How data technologies could reimagine UK transport
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The Digital Traveller series

This paper is one of a series of thought experiments in which KPMG staff consider how digital technologies could support faster, simpler, cheaper, more comfortable and more reliable travel.

This might mean working up new and disruptive business models. Or finding new ways to take advantage of growing mobile connectivity and data sharing. Or tapping into the power of markets, incentives, analytics or the wisdom of crowds. In every case, it involves fresh ideas. We have only pursued concepts that could realistically be delivered within a few years, and which offer benefits to travel operators, public authorities and customers alike. But within those constraints we want to step outside conventional thinking, and test out new approaches to realising public, commercial and personal goals. We want to stretch ourselves, applying new technologies and techniques to solve old problems. We are not calling for a specific future – but we are reimagining it.

Much of the transport agenda revolves around building new roads, rail and aviation infrastructure. But making better use of virtual networks could achieve just as much in making UK travel faster, more convenient and more reliable. In this white paper, Ben Foulser and Giles Morgan consider how we might realise the digital dividend in passenger transport.

Introduction

Where is technology taking us?

In considering the future of transport, journalists and commentators often find themselves drawn towards the revolutionary new vehicles and massive infrastructure projects at the glamorous end of technology. It’s easy to catch the public’s eye with dramatic new hardware such as maglev train lines, driverless cars, Elon Musk’s proposed 600mph Hyperloop, or the elusive goal of commercial passenger space vehicles. Long before all this fresh hardware reaches the production line, however, travel in the developed world is likely to be transformed by the application of much less showy technologies – becoming far more accessible, flexible, reliable, predictable and comfortable. Certainly, in the coming decades the introduction of new transport systems should improve choice and strengthen competition; meanwhile, though, we could produce huge benefits in a much shorter timescale simply by making better use of what we already have.

These benefits are becoming accessible thanks to digital technologies, which massively improve our ability to gather, analyse, process and distribute information. Over the last few years these capabilities have come an enormous distance, and progress continues to accelerate. But the technology is still in its infancy, and we’re only starting to realise its potential; let’s consider a couple of the possible applications.
On public transport...

With the emergence of multi-modal transport cards such as London’s Oyster, transport managers are gathering passengers’ contact details and compiling data on their travel habits; meanwhile, wifi is being installed on many forms of public transport. This makes possible a shift from generalised travel information to a personalised service.

Under our current system, passengers reacting to public announcements – by, for example, seeking routes around cancelled services on a section of tube line – often tend to make similar choices, exacerbating congestion on their chosen diversion. But given an understanding of individuals’ daily journeys and the ability to contact them, digital technologies could be used to suggest a bespoke alternative route to each individual – dispersing passengers across the network and onto other modes of transport, and minimising the knock-on effects of service disruptions.

On the roads...

The spread of satnav and other programmable navigation devices, better use of mobile phone network data and the rise in ‘connected cars’ – which share information in real time – are fast increasing the data available on motorists’ locations and destinations. Aggregated, this could permit road managers not only to predict congestion, but also to avert it: traffic light phasing could permit road managers not only to predict congestion, but also to avert it: traffic light phasing could be altered, variable speed limits made more effective, and the routes suggested by satnav systems coordinated to disperse demand for road space.

In ticketing...

Receiving the travel news on their smartphone, along with a range of alternative ways to reach their destination, the traveller could simply select their preference – allowing the MSP to cash in their existing tickets, purchase a new set and upload them to the traveller’s phone. Rather than procuring and retailing sets of tickets and bookings, MSPs can then sell something much more valuable: a guarantee of completing the journey within a certain time. This would, of course, retail at a higher price. But the people who buy business or first class tickets pay substantial premiums for a more comfortable journey; and for many travellers, certainty over arrival time is a still more valuable commodity.

Given the data to anticipate and monitor travel disruptions and the ability to react in real time by changing route plans, this looks like a viable product for digital travel agents – with the banked premiums from undisrupted journeys funding new ticket purchases for those facing delays.

These are interesting thoughts, but theoretical ones – and it’s not obvious how all these technologies and models would interact in the real world. So we’ve mapped out a business journey from Essex to Scotland, and considered how things work now and how they might develop over the next five years.

To demonstrate how digital technologies and changing business models could address many of today’s problems, we’ve given our 2016 traveller a particularly nightmarish day. It is not, however, unrealistic. Everyone’s had journeys when nothing seems to go right, and often the problems we encounter have their roots in problems that digital technologies can help address – such as excessive congestion at transport pinch points, poor access to information and inflexible ticketing.

