SEATTLE SMART TRAVELER

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16. ABSTRACT

Seattle Smart Traveler (SST) is a World Wide Web (WWW) application designed to test the concept of "dynamic" rideshare matching. SST collects spatial and temporal trip information by using a series of WWW pages, performs a match by sending SQL specifications to a database engine, and supports both the standard phone-based contact methodology, as well as two new, unique contact methodologies based on e-mail.

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T9903-64 SWIFT Smart Traveler

Seattle Smart Traveler

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1. INTRODUCTION

Seattle Smart Traveler (SST) is a Federal Highway Administration field operational test (FOT) currently under way. SST is designed to test the concept of "dynamic" rideshare matching. We define dynamic ridesharing as "the sharing of a single trip by two or more individuals, without regard to any previous history among the individuals involved." (This is similar to the definition of real-time ridesharing in [4].) Additionally, SST defines a "trip" as "a single instance of travel from one geographic location to another." A "trip" is, therefore, one-way, and the popular concept of a "round trip" is, for the purposes of SST, two "trips." This is an important distinction between "dynamic" and "traditional" ridematching systems.

Dynamic rideshare matching differs from traditional rideshare matching in two important ways. The first major difference is the treatment of the traveler's schedule. Traditional systems assume the traveler has a fixed schedule and a fixed set of origins and destinations. [9] A dynamic system must consider each trip individually and be able to accommodate trips to arbitrary points at arbitrary times by matching users' individual trips without regard to trip purpose. The second major difference is that dynamic ridematch systems must provide the match information to the user quickly in order to accommodate near-term (same day) travel, as well as long-term (future days or weeks) trips. Traditional systems frequently provide a matchlist through paper mail, a process that may take more than a day. [11, 15] For these two reasons, the requirements for dynamic rideshare matching are more demanding than those for the traditional rideshare application.

In designing SST, we postulated that the users of such a system view carpooling as a travel option for three types of trips: (1) trips that are part of a commuting schedule - both traditional, fixed commuting schedules and regular but variable commuting schedules; (2) additional recurring trips that are not part of commuting; and (3) occasional trips or single trips to single destinations. Because a university environment provides examples of all these types of trips, we chose to develop the SST application at the University of Washington (UW) using a World Wide Web (WWW) interface and to use members of the UW community as the testbed for the FOT. The UW is an example of a large, closed environment where potential users have multiple, highly variable schedules and a financial incentive to arrive at the campus without a car. Additionally, the UW is an example of an environment with a high level of technological sophistication, where most potential users are computer literate and have access to multiple communications technologies (e.g., email, voice mail, and paging). Such access has been identified as critical in the assessment of rideshare technologies. [1, 6, 10] This combination of variable schedules, computer literacy, and access to multiple communications media makes this population a reasonable representation of future work environments for employees of large agencies and an ideal testbed for dynamic rideshare matching.

2. LITERATURE REVIEW

The Seattle Smart Traveler is designed as a system to enable "dynamic" rideshare matching. Dynamic rideshare matching has been discussed in numerous articles, and there have been some recent relevant field tests. The following section looks at some of this literature.

Although various implementations of dynamic systems have been proposed, they are all similar in what they attempt to do. In a summary of these proposals, Casey, et.al. stated, "(Dynamic ridesharing) differs from regular carpooling and vanpooling in that ridesharing is arranged for individual trips rather than for trips made on a regular basis and requests for ridesharing can be made close to the time when the travel is desired." [4] The systems that have been proposed or tested employ different types of user interfaces with a central matching computer and differ also in the extent to which these systems are automated, whether money is exchanged, and their integration with traditional rideshare matching.

This review will begin with a brief discussion of ridematching systems in general and an example of an impromptu dynamic ridesharing system. Following that is a synopsis of systems that have been proposed but not implemented. The review concludes with the results of some field operational tests that have provided information relevant to the concept.

2.1 Ridematching Programs: Common Elements

Both traditional and dynamic rideshare matching systems share a common goal of linking riders and drivers who travel between the same places at the same time. A 1991 study of 84 ridematching systems around the country examined the common elements of a comprehensive ridematching system and attempted to identify important characteristics of successful systems. [2] In his study, Beroldo identified five components of a comprehensive ridematching system:

- A storage system for commute trip information,
- A matching system,
- An information dissemination method,
- A database update and validation system, and
- An evaluation system.

Of the 84 systems studied, only 27 monitored placement rates (defined as "the percentage of commuters who find alternative commuting arrangements through contacts made as a result of receiving a matchlist"), and since so few systems were studied, Beroldo was unable to find strong correlation between system characteristics and high placement rates. Available information indicated that fully automated matching, same-day matchlist mailing and follow-up, mail-based contact all positively influence placement. However, Beroldo also found that environmental characteristics - external to the ridematching system - such as commute distance, transit alternatives, and parking availability can strongly influence placement rates. He suggested, therefore, that the best results can be achieved with a combination of a good ridematching service and policies that create a commute environment that encourages ridesharing.

