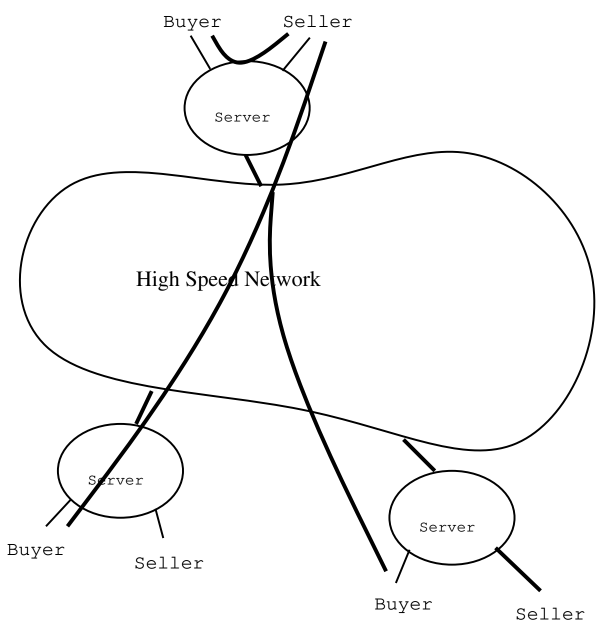

Figure 6: Network traffic results if buyers retrieve the multimedia content of advertisements over the network. The matches between buyers and sellers are shown as thick lines. Note that no network traffic results from matches within the same server.

1. When a server receives an advertisement from a user via a *port*, it stores the advertisement and assigns it a network-wide unique id, called the *Ad Key*. This server is the *Home* Server for this advertisement. The multimedia component of the advertisement is stored in high-speed secondary storage such as RAID while the text portion is stored in RAM.

2. Each advertisement has a set of *target* servers which fall within the geographical region specified by the user for that advertisement. A *Home* server determines the *Target* servers of an advertisement. Note, the *Home* server need not always be one of the *Target* servers as a user may wish to target an advertisement only to a remote geographical area. Upon determining the *Target* servers, the *Home* server then multicasts the *text portion* of the advertisement to the *Target* servers over the network. A *Home* server maintains a list of target servers for each advertisement.

3. The actions of the *Home* and *Target* server are described in detail below.

   - **Home server**: When a advertisement arrives on a *port* targeting its *Home* server, it is matched against all advertisements on that server. These include advertisements that have originated locally and advertisements that have been multicast by other servers. The matching procedure is described in more detail in Section 3.1. The *Home* server collects the matched advertisements and stores them for the user to peruse. The Server Software then signals the user's Home Terminal Software that match(s) have occurred.

   - **Target Server**: An advertisement arriving on a *trunk* of a server will be matched against advertisements which are homed on that server. Whenever matches with local advertisements are made, the text portion of the matched advertisement is sent to the *Home* server of the incoming advertisement.

4. When the user peruses through the matches to his/her advertisement, the multimedia component of the advertisements will be retrieved if requested by the

user. The user's server will fetch the multimedia component over the network and send it to the user over a *port* link.

5. An advertisement can be deleted from the network when the user feels that he/she has received an adequate level of response to the advertisement. A *delete advertisement* message will be sent to all servers that the advertisement was targeted towards. If the user specified a *duration* value when he/she created the ad, the ad will be automatically deleted from the EFM when the duration expires.

3.1 Organization of Data in Servers and the Matching of Advertisements

A server lends itself ideally to a shared-memory multiprocessor organization. This is shown in Figure 7. There are two types of processors (trunk, port) and one central shared memory in which the text portion of the advertisements are stored. The video clips are to be stored in secondary storage such as RAID. The advertisement, in RAM, is stored along with a pointer to the video in mass storage.

We expect to be using a object oriented database at each Server. Logically, advertisements will be collected in different pools. Note that the advertisements themselves are not members of the pools. Instead, pools are collections of advertisement IDs. Thus an advertisement can belong to more than one pool simultaneously.

There are two broad pools to store local and foreign advertisements respectively. In addition, each user will have pools or holds where matches to advertisements will be collected. Within the local and foreign pools, advertisements will be further subdivided into sub-pools. For example, buyers and sellers advertisements will be stored separately. Within the pool for buyers advertisements, there may be yet further classification of the advertisements with respect to topics and subtopics. Associated with each topic is a list of attributes that describe that advertisement's object or service.

