# PROVIDING ON-DEMAND BUS SERVICES IN LOW DENSITY REGIONS

**Pantonium**

## Providing an On-Demand Bus Service for a Low Density Region

The biggest challenge for operators of a traditional scheduled bus service in a lower density setting is the required cost to provide adequate service. In a region with less-than city-density population, a bus service with acceptable service level is almost always too expensive for the tax payers, if it is a public service. A bus service that has cost structure acceptable for the tax payers is not useful, as it tends to be at best adequate for the areas where the population is more concentrated, and not very useful for areas with lower population density.

The cause of this situation is because a scheduled bus service simply cannot handle the mismatch between the high-frequency schedule needed for a denser area and the tolerance for ride-time in a less dense area.

To keep the cost down to an acceptable level, either the operator provides as many buses to the main routes to make the majority of riders happy, but forces unacceptably long ride-times or time between buses for the other riders; or provides acceptable ride-time for the minority, but fewer buses for the majority when they are needed most.

To be fair to the low density bus service operators, this is an issue even within large metropolitan areas, as it is very common to be on the bus for a long time to get to anywhere from a more sparsely populated area, or to wait a long time for a bus not bursting full in a densely populated area during peak hours.

For a city with bigger population, the simplest way to moderate the mismatch is to provide as many buses as possible to the denser areas without making the riding-time intolerable for the riders in the lesser populated areas. In other words, it is a compromise, and nobody is happy about it. If it is done well, the riders will accept it as a fact of life. For low density areas, it might not be possible to implement this compromise without operating costs getting out of control.

But a purely scheduled bus service is from a by-gone era; an era where communication between the bus driver and the service headquarters is limited to inspectors at certain fixed points along the bus routes. A by-gone era, where changing the bus schedule for a fleet is a week-long, if not month-long exercise, and takes many months to implement (changing the signs, printed materials, and even web sites).

Today, communication between the riders, bus driver and the headquarters can be cheap and effective. It is possible to have on-demand bus services.

But purely on-demand bus service is also too expensive. It becomes basically a taxi service, necessarily requiring a much larger fleet of vehicles the size of a private car. So from the cost perspective, it is not an acceptable solution.  There is another way by combining the best of both types of service to meet all possible demands.

## The Solution

The solution to this conundrum of mismatch of frequency versus ride-time is a hybrid on-demand bus service leveraging communication and optimization technologies. The communication technologies required are readily available: Internet-connected mobile devices on the buses and for riders, and web technologies for the dispatch centre. Pantonium has the optimization and mobile application technology.

## The Example

A simplistic example is given to highlight some of the benefits of the solution.

Suppose there is a town called Haven-by-the-lake. It has grown recently to have a modest population with a small town-centre. Through a decree of a higher-level of government, it is now mandated with providing public transportation services to a much larger surrounding area.

The town never had a bus service, as the few streets it had did not warrant a bus service, and it did not have a mandate to provide any kind of transport service to the surrounding area.

The town purchases the Pantonium system, which enables the town to proceed and provide a bus service that is efficient and cost-effective.

After much demand analysis, the town buys 10 buses, assuming that there will always be at least eight of them in service.

## The Operations

Through demand analysis performed using Pantonium, it is determined that for the main arteries, where 80% of all demands come from, six of the eight buses will be running more or less continuous loops during highdemand periods of weekdays. It is assumed that they will be running more or less at capacity during the highdemand periods of the weekdays.

Two buses will run the optimized on-demand portion of the bus service.

A rider accesses the iOS or Android mobile application, or logs on to the website, asking for a ride. The rider provides the origin of the ride, and the destination of the ride, along with the approximate time of the expected pickup. The rider understands that at least 30 minutes are expected before the bus will arrive at the nearest busstop, the bus will wait two minutes before departing without the rider, and the rider would be charged fees for no-shows.

Using the mobile app/website, the system will provide an ETA to the rider within 10 minutes.

The rider is allowed to enter a ride request for the future. In that case, an alert will be sent one day before the ride to confirm the ride, and 10 minutes before the requested time, the rider will be notified again for the ride.

Notifications are sent through either email, text-messaging or app notifications. An automated call-out can be provided if phone calls are required for segments of the society requiring that service.

Once the ride is entered into the Pantonium system, the ride is analysed to determine how it should be serviced using the Pantonium optimization technology. The buses currently on the road and the buses to go on the road are all considered in the calculation, to find the most cost-effective but service-level compliant way to service all the rides in the system.

The service level compliant policy is set according to the ride-time allowed for passengers. The optimization service allows different levels of ride-time tolerance. For instance, for the seniors, the ride-time can be set to 10 minutes more than the ride-time necessary to get from the origin to the destination. It is also possible to assign different priority to riders as well.

The optimization system also allows buses of different capacities to be considered. Also, special vehicles handling needs can be considered.

## The Benefits

The benefits of the bus service are as follows:

- As many buses as possible can be assigned to the main arteries during the peak hours. This makes the vast majority of riders happy during their commute.
- Provides an on-demand bus service for the parts of the region that do not need a scheduled bus service. The result is better than the traditional scheduled bus service to these areas, as the riders know when the bus will be coming and the ride-time is reduced because there is no need for the buses to service large sparsely populated areas to reduce cost.
- Environmental benefits due to buses running as close to capacity as the service-level compliance allowed. There will not be empty buses running around.
- Bus drivers do not need to be on the road when they are not needed which helps reduce labour costs.
- Service levels can be monitored so that the service is always available and yet not requiring empty or mostly empty buses to be operating on the road.
- The bus company can do extensive analysis over time to make the service more efficient, more effective, etc. When new vehicles are needed, the company will be able to plan for the right capacity and the right proportion of larger and smaller buses for different uses.

- The normal bus service and transit for special-needs or wheelchair riders, for instance, can all be handled and operated as one fleet.
- Fee structures can be set up in different ways: premium services with lower ride-time; potential higher ride-time for a reduced fee; passengers with special-needs can be grouped together and scheduled together; citizens can provide tolerance for ride-time for the fee structure, etc.
- Tablets can be used by the driver to find out where to go to for the next point. Safety is not compromised because the system does not change the next stopping point for any bus on the move. In other words, once the driver departs for a destination, the driver does not need to check on the tablet any more until the next stop is reached.

## On-demand

The Pantonium system will run the on-demand portion of the bus service, as the buses sent to the main routes during peak times are endless loops for those periods of time, requiring nothing more than what is being operated right now.

The Pantonium system can be used to run a pure on-demand bus service as well. This becomes very attractive if the bus service area is large with sparse population, when the buses can be stationed in different points of the area to make the ETA much better for the riders. The waiting points can be adjusted from time to time, or even during the day to cut down on fuel consumption.

## The Results

With Pantonium's optimization service and its administrative abilities, it is possible to run a bus service in a low density region with efficiency and still maintain a very high service level in terms of ride-time and responsiveness.

The optimization system will always choose the most effective way to provide rides to the riders, even if the fleet of vehicles is not adequate for the service level set up by the operators of the bus services. This is important when the population increases or an unexpected number of rides materializes without warning.

In conclusion, it is possible to provide an effective bus service in low density regions that results in a truly modern transit system; one with high levels of visibility, control and adaptability for operators, drivers and riders. Current applications of mobile and optimization technology are already providing this type of service in several cities around the world and ready to improve public transit in low density municipalities that may not have enough funding or ridership to support an effective traditional system.

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