2.2 Casual Carpooling

Although both traditional ridematch systems and dynamic systems share a common feature in relying on an external organization to match riders and drivers, the phenomenon of "casual carpooling" belies the notion that either an external organization or advance notice are needed to successfully rideshare. In casual carpooling, potential riders gather at certain locations, often near transit stops, to wait for drivers who stop to pick up the requisite number of passengers to fulfill the requirements of an HOV facility. Casual carpooling occurs in both the Washington, D.C., area (on the Shirley Highway from northern Virginia) and the San Francisco Bay area (coming into San Francisco via the Oakland Bay Bridge). In both cases, there are significant time-saving benefits for HOVs. Issues relating to personal safety do not seem to deter participants.

Reno et.al. suggested in their discussion of the Washington, D.C., casual-carpooling phenomenon that certain conditions are present in the D.C. corridor's environment that are unique and that allow instant carpooling to occur. [13] These necessary conditions are:

- *Size*. The authors suggested that a minimum of 500 people wanting rides from a general area is needed.
- *Travel time benefits*. D.C. area travelers save 15 to 20 minutes by using the HOV lanes.
- *High quality return bus service or instant carpool-formation locations.* This enables riders to get back to their cars.
- *Time to evolve*. This helps commuters learn to overcome their reluctance to riding with strangers and to using this unconventional commuting method.

Although the instant carpooling phenomenon differs significantly from a dynamic ridematching system, it does provide evidence that there is a demand for flexible ridesharing arrangements and that fear of riding with strangers need not be an obstacle to creating a dynamic rideshare-matching system.

2.3 Dynamic Rideshare Matching System Examples

Various types of systems have been proposed or tested to examine the concept of dynamic rideshare matching. The following section examines these systems.

2.3.1 ATHENA Project

The ATHENA project, in Ontario, California is being designed to match drivers en-route with riders for single trip carpools. [4] When private drivers are not available, vanpools, airport shuttles, transit vehicles, or even taxis will be used to provide the ride. No direct communication will take place between rider and driver; rather, the system will make the match and advise both driver and rider of pick-up point, time, and fare.

Although the ATHENA project is still in the design phase, it appears as though it will differ substantially from SST. Instead of providing users with names of others sharing the same trip, it will actually attempt to create carpools or, in the absence of a suitable carpool, it will place the user in another form of transportation.

2.3.2 Wireless Access Ridesharing

Edward Walbridge has proposed a system using wireless PCS telephones to link users to a central ridematching computer. [15] With his Wireless Access Ridesharing (WAR), the geo-locating ability of the telephones, which is already present to route calls, is used to geo-locate users. The location of a user requesting a ride is compared to the moving locations of participating drivers. The user requests a destination by entering a numerical code. This code is then checked against drivers' destinations that have been pre-recorded in the database (and presumably changeable by the driver through numerical code entry). Temporally, WAR finds matches immediately, so recording the arrival and departure times is not necessary. Once a match has been made, the system opens up a direct phone connection between the rider and driver so that the details can be worked out. Once a match is accepted, the system automatically credits the account of the driver and debits that of the rider.

Walbridge identifies two critical issues facing the viability of WAR. The first question is whether the system can generate a sufficient density of requests so that riders do not have to wait too long and drivers will not have to detour too far. The second question relates to the ability of strangers to feel comfortable and safe riding together.

WAR differs significantly from SST in many of it's underlying, philosophical assumptions. First, SST does not distinguish between riders and drivers. SST assumes that many (although not all) of the participants have a car available and that the availability of a car may at times be related to the level of need for a ride. In any event, the issue of who rides and who drives is something that is left to matched individuals to work out between themselves. Secondly, SST allows users to plan for ridesharing. By recording travel schedules in the ridesharing database, the system can be used for both traditional, fixed-schedule ridesharing and one-time ridesharing. Recording schedules allows for planning, while the rapid communication between potential partners facilitated by SST's automatic email generator and MessageWatch paging service also allows users to attempt to make last-minute ridesharing arrangements.

2.3.3 Sacramento Real-Time Ridesharing

Sacramento, California, recently tested a real-time ridesharing system. Although the final report [8] of the operational test reveals that the system received very little use and no actual matches were made, the report does not describe how the system functioned. Marketing materials for "Rideshare Express" (one of three names used for this project) suggest that, from the user's perspective, real-time ridesharing involved calling the ridesharing agency, specifying that a one-time match was sought, and receiving a list of names from the agency that could be called. Closer examination of the rideshare specification [3] revealed that callers requesting a real-time match would only be matched to other applicants who have stated they will participate in the real-time project. 361 drivers (out of 5,000 in the database) signed up to participate as drivers for real-time matches.

SST differs from the Sacramento system in that there is no segregation of real-time users from other users. The Sacramento system, while maintaining the records of all users in the same database table, used a "flag" to indicate that the user was either looking for a real-time match or was willing to participate as a real-time driver. This flag effectively prevented real-time match seekers from being matched with most people in the database. Sacramento's system also relied strictly on the ride-seeker to initiate a match. A driver who wished to find a one-time match would become a seeker for the purpose of the match query and would only be matched with other drivers. From the user's perspective, the Sacramento real-time system seemed to be no different from any other ridesharing system, with the exception that a matchlist could be provided over the phone - a service that most ridesharing systems can provide. What the user did not know is that the possibility of finding a match using the real-time system was much less than it would have been if they had just called and asked for a regular matchlist.