The matching proceeds according to the hierarchy indicated in the Figure 8. Should more than one base attribute match, our software scores it as a "match" of the advertisement. Based on the number of attributes that match, a matching

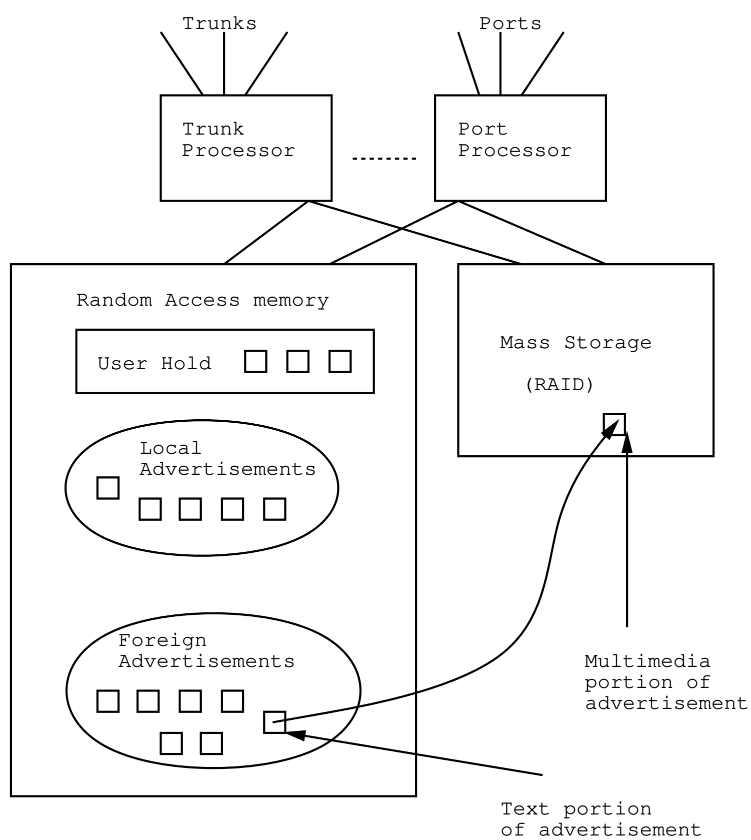

Figure 7: Logical view of advertisement storage on server.

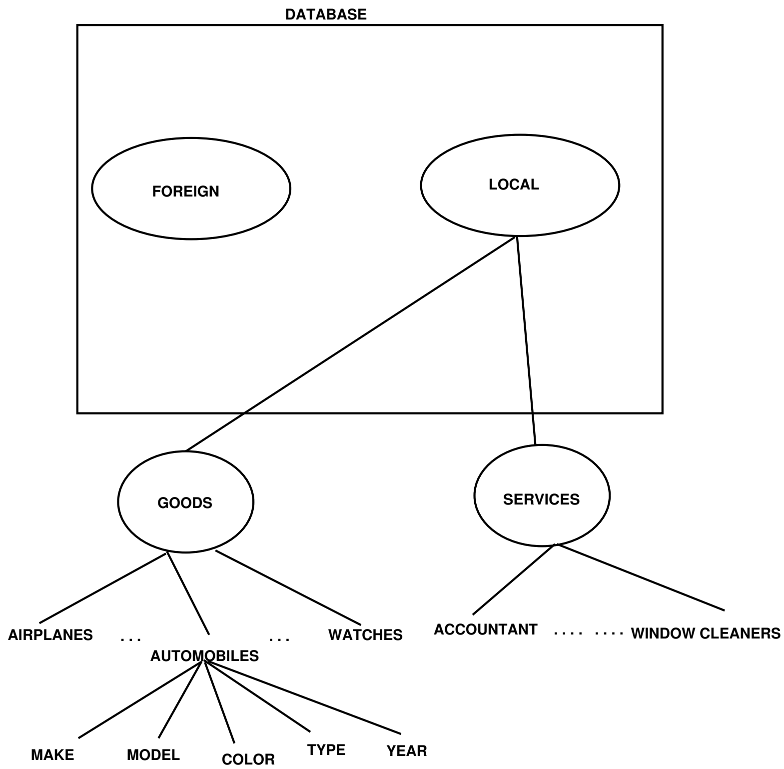

Figure 8: Logical view of database.

index is calculated. One attribute match results in a matching index of 1 and x attribute match results in an attribute matching index of x.

4 Pricing

The main costs of running the EFM will be:

1. Leased communication lines.

2. Software and hardware management.

3. Personnel.

4. Billing.

The main sources of income for the EFM will be subscription fees for new users and advertising charges. Customers would be billed for advertisements as follows:

1. A basic flat fee for each advertisement, whether buyer or seller.
2. Geographic reach of the advertisement.
3. An additional charge for video clips, based on the length of the video.