Having said that, our 2021 journey does not represent a prediction of the future, nor a recommendation for one. Instead, it’s a thought experiment: an attempt to explore how we might make use of digital technologies, and to identify the requirements, the obstacles, the goals – all the messy practicalities of landing technologies in the real world of legacy systems, vested interests and diverse opinions. Markets and technologies may instead head off in new and unexpected directions. But we already have the digital skills to improve journeys in the ways set out in our 2021 scenario. It’s worth considering how we could go about realising those benefits.
Journey 2016:

Ingatestone, Essex, to Edinburgh Napier University, Craiglockhart Campus

An entrepreneur working on a start-up business proposal needs to travel from her home in the village of Ingatestone, Essex, to Edinburgh Napier University: she’s meeting a potential collaborator at a biotechnology spin-out business. The two-hour meeting is to start at 3.30pm on a Thursday, and our businesswoman is short of both time and money – she’s looking for an economical journey that will enable her to avoid a stopover in Scotland.

Her first task is to plan her journey, initially by visiting the National Rail website. Ingatestone is only half an hour from Liverpool Street station by train, and there are frequent buses from Edinburgh station to the university. But the meeting’s 5.30pm finish makes it tricky to get back: she’d have to leave home at 8.30am, and wouldn’t return until 1.30am the following morning (see 4: Footnotes).

Next she visits a flight comparison website, spotting a budget airline with convenient services from Stansted – 35 minutes from Ingatestone by car. She’ll need to take two buses at the other end, but flying permits her to leave home at 10.55am and get back by 10pm. Including her driving costs and the charge to park within walking distance of the terminal, the total price is £138 – just £7 more than the train. It’s a no-brainer.

Having run searches on six websites, she makes her decision and books two flights and airport parking: it’s taken her 70 minutes, but she’s confident she’s chosen the best option. On the morning of the flight, she checks in online and hits the road.

The plane finally takes off 70 minutes late, at 13.40, and lands at 3pm.

She abandons the bus route to jump in a taxi – adding about £20 to her travel costs – but the Longstone Road in east Edinburgh is busy and she loses ten precious minutes. On the journey, she reflects on what’s gone wrong – and struggles to work out what she could have done differently: the system has let her down, and spending more on tickets wouldn’t have hastened her journey.

She finally arrives for her meeting hot, stressed, and 15 minutes late: her contact at the university is polite, but it’s not a great first impression.
Journey 2021:

Ingatestone, Essex, to Edinburgh Napier University, Craiglockhart Campus

Now let's consider how digital technology, "big data" and evolving business models could transform our entrepreneur's travel experience. We've placed this journey five years in the future, but much of the required technology and infrastructure already exists; and recent years have demonstrated just how rapidly disruptive business models can displace the traditional business leaders. It's feasible that this kind of a journey could be possible within half that time.

Booting up her preferred travel 'managed service provider' (MSP) app, the businesswoman inputs her starting point and destination, and answers a few questions. Economy or business class? What's her tolerance for long journeys or multiple changes? And will she pay a premium to secure greater certainty as to her arrival time? She wants answers to these questions. Economy (MSP) app, the businesswoman inputs her starting point and her choice of connections at each end and pricing information. She plumps for the Stansted flight, and makes a single payment to the MSP covering the flights, parking and bus tickets. The arrival time guarantee makes it significantly pricier than the £138 she'd have paid if she'd booked tickets individually, but this "insurance" element will give her options if she hits problems during the journey.

Within seconds, the app presents her with the rail and aviation options, along with her choice of connections at each end and pricing information. She plumps for the Stansted flight, and makes a single payment to the MSP covering the flights, parking and bus tickets. The arrival time guarantee makes it significantly pricier than the £138 she'd have paid if she'd booked tickets individually, but this "insurance" element will give her options if she hits problems during the journey.

Meanwhile, she's reassured by a live feed providing a comforting estimate of the time it'll take her to get through security, even as incoming passengers peak, the queues are staying short (see box *Flexible resourcing at airport security*). But as our entrepreneur cruises up the M11, the app informs her that fog at Edinburgh is causing delays. Changeable winds are making it hard to predict when normal services will resume, so her 'insurance' kicks in and the app offers to change her outward-bound flight – putting her on the 12.10 to Glasgow International Airport, which is free of fog. Using live data on road conditions and Stansted's security desk queues, the app judges that there's just enough time to make the flight. And whilst the MSP must write off the cost of one leg of the Edinburgh route, the airline is keen to shift the last few seats in its Glasgow flight – so the cost is well within our traveller's insurance cap.

