

GoTime: Real-time passenger information and transit management

Organization

Halifax Regional Municipality — Metro Transit

Status

Started 1984, ongoing

Overview

GoTime is a real-time transit management system that includes passenger information. It is a unique system developed by Halifax local governments and Metro Transit, the local transit agency. The initial version, launched in 1987, has been through one major upgrade, and a second is pending. Its initial development was at the forefront of advanced technology applications for transit management in North America.

GoTime uses radio communications and several means of tracking bus movements to keep both individual drivers and controllers continually aware of schedule adherence. Passengers access the estimated time of pending bus arrivals at any stop by dialing a telephone number from any location, activating an autodial phone or speakerphone at selected bus stops, or viewing video displays at shopping centres and passenger terminals. On a typical day, between 6,000 and 10,000 calls are made for GoTime bus arrival information.

GoTime's initial development and subsequent major upgrade cost \$1.6 million and \$2.3 million, respectively. Annual operating costs are estimated to be in the order of \$200,000.

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Resources

- Metro Transit — GoTime information (www.region.halifax.ns.ca/metrotransit/GoTime.html)

Community context

Halifax is the capital of Nova Scotia, and its population of 360,000 represents 40% of the provincial total. The fast-growing metropolitan area is the 13th largest in Canada, and is forecast to have a population of 450,000 by 2020. The Halifax Regional Municipality was created in 1996 by an amalgamation of four urban and rural municipalities (Halifax, Dartmouth, Bedford and Halifax County).

Metro Transit, an agency of Halifax Regional Municipality, carries about 14 million transit passengers each year (about 40 rides per capita) at a 70% revenue/cost ratio on more than 170 conventional buses and three ferries. It carries a relatively high proportion of Halifax commuters to work (about 10%), and is part of the reason that the area has a low rate of commuters who drive (about 68%, among the five lowest of all Canadian metropolitan areas). Metro Transit's adult fare is \$1.75 cash, a \$1.50 ticket or a \$57 monthly pass.



Ferry operated by Metro Transit

Policy context

The GoTime service that is the subject of this case study began in 1984. In 2002, the Halifax Regional Municipality completed a major strategic review of Metro Transit, the major goal of which was to improve service levels and ridership. Specific objectives to achieve this goal over the first five-year implementation period included substantial increases in annual ridership (from 12.7 to 14 million), annual rides per capita (from 40 to 50) and share of the peak period travel market (from 6% to 8%). The strategy recognized that these targets will only be achieved if

transit's competitiveness improves and riders are attracted from other travel modes. To do so will require improved productivity, service quality and customer satisfaction.

Rationale and objectives

GoTime's development as a leading-edge real-time system for passenger information and transit management was a somewhat opportunistic enhancement to its original purpose. Originally, Metro Transit was planning to purchase an automated passenger information system that would offer scheduled bus arrival times by telephone. However, internal information systems staff at the former City of Halifax proposed to develop a more advanced real-time system from scratch, for a similar cost. The increase in functionality for the same money was attractive, and GoTime was launched.

The two main purposes of GoTime, both of which remain as valid today as they were 20 years ago, are:

- **To provide riders with real-time schedule information.** GoTime was designed to offer riders the actual estimated time of arrival of the next bus, through a variety of convenient channels including telephones and video monitors.
- **To provide operational information to system controllers.** GoTime was designed to collect data on schedule adherence and service delivery problems, and to provide an automated record of operating data such as bus mileage and service hours. This gives transit staff the information they need to create more efficient and reliable route schedules.



Metro Transit passenger terminal

Actions

Development history. The first-generation GoTime system was designed and programmed by the former City of Halifax for Metro Transit. The transit agency was initially seeking an off-the-shelf system to provide static route schedule information to passengers by telephone, but the City of Halifax offered to develop a real-time passenger information system for about the same cost. Implementation started in 1984, and after several development delays the GoTime system was accepted and implemented by Metro Transit in 1987.

