Public transport in the UK: why not "*always connected*" ?

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This is the second in a series of 6 short papers

A correspondent has responded to the 'Almost always connected' paper with the comment:

> Unfortunately you cannot guarantee data networks to moving trains, remote locations and dead spots on bus routes.

True, and that is why the concept is that of enabling and following the passenger's journey via a cloud concept to which the passenger's smart device is '*Almost always* connected'. By extension, the concept could add advising the passenger who is apparently going to do the wrong thing [1]. The cloud, however, is not the same as is currently understood by the term 'cloud computing': it is, within the present envelope of study, a cloud of knowledge about your travel, past, present and planned future, in the UK, by surface and sub-surface public transport.

In the concept:

> The passenger travels in a personal distributed data cloud.
>
> The passenger carries a smart device with which to access and, if necessary, change the data relating to his or her journey.

Computing power is indeed used, some in the passenger's smart device, the rest located in multiple places not explicitly known to the passenger. The high level purpose of the computing power is to oversee the passenger's journey and ensure that the passenger's permission to travel and journey progress are visible to the right people and the right equipment at the right time.

- The major core 'right people' are (a) the passenger, (b) the train manager or managers, and (c) the operators of the transport network.
- The right equipment includes, but is not limited to, the passenger's smart device, the train manager's smart device, the train's on-board systems, the rail station gates through which the passenger passes, the station staff.

(I am aware that other public transport modes, such as express coach services, local bus services, and trams, and ferries, etc, are not explicitly explored here, and that the primary focus is on heavy rail passenger services; I crave the indulgence of the reader here, and issue a reminder: surface and sub-surface public transport is multi-modal.)

The concept is that the whole communicates with a large, distributed data cloud ICT[1] service that stores and handles and updates and delivers data to and for many passengers and systems and staff and items of equipment. That service operates across a distributed data network, carried on appropriate communications channels – on the train, to and from the train, at stations at which the

[1] The initials ICT bring back memories, for the author once worked on mainframe design for a company called ICT (International Computers and Tabulators Ltd) during the period when that company and several others were merged to form ICL...

service calls, to and from the passenger's smart device, et... For the passenger, the access channels will typically be via mobile device networks and WiFi systems.

Countering the problem of losing data cloud connectivity (in most cases only temporarily but can be long lived) is built into the concept by implementing distribution of multiple but usually short lived copies of the passenger's ticket to all of the parties involved – including of course to the passenger's smart device. That will first be done in advance of starting the journey, and the data will then be updated as the journey progresses. This of course requires:

- a major upgrade of infrastructure and on-train equipment – in particular internet connectivity is required throughout the vehicles making up the train and in locations such as tunnels where the signal currently does not reach. (A side effect could be that Jeremy Acklam's MultiPass could be implemented inside the mobile devices carried by the passenger rather than needing a separate gismo…)

The 'Almost always connected' concept of a swarm of copies of the data defining permission to travel for each and every passenger, and the associated monitoring of the journey, is a big nudge in the direction of being better able to satisfy the passenger even when something doesn't work, while at the same time looking to protect the operator of public transport.

Users and promoters of this potentially emerging method will of course be very concerned about performance, and that is another area that the 'Almost always connected' theme addresses. Providers of software and systems must endeavour to eliminate flaws in their systems, the operators of communication networks will do the same for connectivity, operators of public transport will strive to get you to your destination, and so on – performance criteria will have to be defined in procurement specifications and monitored in operation.

And there will be fallback if the network fails:

- The passenger can have a paper itinerary if desired, acting as permission to travel – that could of course be a 2D bar coded piece of paper…

- The passenger will have the ticket and associated supporting data in his or her smart device – and the passenger will be able to display that in text form and as a 2D bar code.

- The passenger's device may well have both mobile phone network and internet connectivity.

What if the passenger's device has a flat battery? That I believe is on the way to being resolved with a plethora of devices and services.

What if all of the technology fails? Train Managers and station staff will revert to fallback methods used by the current status quo ante.

When a method or a product is to be launched or, increasingly these days, a system is to be launched, key tests that must be applied include:

Does it work for the intended users?

Does it work for the owners and operators?

Is it secure?

(I am of course assuming that already the promoters have satisfied all concerned that the answers to the questions 'Is it legal?' and 'Is it safe for all comers? are 'Yes'.)