When the day comes, the MSP refrains from checking her in before she leaves home; it can do so automatically as she nears the airport. Traffic is heavy on the car journey to the airport, but road network managers divert some vehicles off the motorway and impose a temporary 50mph speed limit on the rest, with high levels of compliance; the variable limit keeps traffic moving and our traveller on course to catch her 'plane (see box *Data and traffic management*).

Sharing the cab with another business traveller, our entrepreneur has time to get an hour's work done as the car heads east; she takes the opportunity to integrate some newly-released data into her presentation. In Edinburgh, the Longstone Road is busy, but Edinburgh transport managers have been coordinating the navigation advice received by drivers so the traffic keeps flowing. And anyway, she has time to spare: arriving at the university, she locates the meeting room then sits down to re-read her presentation over coffee; when she meets her contact, she's calm, well-prepared and bang on time.

Landing at 13.30, she has two hours to reach Napier University. That's too tight for public transport: a bus into Glasgow, train to Edinburgh and bus to Craiglockhart would get her there 20 minutes late. But the 50-mile drive down the M8 should only take just over an hour. The MSP – choosing the most economical way to hit her deadline, as its terms and conditions permit – puts her in a Uber Pool taxi, saving a significant chunk of the £80 it would pay for a standard cab.

Aware of the need to interact with its customers whilst they’re on the move, the MSP has built hands-free technologies into its app - so our traveller’s smartphone connects via Bluetooth to her in-car entertainment system, displaying her options on the dashboard screen as it reads them out through the car speakers. She uses the smartphone's voice recognition technology to enter her answers, prompting it to display the Glasgow route on-screen for a final confirmation. Then the MSP checks her in remotely, downloading her boarding pass onto her smartphone and keeping her updated on travel conditions as she approaches the airport. Guided through the airport via instructions on her smartphone screen, she enjoys a brisk but unrushed passage to her boarding gate: she’s soon airborne and Scotland-bound.
Managed Service Providers (MSPs)

Many companies – such as Masabi, Alibis and Trapeze – are already offering ‘mobility as a service’ apps that enable travelers to compare journeys across transport modes. Licensed travel agents such as Hogg Robinson buy tickets in bulk, and monitor real-time travel data from airports and other transport operators. And the digital ‘wallets’ provided by giants such as Google and Apple permit people to store sets of tickets in their smartphones.

However, existing travel services are often slow, complicated to navigate, and lack the ability to alter tickets and routes in real time. The travel MSP concept simply takes existing infrastructure and data systems, makes better use of advancing digital technologies and smartphone connectivity, and provides a new retail offer – enabling customers to not only upload all the required tickets in a single transaction, but also to amend their planned route mid-journey as conditions change.

MSP firms could generate a margin in various ways, such as providing advertising spaces within the app, charging a small commission, and securing bulk discounts from transport providers. Offering an arrival time guarantee is more complicated – but ‘big data’ and analytics technologies are rapidly improving our ability to assess risk on individual journey scenarios, providing the metrics to inform intelligent pricing.

Taking our Essex-Edinburgh journey as an example, the MSP firm could estimate the risk of delays on each route, and provide a new offer – allowing customers to not only upload all the required tickets in a single transaction, but also to amend their planned route mid-journey as conditions change.

Flexible resourcing at airport security

Although airports vary the number of staff and active scanners to increase capacity at busy times, they can still be caught off guard when, for example, transport delays bring a sudden influx of late-running passengers. Then security queues can lengthen at just the moment when many people are in a hurry, leading to missed flights.

However, airports are already developing ways of predicting and catering for such sudden changes in demand by monitoring data feeds and building up intelligence on how travel conditions affect arrivals at the security desks. Gatwick Airport, for example, is running a trial programme monitoring delays on the rail and roads networks.

Data and traffic management

The growing prevalence of ‘connected cars’ – which transmit location data in real-time – and greater coordination between the providers of satnav and smartphone navigation systems could permit public sector roads managers to offer much more holistic management of the suggested routes provided to drivers.

Navigation system providers such as TomTom and Google already provide real-time data feeds to road operators. Given a two-way connection and some analytics technology, roads authorities could combine this information with feeds from connected car operators and their own video streams to identify and predict points of congestion. They’d then send back advice on how navigation providers’ customers can best avoid delays – suggesting how groups of drivers can best be split in order to avoid creating new hold-ups.

In our 2021 scenario, those travellers whose journeys would be faster if they used more efficient routes would be directed, and provided with new routes that divide the group across a range of minor roads – minimising displaced congestion to reach their destinations.