At the time, GoTime was one of very few real-time passenger information and transit management systems in North America. Over the first decade of its existence, GoTime was profiled in several journals as an innovative application of technology that had numerous benefits.

By 1992, the GoTime hardware was becoming difficult to maintain, and technological advances promised greater performance and enabled new features. A comprehensive multi-year upgrade of GoTime, from 1992 to 1996, included installation of fibre optic telephone lines, faster processors, the replacement of simple video screens with computer workstations at shopping malls and passenger terminals, a full rewrite of the central software, and new bus hardware and radio equipment.

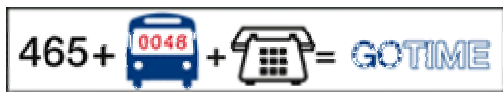
Transit management functions. Metro Transit's control centre has at least one controller on duty at all times, and two controllers during peak periods. They continually monitor GoTime's principal output—the real-time location and schedule adherence of all buses in service. Their computer screens show how many buses are active on each route, whether each bus is running late or early (shown using different colour codes) and by how much, and where each bus is within its currently scheduled series of trips. Other functions include:

- GoTime lets controllers communicate with each bus by radio, calling individual buses or groups of buses according to vehicle number, operator number, all buses on a route, or any subset of the overall fleet.
- A display on the dashboard of each bus keeps operators informed of whether they are running early or late, and by how many minutes.
- The system logs both routine and unexpected events, enabling planners to identify operational problems and develop possible solutions.
- Drivers can simply hit an emergency switch to immediately dispatch fire and medical services to the vehicle's last known location.

Passenger information functions. GoTime lets passengers access real-time bus arrival information through several means:

- Passengers can dial 465-#### (where #### represents a bus stop's GoTime identification number) to hear an automated voice announce the time of the next two arrivals of each bus route servicing the stop. If the next bus is not yet in service, then passengers are informed when it "is scheduled to arrive;" if the bus is en route but more than 15 minutes away, they are informed when it "is estimated to arrive;" if the bus is less than 15 minutes away, they are informed when it "will arrive." GoTime receives 6,000 to 10,000 calls on a typical day, with up to twice that number during inclement weather.
- Automatic connections to GoTime voice system announcements are provided by autodial telephones at four locations and push-button activated speakerphones at 12 locations. One problem with the speakerphones has been volume control — announcements must be loud enough to be heard over rush hour traffic, but not so loud that they disturb nearby residents at quieter times.
- Twelve video displays at shopping malls and major bus terminals display the arrival status of all relevant routes.

All of these permit routine announcements to be replaced or accompanied by special messages. A number of "canned" messages can be added to the voice system or a portion of the video display screens, including announcements of service detours, delays or cancellations due to road conditions or congestion (such as those arising from construction, weather or accidents).



Operational details. The central computerized "brain" of GoTime is housed at Metro Transit's control centre. It includes an object-oriented database and C++ software program in a Unix operating environment, which apply schedule information downloaded from Metro Transit's route scheduling software. The central system manages two-way communications with the automated vehicle location (AVL) system and feeds information to the voice system, as described below.

The AVL system includes hardware on-board Metro Transit buses, a series of electronic roadside signposts, and a radio communications system that carries voice and data transmissions. A microprocessor on each bus tracks and records vehicle location data that come from several sources:

- A proximity sensor on each bus counts revolutions of the left front wheel, and sends the information to the on-board microprocessor that compares the equivalent

distance travelled to the known distance along each route.

- A radio receiver on each bus keeps track of when the vehicle passes an electronic signpost (a small radio transmitter attached to a pole or building, of which there are two or more along each route), and the on-board microprocessor uses the signpost's known location to correct any deviation in the location predicted by the vehicle's wheel sensor.
- Each opening and closing of bus doors to service passengers is signaled to the microprocessor, which uses a list of known stop locations for the current route to correct any deviation in the location predicted by the vehicle's wheel sensor.

The on-board microprocessor stores the current operator, shift, route and run numbers; the estimated distance along the route based on wheel sensor data; and the time and location of the last signpost and active bus stop. This information is periodically transmitted by radio to the central GoTime computer, which automatically requests it at least once a minute in peak periods, and more frequently at less busy times when overall transmission capacity is distributed among fewer buses.