SST, in contrast, uses the entire database as potential matches for a real-time request and does not differentiate between riders and drivers. Matches are made strictly on the basis of spatial and temporal convergence, and determination of who rides, who drives, and whether a ride will be offered for a particular situation is left to the matching parties to arrange. SST's inclusion of the automatic email generation and MessageWatch paging options facilitates communication between potential partners.

2.3.4 Bellevue Smart Traveler

The Bellevue Smart Traveler (BST) project conducted a test of a dynamic rideshare-matching system from November 1993 to April 1994. [6] 53 people were registered users of BST, and from these, three origin-based "ride groups" where formed (the destination for all groups was downtown Bellevue). Users called an automated telephone system to offer or search for rides. Since origin and destination information about the caller was already known, the only information requested by the system was the day, time, and direction (to home/to work) of the ride. Users could also search for rides via an alphanumeric pager. The pager received an hourly transmission containing the currently available rides for the pager holder's ride group. Over the five-month period of the test, 509 rides were offered and 148 rides were sought. Six ride matches were logged (logging of matches was optional).

Surveys indicated that coordinating schedules and finding rides for both legs of the work trip was a major reason that matches were not formed. This lack of suitable rides may have been due to the size of the rideshare groups. Other survey comments revealed that many users viewed the system as a means to form traditional carpool arrangements, not the dynamic arrangements for which it was designed.

The test results ran counter to the information gathered in a pre-test, user-needs assessment. When questioned, 35 percent of the respondents said they would be likely to rideshare if a ride were available to and from work on an on-demand basis, 21 percent said they'd be likely to rideshare if a ride were available for special trips on an on-demand basis, 24 percent said they'd be likely to rideshare if a ride were available to and from work on a regular, scheduled basis.

The BST system varies greatly from that of SST. To begin with, BST did not actually do any matching. Spatial matching was accomplished off-line by placing participants in ride groups. Temporal matching was left to the individual participant. A pager holder had to review each of the ride messages to determine whether a match existed. Contacting another user to form a match had to be done by phone to either a phone or pager number. Since the spatial matching was accomplished through ride groups, the matching was limited to work trips, with travel time being the sole variable element. SST allows both time and location to vary, thereby enabling ridematching for both work and non-work trips.

2.3.5 Los Angeles Smart Traveler

The Los Angeles Smart Traveler was a multi-modal, multiple interface Advanced Traveler Information Systems project that included a dynamic rideshare-matching component, the Automated Rideshare Matching System (ARMS). ARMS was designed as an audiotext interface with the existing regional rideshare database. The interface allowed users to change their previously registered travel times and to search for new matches on the basis of new times. The time change was not permanently recorded in their record. The names and telephone numbers of the matchlist were read to the caller over the phone. Additionally, an automated messaging component allowed the user to record a message and have the audiotext system dial the numbers of those on the matchlist, and play that message when the phone was answered. In order to use ARMS, individuals had to have been previously registered with CTS, the regional ridesharing agency. If they had not previously registered, they could transfer out of the automated system to speak with an operator and do so.

An evaluation of the Los Angeles Smart Traveler examined ARMS during the period from October 1994 to March 1995. [5] Along with gathering usage data, the evaluation conducted surveys of users and non-users. The evaluation concluded that the market for "one-day-only" rides is very limited because of participants' concerns about giving or taking rides from strangers.

ARMS differs from SST in a number of ways. First, ARMS was not a complete ridematching system; rather, it was an audiotext interface to an existing system. Issues relating to the accuracy of the system's database were beyond the control of ARMS. SST is a complete system, in which old records are automatically purged. Second, ARMS served a large portion of an entire metropolitan area, whereas SST primarily serves a single employment site. ARMS only allowed users to change their travel times, and these changes were only temporary. SST allows users to permanently change and vary both travel times and locations. Finally, the visual medium of the WWW that SST uses is much more favorably perceived than the audiotext used by ARMS.

2.4 Summary of Reviewed Literature

The literature on implementations of dynamic rideshare-matching systems shows that SST will be the most complete system implemented to date. Three prior attempts at creating a dynamic rideshare-matching system were not designed to test the entire concept. ARMS was a dynamic interface to a static ridematching system, BST did not actually do ridematching, and the Sacramento experiment offered only limitations to the traditional system.

The systems reviewed here that have been proposed but not implemented aim to move beyond rideshare matching and into "automatic carpooling." In other words, they have removed the human element from the process and attempt to create a carpool, as opposed to a matchlist that a user will, after exercising personal judgment, turn into a carpool.

3. SST DESIGN

SST is designed to be a complete rideshare-matching system, capable of providing matches for those with traditional needs as well as for those with variable schedules and occasional needs. This design recognizes that the traditional ridematching requirements are only a subset of the requirements for a dynamic rideshare system.

SST is designed to be accessible through the World Wide Web. This design decision was driven by two features of the WWW: (1) the popularity of the WWW along with the wide availability of free browser software and (2) the availability of the WWW 24-hours a day, 7-days a week. These two features ensure that SST can be delivered to a wide audience at the individual user's discretion and convenience. These features were also deemed necessary to entice a sufficient number of users to reach the critical mass required for dynamic ridematching to actually take place.