This data could be combined with other information such as live flight times, route-planning searches on systems such as National Rail and RAC route planner, and anonymised feeds from the satnav providers and connected car managers. Bringing this information together and running analytics techniques that call on past experience to predict the impact of changing conditions, airports could soon have the ability to continually predict demand at the security gates – and thus to adjust staffing levels, staying a step ahead as the flow of travellers changes.
The nature of this structure is probably a matter for the Department of Transport. But the incentives exist on all sides to make better use of our roads network; and as the UK population grows, the economic, social and environmental reasons for doing so will grow ever more persuasive.

Would an ‘insured’ journey always carry a price premium?

Yes – the MSP concept as set out here doesn’t drive down the price of travel; it simply permits people to purchase greater certainty over their arrival time. However, the concept could be reversed to offer travel at below full market prices.

With ever greater visibility around ticket availability and fast ways to purchase and download tickets, it will become easier to purchase journeys at the last minute – when operators often drop prices to shift unsold stock. So MSPs could offer customers who are relaxed about how they travel and when they arrive very cheap journeys – offering only to purchase tickets that will get people to their destination within the day. Then, seeking the cheapest combination of tickets available at the last minute, MSPs could put a multi-modal journey together just before the traveler’s departure time. The customer would have no idea how they’d be travelling or how many connections would be required until they were about to leave – but this approach would help fill unsold seats across the transport network, whilst providing the cheapest possible travel options for people who might not otherwise be able to afford to make a journey.

Questions for you

As we’ve explained, this document is intended to be a thought experiment – not a prescription or a prediction. However, following this line of thought does raise interesting questions about new business models, technologies and capabilities. And it identifies market opportunities that are, in one form or another, likely to be seized by digital businesses in the near future.

As we’ve seen, in today’s world new companies can overturn long-established markets incredibly quickly with a new business model. And many of these business models are built around connecting suppliers and consumers in new and innovative ways, using the rapid transfer of data to match supply and demand. The MSP model outlined here is simply a variation on this approach: reconceiving transport services around rapid transfer of data to match supply and demand. The nature of this structure is probably a matter for the Department of Transport. But the incentives exist on all sides to make better use of our roads network; and as the UK population grows, the economic, social and environmental reasons for doing so will grow ever more persuasive.

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In planning out our two journey scenarios, we conducted web searches on 6 June 2016 for travel on 16 June 2016 to a meeting scheduled for 15.30-17.30. The starting point was Ingatestone in Essex, the destination was Edinburgh Napier University’s Craiglockhart Campus.

The rail option, researched on http://jojo.nationalrail.co.uk/ and www.travelinescotland.com/, involved an 8.46 departure, two changes at Liverpool St & Kings Cross, and arrival in Edinburgh at 14.20. The return journey departed Edinburgh Station at 18.42pm, arriving at 01.21am on Friday 17 June. The cost was £128 return. We assumed that our traveller lives a 15min walk from Ingatestone station. The no4 bus from Princes Street to Craiglockhart takes 25mins and costs £1.60 each way. The total journey cost was £131.20.

The aviation option, researched on www.skyscanner.net/, www.travelinescotland.com/, http://www.rac.co.uk/route-planner/ and https://v2.holidayextras.co.uk/, involved the 12.30-13.50 Ryanair STN-EDI flight and a 19.35-20.55 Easyjet return, costing £73. The original plan then involved the no100 bus from the airport to Shandwick Place, West End; and the no10 from Lothian Road, West End to Craiglockhart. Total bus journey 49mins each way, arriving 15.11; return price £12.20.

RAC’s route planner recommended an Ingatestone-Stansted route via the A12, M25 and M11, estimating 35mins for the 32 mile journey. Parking close to the departures concourse cost £37 for a 24-hour period, and driving costs were estimated at 50p/mile. We allowed one hour from arrival at the airport to the flight’s departure time, and 30mins from landing back at Stansted to reaching the car park. The total cost of the aviation option was £138.20.

The research took 50mins, and we allowed an additional 20mins for making all the relevant bookings – an optimistic estimate if our traveller doesn’t already have accounts with the two airlines and airport parking provider.

Researching the Glasgow flight, we found a Ryanair service to Glasgow International departing Stansted in just an hour’s time for just £48. The website https://yourtaximeter.com/ priced the cab journey to Edinburgh Napier at £75.80, and the MSP’s use of uberPOOL would bring this cost down still further. So in this instance, our MSP would have incurring an additional gross cost of about £100 to fulfil its arrival time commitment, with this spending partially offset by the £12.20 saved in bus tickets. We have not suggested exactly how much insurance might cost in this case, but it’s fair to allow an insurance spending cap of more than £100.