Here I take a specific scenario from early work on the SEFT[2] project:

An intended passenger on the rail network:

- buys a ticket online from his or her home, asking for it to be available for collection at the departure station (a target 20min max time to deliver to the departure station is, I believe, currently accepted by suppliers).

The intended passenger:

- travels to the station (which is an open and unattended station)
- arrives at the station at least 20 mins after purchasing the ticket
- attempts to collect the ticket at a validator on the station – fail
- attempts to collect the ticket at the other validator on the station – fail
- attempts to collect the ticket at the TVM at the station – fail
- attempts to use the free-to-use customer service phone at the station - fail

The train arrives.

What does the intended passenger do?

At this point in the original discussion, the supervisor of the piece of work for SEFT said that the passenger cannot travel.

The correct answer is:

- the passenger gets on the train

Why is that correct? Because:

- the passenger has a contract for travel, albeit one containing complex conditions
- the passenger believes that the problem of the unavailable physical (or electronic) ticket is not his or her problem
- the passenger expects that the problem will be resolved in the passenger's favour once the journey is complete

A correspondent reports that passengers who experience this type of problem and then get on the train without a physical ticket have sometimes been surcharged at the destination station, despite explaining the scenario of failure to be able to collect the ticket – the challenge of 'Almost always connected' is that of making available at the right place and at the right time the data that proves (or disproves) the passenger's assertion of having permission to travel, leading to an agreement based on the truth.

As a result of being 'Almost always connected', data relevant to a journey purchased:

- will be transmitted to the intended passenger
- will be pushed out (i.e. distributed) to all of the network nodes where it may be required to be used or at least viewed.

[2] South East Flexible Ticketing

Thus, in the example of the online purchase of the ticket, copies of the data representing the contract to travel will be pushed out to:

- the passenger's smart device
- start of journey station or stations (to the WiFi network hub and items of equipment where the passenger may well wish to collect the ticket)
- stations where the passenger may well leave the train
- the equipment on the train (including to the equipment that the Train Manager carries while checking tickets, and to the dedicated secure messaging function of the WiFi network on the train).

Performance criteria for the whole installation will be for extremely high success in getting *copies* of the data to all the places where access to the data will or may be required.

Importantly:

- most of those *copies* of the data are transient, and thus will have a limited life: they will be deleted once the passenger's journey is complete (but the master record will be available online as and when the cloud can do that);
- attempts to change the data (such as by the Train Manager reporting that the ticket is in use: journey in progress) will be actioned using a secure method that protects against fraud.
- there will be provision for break of journey and re-join where that is permitted.

A recent scenario where the new method would help:

> The author travelled on an early weekday train from Birmingham New Street to Milton Keynes. I chose the London Midland service. It turned out that there were 2 services leaving quite close together – and my ticket was for the second of those trains. I arrived at New St early, and was allowed onto the platform before the first train arrived. I got on that train. I was charged a supplement (a very reasonable amount) for being on the earlier train.
>
> Had the new method been operating, I would have been able to see on my smart device both of the services, my ticket for the second of them, information about the supplementary charge for taking the first train. I could also be given the opportunity to pay the supplement online. And the Train Manager would be able to see what I had done.

Another example that the 'Almost always connected' method will help with:

To get to ITSO's OAG meetings the author currently travels as follows:

> Walk to a bus stop
>
> Bus to Bristol Parkway rail station (as that journey starts before 0900, I have to pay because it is too early for ENCTS bus passes to be used in Bristol)
>
> Train to Swindon (reserved seat)
>
> Train to Didcot Parkway (reserved seat)
>
> Train to Oxford
>
> X5 Express bus to Milton Keynes (it is by then 0930 so the ENCTS pass can be used)

Quite complex… A lot of mag stripe coupons that have to be picked up at a station… And the trains my not be on time… And, if the trains are not on time, I may well not be able to have all of the information about that and about its consequences…

The X5 bus leg is easy: slap the ENCTS pass down on the Parkeon ETM's target on the full size tri-axle coach used on that route, and wait for the green light (but not as easy as it ought to be, because it is not easy to see that angled green light when you are only 5ft 6in, so usually the driver gives me a nod or a friendly gesture).

The 'Almost always connected' method will only help if it really does work properly and is highly reliable…

[1] The old song comes to mind:

> *Oh Mr Porter what shall I do*
> *I want to go to Birmingham*
> *And they're taking me on to Crewe*
> *Send me back to London as quickly as you can*
> *Oh Mr Porter what a silly girl I am.*

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