In this paper we present the design of SST in two parts. We first review the matching information that is collected and the spatial and temporal matching scheme employed in SST, and we then review the technical design of the SST program.

3.1 Design: Collection of User Information

SST is set up as a series of Hypertext Markup Language (HTML) "forms" to request required information from the user. The opening page of SST requests either (1) a new user's student or staff number or (2) an established user's user identification and password. Both these actions force authentication of the user. SST is currently an experimental program that limits the user group to the University of Washington community, and the authentication process enforces this restriction. The SST application also requires contact information and a password. The requested contact information is a phone number and an email address. The email address is important because SST is able to automatically generate and send email messages to users with matching schedules. It is noteworthy that the user's home address is not requested as part of the SST registration. A home address is not used for matching purposes, and there is no paper copy of a matchlist to mail out, so a home address is not needed. The items just mentioned (email, phone number, and a password) are the total extent of the personal information collected as part of the SST registration process. To perform ridematching, mechanisms to collect and manage individual trip data are necessary, and the methodologies used by SST to accomplish this are described in the following section.

3.2 Design: Matching Temporal/Spatial Domains and Contact Methodology

Information collected by SST is always specific to the individual trips. From a user perspective, trips are divided into three categories in SST: (1) "regular commute" trips, (2) "additional recurring" trips (a trip made on a regular basis, in addition to a commute trip), and (3) "occasional" trips. However, all three types of trips require essentially the same temporal and spatial information: (1) trip spatial origin, (2) trip spatial destination, (3) day of the week and trip-departure time range, and (4) trip-arrival time range. In addition, all trips are assigned an expiration date. This expiration date is assigned automatically for the first two types of trips, and the user specifically selects the expiration date for an occasional trip. The expiration date is used to remove trips whose temporal relevance has expired, an important feature sometimes overlooked in ridematch systems that do not age the trip information.

In the SST system, two important design decisions were made regarding the collection of the temporal and spatial information required to perform ridematching. The first decision involves the collection of temporal data. SST requests that the user enter a range for both the departure and arrival times. This makes the level of flexibility in a trip schedule explicit to the user and under the control of the user entering the travel information.

The second design decision involves the spatial information for origin and destination. The spatial information is requested with a series of pull down menus that implement an efficient search tree. At the top of the tree, the user can select from eight landmark types. The tree structure for selecting spatial information is shown in Figure 1.

