WHITEPAPER

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Convergence, Customers and Compromise

By David Panter

Changes in the capabilities of on-board ticketing systems are giving transport authorities a cheap leg up to a real-time passenger information (RTPI) platform. Often these systems are initially attractive, but the opportunity costs of this approach are hidden.

For organisations aiming to be customer-centric, this poses a dilemma as the compromises made by selecting a low-cost automatic vehicle location (AVL) solution may ul-timately result in the long-term loser being the very person they want to help – the passenger.

By recognising the underlying benefits of implementing a specialist AVL and RTPI system, transport authorities will be able to ensure all their customers are equally served, increase their flexibility to choose new ticketing options and deliver superior customer service in today's rapidly changing world.

BACKGROUND

Historically, electronic ticketing systems on buses and trams were standalone systems that did little more than automate a paper ticketing system. It was the responsibility of the driver to determine the correct ticket to sell based on where the bus was and where the passenger said they were going. Ticket sales were recorded and communicated to a back office accounting system once a day when the bus returned to the depot. Downloads were either by physically transferring a module or cash box or, more recently, by WiFi.

Automatic Vehicle Location (AVL) systems developed in parallel to ticketing systems. Their purpose was to gather information from the vehicle and show operators where the bus was in real time via a tracking and dispatch system. In the USA, AVL technology growth was also driven by the need to supply audio next stop announcements in line with the *Americans with Disabilities Act of 1990*.

Generally, ticketing and AVL systems operated independently with little to no communication with each other. Where there was communication, it was typically a one-way message of the currently selected route ID sent from the ticketing system.

As ticketing systems evolved, they were fitted with GPS receivers that allowed them to determine the general location of the bus and support a Check-In/Check-Out ticketing capability. Sales were still downloaded via WiFi at the depot.

Further maturation of ticketing solutions saw the capabilities of these systems converge on some of the features of AVL systems. The addition of a 2G/3G/4G wireless capability allowed the ticketing system to receive ticketing and trip updates as well as provide bus position updates in real time. Improvements in GPS receivers also made the location data more reliable.

Advances in technology meant that low-cost AVL solutions were developed for other industries such as trucking, which could also deliver a vehicle's position in real time. With some limited hardware connectivity, they too had critical route information, could show where the bus was along the route and began to converge on the dedicated bus tracking and dispatch system features.

Underpinning both the ticketing AVL feed and the low-cost trucking solutions were back end systems that could use the reported locations to show vehicle locations and predict arrival times at stops.

Many transport authorities believed that with the location information obtained from the ticket machines and the arrival predictions available at a small marginal cost (a.k.a. the low-cost AVL solution), they no longer needed the power of a dedicated AVL system. Sadly, this has proven to not be the case

WHY CONVERGENCE LOOKED GOOD IN THE SHORT TERM

The attractiveness of a convergent solution is readily apparent. Transport authorities get a low cost feed of AVL

data on their fleet, which they can then use to predict arrival information for stops and deliver to members of the public who are clamouring for visibility on transport run times. With tight transport budgets, this looks like a simple decision.

However, once an authority goes down this path, they inevitably find a number of limitations. Notably:

1. They cannot deliver passenger information on the bus and often cannot deliver real-time operational information to the driver.
2. Just knowing where a vehicle is located is seldom enough to be able to manage its operational performance. You need to know what trip the vehicle is on now and what it is going to be doing next.
3. The core device fitted to the bus has limited hardware connectivity and is often unable to interface with a wide range of on-board devices such as door sensors, next stop displays, audio systems, headboards and radios.
4. Data maintenance is complex and ongoing. The data demands of a ticketing system or a trucking AVL system are much lower than that needed for effective fleet management.
5. The flexibility to enhance or upgrade the ticketing system using the latest technology is lost as the authority is locked in to the incumbent ticketing vendor even more deeply. New innovations that meet the evolving needs of the modern passenger have recently become available, including advanced near field communication (NFC) ticketing solutions, Be-In/Be-Out (BIBO) technology, smartphones and the use of credit cards as the ticketing media. Being chained to the current ticketing supplier limits your ability to embrace these new options and makes you slower to deliver these benefits to the public. In the worst case, commuters may never even see these technologies.
6. The cost to replace the ticketing system (even with the same vendor) is greater, as they must now also replace the AVL system at the same time. It is likely the two systems were bought at different times and it is more than likely that the ROI for the AVL solution is invalidated by the short-term need to replace the ticketing system.
7. The features offered for fleet management are underdeveloped for public transport needs. AVL management tools are often built off successful commercial transport installations. However, public transport operations have quite different needs to freight businesses. While some of the location functionality is similar, such as knowing where a vehicle is or was at a specific time and showing this on a map, others (such as the need to maintain a schedule to each stop, variable load times, passenger safety and the need to keep passengers informed at all stages along the journey) are either not present or are bolted on afterwards.