Based on the current location of each bus along its route, and using an algorithm that predicts travel time between bus stops as a function of time of day, the central computer continually maintains an estimate of the time that each bus will arrive at the stops ahead of it. Each stop (or group of up to three stops) has a unique four-digit number that is displayed on the bus stop sign. Each stop number is linked to up to four routes, so some major stops serviced by five or more routes will have more than one number.

Results

It is a challenge to quantify the impact of a service like GoTime. While early customer surveys indicated high levels of user satisfaction, the system's endurance and continued levels of use are perhaps the truest indication of its value. As mentioned above, from 6,000 to 10,000 calls are made to GoTime on a typical day, and thousands of passengers view real-time information on a dozen video screens.

GoTime is even more indispensable for Metro Transit's service planners, route schedulers and service controllers. It offers information and enables interactions that are essential to providing high-quality, cost-effective service. It keeps bus operators aware of their minute-to-minute schedule adherence, helping them to stay on time.

Metro Transit's service area features varied terrain and many winding routes with limited crossroads. Before GoTime, controllers had to be in the field to observe individual vehicles, manually check schedule adherence,

and respond to problems by issuing instructions or adjusting resources (e.g. calling additional buses into service). There was no guarantee that an individual problem would even be noticed. Today, GoTime instantly notifies controllers of even minor issues affecting any one of the 150 buses that Metro Transit has in service at peak times. This change in the nature of controllers' jobs did not occur without some disruption and mixed opinions among staff, but there is no question of its benefits.

GoTime generates a large volume of detailed operational data that, in theory, is useful for routine analysis of service issues. However, the vast quantity of data also limits its utility — focused analysis of data from a limited time span can be done economically, but more general monitoring over a period of months can consume excessive time and effort.

GoTime was credited with helping to stop a trend toward declining ridership shortly after its launch in the mid 1980s. Whether it has continued to help in building Halifax's solid ridership levels is a difficult question to answer, in view of the many other important factors that influence personal travel decisions.

Participants

GoTime is managed by Metro Transit's Operations section. Metro Transit schedulers ensure that relevant information is downloaded to GoTime's database following each schedule change, and fleet staff maintain the on-board hardware and signposts.

Resources

The cost of the original GoTime system, developed between 1984 and 1987, was \$1.6 million. This amount included \$1.35 million in contributions from four municipalities, and \$0.25 million from the Province of Nova Scotia.

The GoTime upgrade completed in 1996 cost \$2.3 million, including \$1.5 million from Halifax Regional Municipality and \$0.8 million from the Nova Scotia government.

The cost of operating and maintaining GoTime is difficult to establish because the roles and responsibilities have long since been integrated into divisional budgets. It may be in the order of \$200,000 annually.

Timeline

1984. Start of GoTime development

1987. Implementation of first-generation GoTime system

1992. Start of major GoTime upgrade

1996. Completion of upgrade and launch of second-generation GoTime system

Lessons learned

The principal lesson of Metro Transit's GoTime is simply the validation of the benefits of a real-time transit management system: accurate passenger information, minute-by-minute monitoring of detailed transit operations, and the ability to adjust operations quickly.

While thankful for GoTime's success, Metro Transit staff also believe that today's off-the-shelf transit management systems can likely offer similar benefits without the lengthy development periods that GoTime required. They also see geographic positioning systems, which may well play a role in the third incarnation of GoTime, as a more flexible and reliable replacement for many of GoTime's component technologies.

Next steps

The second-generation GoTime system is still active but approaching the end of its service life. A review of the system, including an assessment of possible upgrade or replacement strategies, is likely to take place within the next few years. GoTime is still working well and additional functionality is not currently an issue, but the costs and benefits of alternative technologies (such as automated vehicle location using global positioning systems) will be studied and compared to those of simply upgrading GoTime's current hardware and software.

Images are courtesy Metro Transit