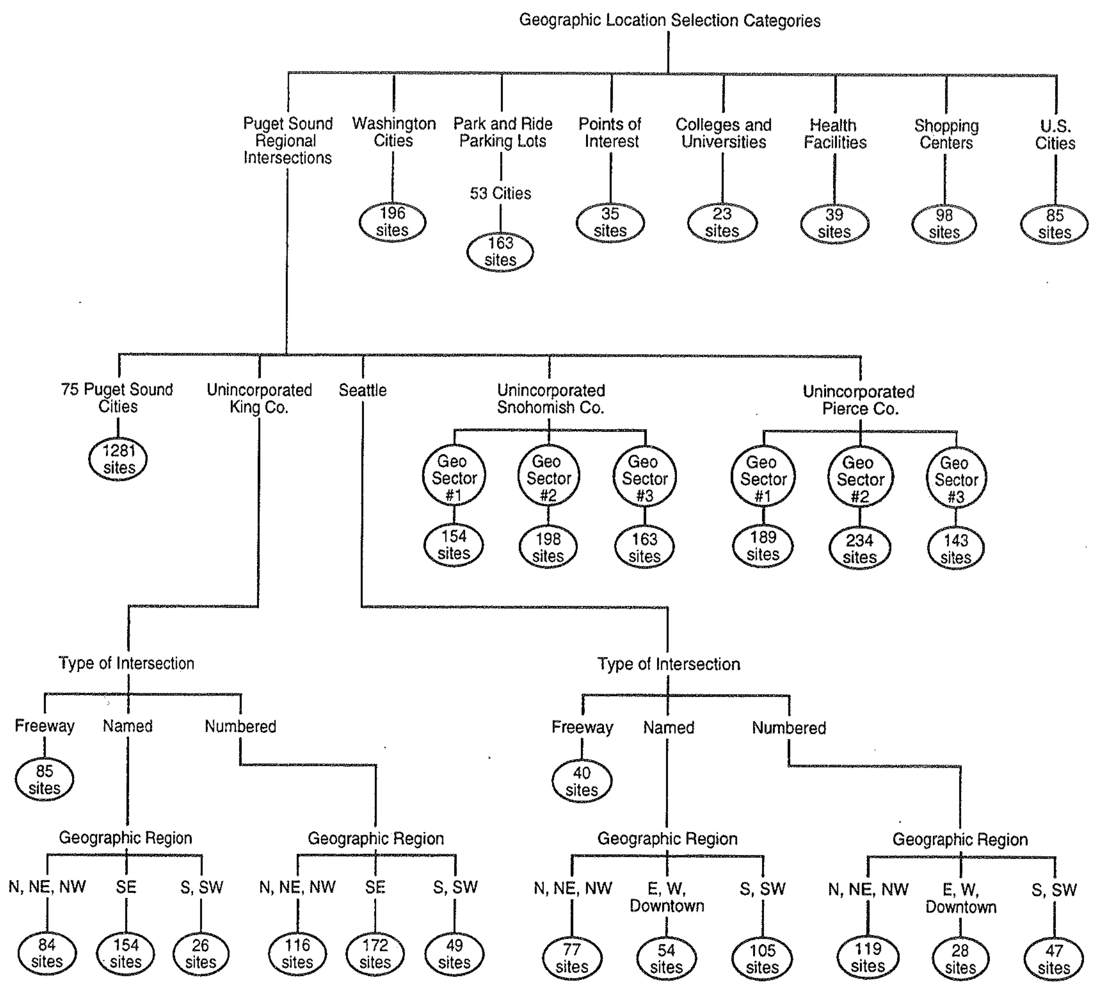


Figure 1: Geographic location search trees

This tree structure is used to sequentially reduce the area of the search until a single landmark can be identified. The depth to which the user must descend in each tree depends on the starting point. For example, to get to a specific road intersection in Seattle, the user must descend four levels (the greatest depth in the entire tree). The user starts at "Puget Sound Intersections" in Figure 1, proceeds to select the city of Seattle, decides that the street is either a freeway, a named street, or an intersection identified by numbered streets, and finally selects the specific intersection from a list. In contrast, to select many other spatial landmarks, only two choices need be made (see "Shopping Centers" in Figure 1). This reliance on landmarks to describe the trip endpoints removes the need for origin and destination addresses, as well as the need for GIS software, but it does limit the total number of origins and destinations that are available to the user. (The implementation of SST uses latitude and longitude geo-coordinates of over 3,500 locations in the Puget Sound region, 200 cities in Washington State outside of the Puget Sound region, and 100 cities across the nation. The coordinates are taken from the TIGER spatial data database.)

Once temporal and geographic information has been collected, the matching is done using a database engine and structured query language (SQL) commands. The database is queried for entries that match temporally and then geographically. The temporal match finds pairs of participants whose start and endpoint temporal ranges overlap (recall that the user explicitly enters ranges for the departure and arrival times). The default geographical matching range is 15 percent of the length of the trip in all directions from each end point to match against other user endpoints. This geographical coverage is user configurable and can be varied by broadening (25 percent) or narrowing (5 percent) the scope of the search. (It is noteworthy that while this matching approach is GIS based, it uses variably sized areas around endpoints rather than route-based matches as in [12].) Once a set of matching trips has been produced, the names, phone numbers, and email addresses of users with matching trips are displayed on the screen. Riders who have a matching trip schedule must contact each other, and SST takes a unique approach to supporting this contact.

SST provides a matchlist with phone numbers and email addresses, a standard practice in ridesharing programs; however, in addition to a simple matchlist, an automated email option is integrated into SST. This option allows a user who has found matches to have pre-formatted email automatically sent to one or more of the other users with matching trips. This message contains the sender's contact information and trip details. In addition to basic email, SST provides a functionality that permits the user to email a message to a remote user's Seiko MessageWatch. The message contains either a phone number or a notification of the arrival of email. These two email contact methodologies, used to augment the more traditional matchlist, are unique to the SST program.

The SST program collects spatial and temporal trip information using a series of WWW pages as described, performs a match by sending SQL specifications to a database engine, and supports the standard phone-based contact methodology, as well as two new, unique email-based contact methodologies. The next section presents the actual mechanics of creating a ridesharing application that requires state information about the user in a stateless WWW environment.