Note that we expect that sellers are much more likely than buyers to include video clips. Not all types of advertisements will be charged the same fee. If it is known that certain categories of advertisements are retrieved more frequently, then these advertisements will cost more to submit.

Ideally, in the interest of fairness, the buyer should pay for retrieving the video components of advertisements over the network. This may not be possible since in current marketplaces, the seller is traditionally responsible for bearing the cost of advertising.

5 System Usage

The EFM is envisioned as an ubiquitous system. For it to be truly effective, it needs to be as widely available as the current telephone service. In this section, using Westchester County in New York state as an example, we attempt to estimate the volume of advertisements over the network due to the EFM. Westchester County is representative of many parts of the US since it contains urban, suburban and rural areas. We will describe several factors which have an impact on network load.

5.1 Server size

One of the factors determining network load is the number of customers served by one server. The capacity and capability of a server limits the number of consumers who can be served by it. It is expected that each server should serve approximately the same region as a modern telephone central office.

However, the technology used for the link from server to home imposes restrictions on the maximum distance of the link. We expect that some variant of Asymmetric Digital Subscriber Line (ADSL) technology will be used for these links. Using ADSL technology, we find that the range for 3 Mbit/second (for MPEG encoded video [8]) is not likely to be more than 4 - 5 miles. We do not need a full-duplex high-bandwidth link between the server and the home since the user can not browse advertisements and submit advertisements simultaneously. In Westchester County, each central office serves approximately 16 square miles and about 17,000 customers.

5.2 Advertisement volume

We expect that there will be two types of advertisements in general:

- Advertisements by buyers and sellers of material goods. We expect that the advertisements for goods will be closer in form and nature to the classified advertisements found in newspapers and magazines.
- Advertisements by buyers and sellers of services. The advertisements for services on the other hand, might be closer to the form of advertising found in the telephone directory yellow pages. In this case, the sellers advertisements are likely to be long lived and matched many times against many buyers advertisements.

In Westchester, the market we seek is currently covered by:

1. Large regional newspapers such as the New York Times, which contains approximately 20,000 classified advertisements per week.
2. Suburban newspapers such as those published by Gannet Suburban Newspapers. These papers have approximately 7,000 classified advertisements per week.
3. Locally published classified advertisement digests. These are usually free and contain only classified advertisements. In Westchester County, the Pennysaver fits this description. This magazine is a weekly and usually contains approximately 5000 classified advertisements in each issue.
4. Magazines with nationwide circulation. There are innumerable specialty magazines containing classified advertisements. The volume of these advertisements is much smaller than in the newspapers since these magazines are published only monthly, but represent buyers and seller country-wide.

In addition to these classified advertisements, the Yellow Pages for Westchester County contain several hundred thousand advertisements for services.

We conjecture that the volume of classified advertisements submitted to the EFM could equal or exceed the current figures shown above since the ease of submission of advertisements, through a comprehensive means, could accrue many more customers.

If EFM were widely available in Westchester County, there could be as many as several hundred thousand customers. It is conceivable that several thousand users could be viewing video over the network simultaneously. If each customer uses 3 Mbit/s for a video stream, we expect the total network traffic within Westchester County alone, would be in the range of several hundred gigabit/sec. Combined with the traffic to and from neighboring counties in New York, New Jersey and Connecticut, the aggregate traffic approaches the terabit/sec range.

6 Conclusion

In this paper we have proposed an electronic marketplace, the Electronic Flea Market, to allow users to buy and sell goods and services to each other. The EFM is based on a client-server model and allows multimedia advertisements.

The EFM would bring together diverse mechanisms of advertising in large geographical areas. Unlike the currently proposed electronic markets, such as the FYI Network's ad cable channel [7], the users would be able to generate ads using their home terminals. The advertisers would be able to use their own creativity and ingenuity in generating their ads. The EFM would also provide a unique active matching service to the user. With the expected volume and overhead costs, the EFM would be affordable and appealing.

Users of the EFM would have a range of options from simple text only ads to more creative and appealing video displays. Display advertisements, which currently offer the highest information content in print media may cost as much as $300.00 per issue even in a local digest like the PennySaver. Display advertisements in the New York Times cost a magnitude more.

Trading would be simplified, easier and thereby increased in this marketplace. Besides this economic windfall, the EFM would bring substantial environmental benefits by reducing the paper used in current classified ads. The EFM would be an eminent and inevitable application of the gigabit networks in the future markets.

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