WHERE AN AVLC SOLUTION ADDS VALUE

The key function of a modern Automatic Vehicle Location and Control System (AVLCS) is to correctly locate the vehicle and then do something useful with that data. We are fortunate that GPS location has improved significantly in the last few years and is generally considered acceptable for many location needs, including ticketing and map updates of vehicle locations for public consumption.

Location data is sent to the back end system, where it is immediately processed and displayed. One output of this process is a series of predictions for the bus arrival at stops further along the route. Published in the CEN SIRI format for consumption by third parties, passengers typically see this information on their mobile phone or on a website. Another use of the data is a map display that shows the routes and buses moving along these routes.

At this point, many transport authorities sit back and relax, knowing that they have digitally delivered real-time information to their passengers at minimal extra cost.

What sets leading transport authorities in cities like London, Singapore, Durban and Canberra apart is that they know there is so much more that can be done. They see the opportunity to help operators deliver a quality service and they understand the benefits to passengers of having real-time information on the bus itself. Let's look more closely at each of these stakeholders.

Bus Operators

Bus operators have the frontline responsibility to deliver transport services. They are proud of the quality of service they provide and want to

exceed the public's expectations.

Recent changes in policy see many transport authorities in Australia and New Zealand putting operators on performance-based contracts. These contracts define the levels of missed services and on-time running, and penalise operators if they are not met. It is in the best interests of both parties (and passengers!) for operators to be able to effectively manage their fleet in real time and meet the objectives of the transport authority. To do this, they need:

1. **Visibility of the fleet.** Not just by vehicle, but relative to the timetable. This should show what the vehicle is doing now and what is planned for it to do next.
2. **Notification of problems or potential problems.** These include:
   a. A trip not starting
   b. A vehicle running off route
   c. Headway not being maintained
   d. Vehicles running excessively early or late
   e. Passenger loads being exceeded
3. **Access to a range of options to address the problem.** Solutions to common issues can be prepared in advance and then activated when needed. More unusual situations, such as when buses are used for rail replacement services, will require operator intervention and specialist operational knowledge. These situations may need support from mobile AVL solutions such as tablets.
4. **A means to communicate the desired action to the vehicles.** This might be by radio, messaging the driver console or both. The communication channel needs to be intuitive and simple to use.
5. **A means to communicate to passengers.** Nothing reduces passenger concerns more than being told what is going on. Operators should routinely make use of displays and audio systems on buses, displays at stops, the web (including social media) and mobile apps to keep passengers informed.

Drivers

Often overlooked, the drivers of our buses and trams are a vital part of any transport network. They can make the difference between a smooth, pleasant journey where passengers can read and relax to one where customers feel they are chained to the front of Mad Max's desert duellers.

Enabling Peak Performance

An AVLCS also empowers drivers to improve the quality of their services by keeping them informed of what is going on while they are behind the wheel. For example: providing a countdown to the next service departure time; showing the current running time against the scheduled time; and showing the running against a headway target in an easy-to-read, intuitively colour-coded format will help the driver deliver quality services.

Monitoring driver behaviour by capturing speed and G forces provides operators with the data they need to implement an effective feedback mechanism. This AVLC data can then be paired with training modules to help drivers deliver a quality service every trip.

Driver Safety

As the primary point of contact with the public, drivers are exposed to a range of risks. An effective duress alarm lets the control centre know what is happening and helps minimise the driver's exposure to a dangerous situation.

Passengers

Ultimately, real-time information and vehicle control is all about the passenger.

The value passengers put on real-time information system is reflected in increased patronage. A 2012 study of Chicago Transit Authority bus routes that had been upgraded to feature re-

al-time passenger information (RTPI) found that their average daily ridership rose by 2%. Similarly, a 2015[1] study for New York City's bus system also found that after three years, the increase in ridership attributable to the RTPI system totalled 2%. This translates to more than $5 million per year in additional fare revenue.