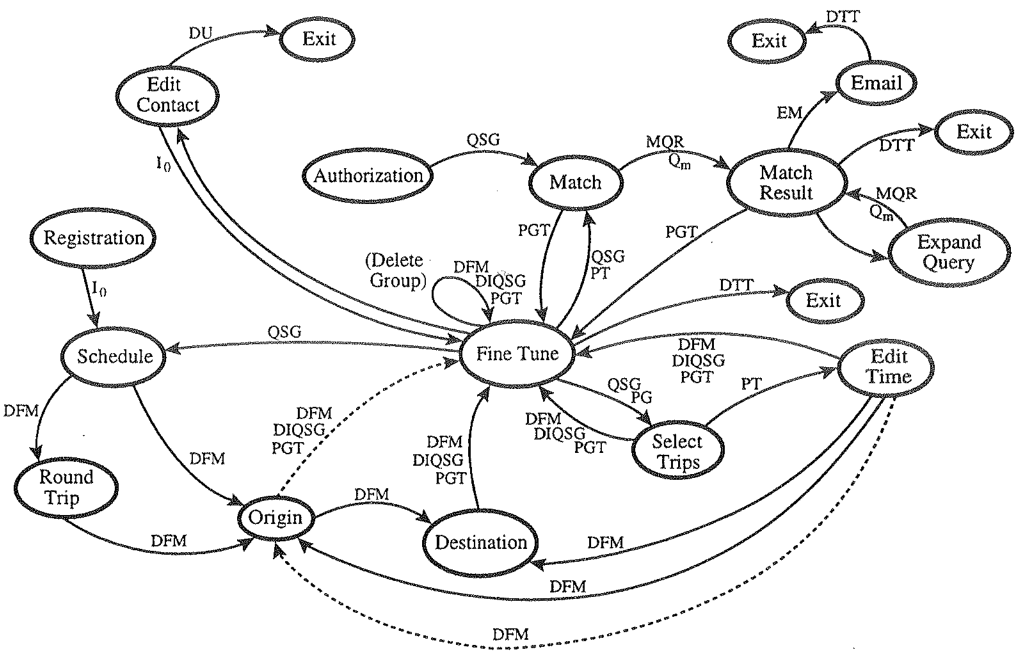
4. THE SST APPLICATION AND THE WWW

In this section we describe the paradigms used inside the SST application. SST, as a WWW application, must address many of the problems that all program developers face in this environment. The main WWW problem encountered in developing SST is that browser interactions with a WWW server are inherently stateless. SST needs to maintain the state of an ongoing transaction (e.g., the user information about trips and contacts), and maintenance of that state information is difficult. In addition to the difficulty with state, most Web browser applications have a facility that enables the user to return to a previously displayed page without notifying the server of that page in any way (the "back button"). The existence of a back button makes it virtually impossible to guarantee that the state information is accurate. SST overcomes these difficulties using a database paradigm.

The SST application uses a database to store the information about users and the trips they are registering. (We use the mSQL database written by David Hughes and available as shareware at <ftp://bond.edu.au:/pub/Minerva/msql>.) This cumulative information (trips and contact details) makes up the "state" information about a user. Figure 2 is a complete state diagram for the SST program. The states are represented by ovals and the state transitions by arrows. Users always transit between states in the direction of the arrows.

Each of the transitions is marked with the abbreviation for one or more of the 14 specific routines that must be invoked to accomplish individual state transition. If more than one routine is needed, several program abbreviations appear. SST was designed modularly so that a fixed set of routines is applied in appropriate order to implement the overall state transition process.

We use database relations to maintain state information during "transactions." A "transaction" in the SST program is the action of moving from one state to another. To preserve the state information, the SST application uses two sets of database tables: (1) the permanent tables that exist as a file and (2) temporary tables created when a user



Legend

Q	Query
D	Delete
S	Sort
G	Group
Q m	Match Query
Io	Initial/uses info
I	Insert

Data Base

QSG	(Filename)
DIQSG	(Filename)
Qm	(List, Parameter)
Io	(Name, Password....)
DFM	Data File Manager (List, Variables) {Purge Date, Inception Date, Round Trip (flag), Return Day (flag), Day, Type, t_{d1}, t_{d2}, t_{a1}, t_{a2}, P_d, P_a, Group#, Trip#}
DF	Data File

Data Management

		IN	OUT
PT	Print Trips	(List)	(Trips in List)
PGT	Print Grouped Trips	(List)	(Trips in List)
EM	Email		
PG	Print Group	(Number)	
PPS	Package Per Screen		
DTT	Delete Temp Tables		
DU	Delete User		
MQR	Match Query Report		

Figure 2: SST state diagram

registers or logs in. The user information is updated in the temporary tables from the WWW pages, and when specific state transitions take place (specifically, those labeled

DIQSG in Figure 2), the temporary tables are written to the permanent tables. In this way the user information is saved across state transitions.

SST is implemented as HTML with embedded forms. The usual method for handling a form embedded in an HTML document is to create a custom, common gateway interface (CGI) program that performs any actions required by the form. State transitions are then implemented as the invocation of the CGI Form Server by an HTML form.

Because the state transition takes place only on the submission of a form to the CGI Form Server, several WWW pages may exist within one state. For example, when selecting trip origins, the user is in the state labeled "Origin" in Figure 2, and the entire location tree is traversed while the user is in the Origin state. The CGI Form Server is invoked only after a site at the base of the tree has been chosen, and the trip origin coordinates are then committed to the database. The act of committing the data to the database causes a transition to either the "Destination" state (where trip destination coordinates are collected) or the "Fine Tune" state.

5. PRELIMINARY RESULTS

The SST program went "on-line" in mid-March 1996. In this report we present the results as of mid-November 1996. The number of users participating in a ridesharing program can have a significant influence on the success of such a program; however, the absolute number of users needed to be successful is difficult, if not impossible, to quantify. Figure 3 presents the number of UW users acquired by the SST program as a function of time; it also presents the same statistic for the long-term, regional carpool effort operated by King County METRO[1].

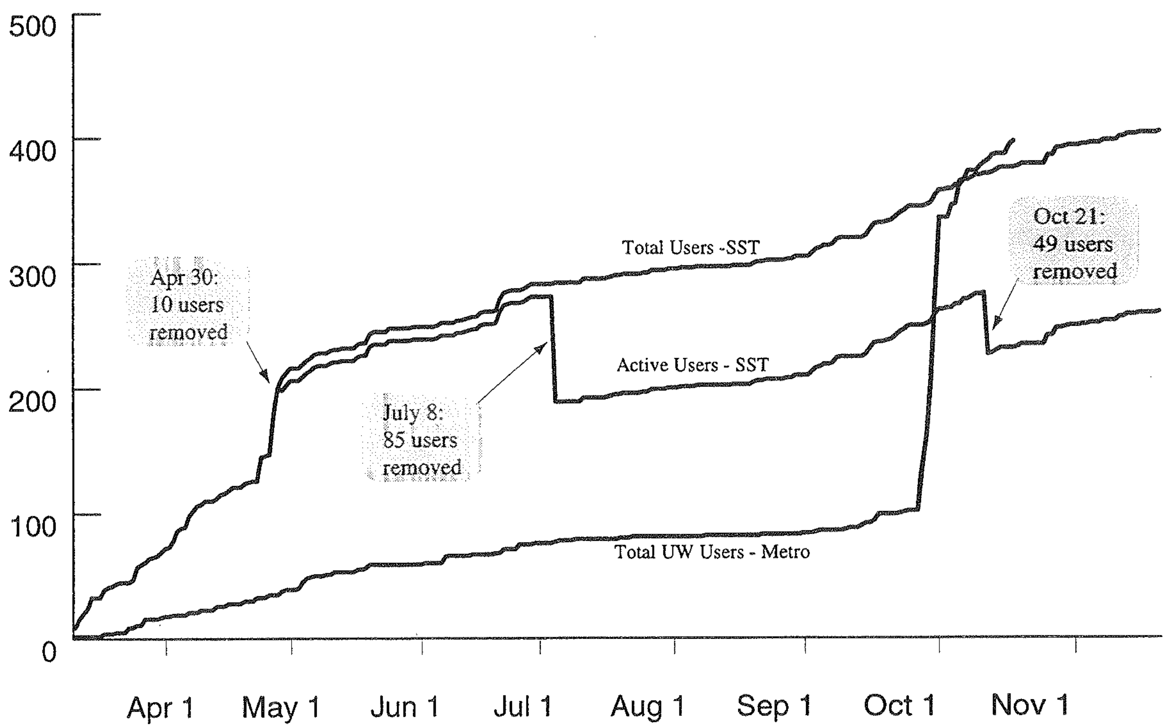


Figure 3: Cumulative and active users as a function of time

Although both ridesharing efforts end the study period with roughly equal numbers of new users, several important differences exist. The first difference is the

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[1] Note that we are comparing the newly acquired users, not the total user database. King County METRO began the study period with some number of existing users.

clientele; in comparing the users (by name), there is only a 20 percent overlap between the two efforts, indicating that SST is reaching a clientele that did not exist for a long-term, regional carpooling effort. The second difference has to do with the service provided to new users over the study period. If the area under the user curves is viewed as user-weeks of service, the SST effort provided substantially more service over the period investigated. This additional service results from the availability of SST to the user. Direct user access, 24-hours a day, is a feature of SST not found in more traditional ridematch systems. Figure 4 presents SST use by time of day. To date, almost 20 percent

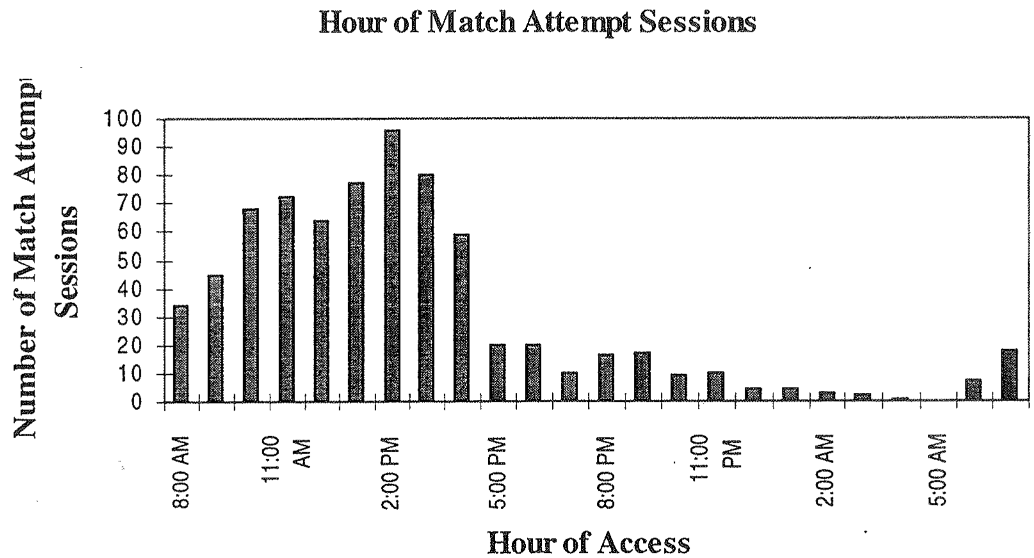

Figure 4: SST hours of use

of the system accesses have occurred before 8:00 am or after 5:00 pm, indicating that a sizable portion of the system usage occurs outside of normal business hours. This gain indicates that there is a niche for a direct-access ridematching system that is unmet by traditional ridematch efforts.