An AVLCS supports a range of equipment on buses and light rail that is focussed on improving the customer experience, whether by communicating information more effectively or by enhancing their safety or commute. These improvements include next stop displays, audio announcements and connection protection.

Next Stop Displays and Audio Announcements to Passengers

Next stop displays have typically offered one or two lines of information via an LED display of around 20 characters. Located at the front of the bus, these displays are normally driven directly from the AVLCS processor. Because the AVLCS monitors the bus stop request signal, it can also show "bus stopping" on these displays, further enhancing the value to the passenger.

Commonly paired with the display of the next stop information is an audio announcement for passengers that is broadcast throughout the vehicle.

More recent generations of next stop displays raise the bar for passenger information with full colour, flat-screen LCD displays. Typically, there will be two displays per bus: one located at the front of the bus and one near the rear door. Both displays will usually show the same information at the same time.

Route Display

Transfer Display

Information can take different formats and commonly includes:

- A stylised linear map showing the next 3 or 4 stops
- The name/number of the next stop
- Time to the next stop
- Information on connecting services
- Bus stopping indicator
- Service disruption information
- Current time
- Advertising (optional)

At-Stop Announcements to Boarding Passengers

External destination voice announcements provide confidence to people boarding the vehicle that this is the correct bus or tram. This helpful feature is particularly valuable to customers with visual impairments.

Connection Protection

An AVLCS can go one step further than just displaying connection information by automatically managing the fleet so that critical connections are not missed if one service is running early or late. In a passenger-centric city, the days of

1 http://www.sciencedirect.com/science/article/pii/S0968090X15000297

getting off the tram to see your connecting bus disappearing down the road are gone, along with the associated stresses. Extensively used in cities like Zurich and London, connection protection delivers on the promise of great passenger service.

WHO MISSES OUT?

The problem with the drive to the lowest cost option is that **it is the passenger who misses out**. Commuters on premium services like Melbourne's SmartBus know where they are and when the bus is due at their stop, but riders using non-premium services only have access to mobile information. And yet, many of these passengers are the very people who would benefit most by having on-board information.

Melbourne has good networks of on-street signage, but in many other cities there is limited electronic signage at stops, with only mobile information available to passengers. There is no real-time information available to drivers and operators cannot see their fleet operations or communicate to the very people who are using their services. Some progressive bus operators have put in their own low-cost AVL system to give them oversight of their fleet, but as discussed earlier this is only a partial workaround at best.

Transport authorities can turn this situation around by making forward-looking decisions that will deliver the full set of benefits to passengers; for example, working with fleet operators on achieving their stated outcomes and sharing technology resources to further enable them.

CONCLUSION

The convergence of ticketing systems and low-cost AVL solutions into the AVLCS space offered transport authorities what seemed to be a pain-free way to track vehicles and deliver real-time bus and tram information. The ease with which this approach can be implemented and the apparent cost savings are enticing. However, these systems do not deliver what commuters and bus operators truly need.

Using these cheap substitutes only makes you pay in the long run: key on-bus passenger information for riders and drivers is not possible, control of the fleet is non-existent and where ticketing systems are extended to provide AVL data, the cost of moving to a better ticketing solution is inflated.

A modern AVLC solution breaks this nexus. It provides visibility and control of the fleet to operators, allowing them to proactively work towards performance objectives, improve drivers' skills, reduce service disruptions and deliver enhanced monitoring and communications. A host of passenger-focussed benefits include on-board next stop alerts, service connection information, improved reliability and a smoother ride.

By recognising the value an AVLCS delivers to passengers and bus operators alike, leading transport authorities empower all public transport players to work as a team. This approach allows everyone in the mobility ecosystem to become truly customer-centric and delivers one ultimate winner —**the passenger**.

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If you have questions about automatic vehicle location and control centre technology, or would like someone from Trapeze to provide consultation on your organisation's ideal intelligent transport solution, please contact ***info@trapezegroup.com.au***

Trapeze Group works with public transport organisations and their communities to develop and deliver smarter, more effective public transport solutions. For more than 25 years we have been Here for the Journey, evolving with our customers around the world to helping them move people from point A to Z, and everywhere in between.

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