These two observations demonstrate that SST reaches a new, sizable group of users in comparison to an established carpool system. SST was designed to operate in an environment with variable schedules and was implemented at the UW, which operates on a ten-week term system. In the face of schedules that can be drastically different between terms, effective ridematching must guarantee that the trips being matched really are the current trips that the users might share. To address this problem, ST is based on the notion of active participants. An active participant is a user that has accessed SST during the current academic quarter, typically to update schedule information or to seek a ride. Active participants are the only users who are eligible to be matched with other users. (The users who have not accessed the system in the current quarter are inactive and are not used for matching purposes.) Figure 3 shows the active users as a function of time, as well as the number of users purged at term boundaries. While purging of inactive records reduces the total number of users in the matching database, it increases the utility of the information. It is noteworthy that a significant number of the SST users remain in the active category even after three purges, indicating that the ridesharing community reached by SST is an active one that is fairly stable over the study period.

For ridesharing to be successful, the participants must have trips with matching characteristics. Figure 5 presents the temporal history of (1) the cumulative number of attempted matches, (2) the cumulative number of successful matches, and (3) the cumulative number of email messages sent to attempt to establish a carpool. Trips entered by SST participants quickly reached a match rate of approximately 39 percent and maintained that match rate over the study period, even with a relatively small total population and variable schedules.

Some other interesting statistics come out of the SST data. As of the writing of this paper, 68 percent (112 people) of the active users were members of the faculty and staff of the UW; 32 percent (53 people) were students. Among the staff user group, 90 percent (101 people) have regular and unvarying schedules typical of traditional ridesharing, while only 10 percent (11 people) indicated any variation of schedule depending upon the day of the week. Among student users, however, 66 percent (35

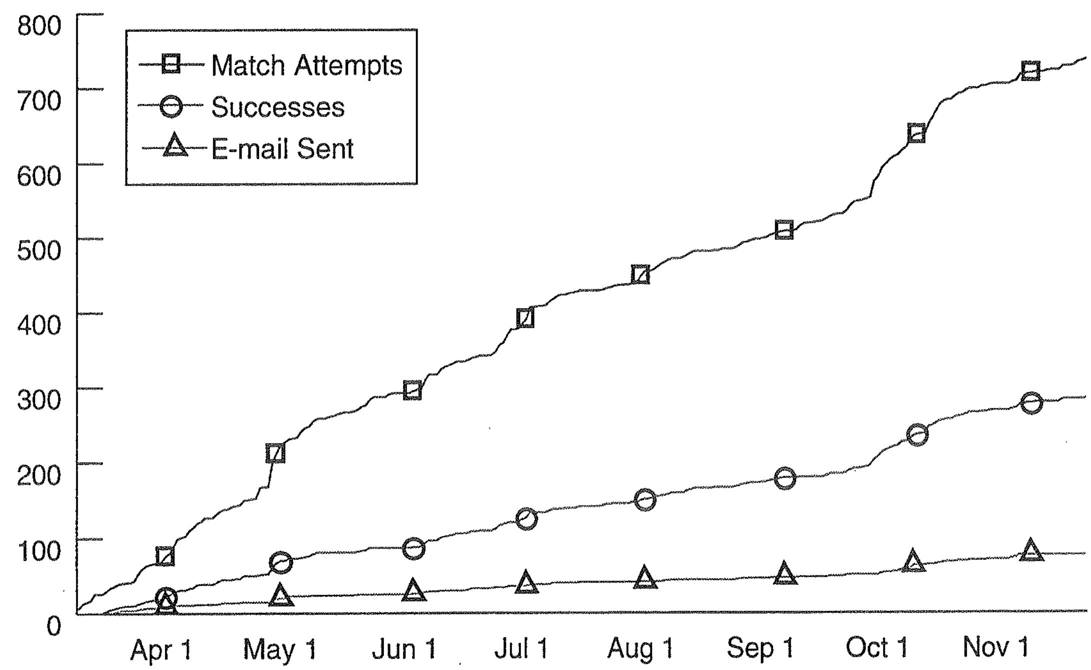

Figure 5: Usage as a function of time

people) have these traditional schedules, while 34 percent (18 people) have schedules that vary by day. Not surprisingly, of the 2,065 trips registered in the database, 93 percent are categorized as traditional commute trips (88 percent of commute trips arrive between 6:30-9:30am and leave between 3:30-6:30pm), 4 percent are user-categorized as recurring, non-commute types, and only 3 percent are identified as special dynamic trips, the modality at which this study is targeted. The number of student users and variable schedules has grown considerably since an outreach campaign was begun in the fall of 1996 to attempt to involve larger segments of the student body. The correlation between increased student use and increased numbers of dynamic trips leads the authors to believe that as the student user group continues to grow, the dynamic capabilities offered by the SST program will be increasingly utilized.

The discussion presented in this paper reflects the quantitative measures that can be observed internal to a ridematch system. The larger question of formation of carpools requires direct interaction with the users in the form of survey instruments. In the coming months, surveys will be distributed to the users to obtain quantitative information on carpool formation based on ridematch results. However, to date, SST has demonstrated that there is a sizable ridematching clientele who are outside the existing traditional carpool community and whose needs are met by a dynamic, direct-access, widely available, instant ridematching system like SST.

See SST at <**http://sst.its.washington.edu/sst**>

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