Transport Strategy, Planning and Operational Management: Integrated Data Platforms

A Matatika Thought Piece on Transport 3.0 Digital Innovation

Aaron Phethean, Founder and CEO

Nick Bromley MBA, Innovation Programme Director

Introduction and Background

UK transport networks grew in the 19th Century out of the need to move raw materials and goods between manufacturing processes and markets. Transport 1.0 saw canals, rail, and roads all develop to meet the needs of the industrial revolution. From the early 20th century, speed of transport became increasingly important especially as the movement of people for leisure and work took off. Transport 2.0 was about increasing physical capacity, to reduce journey times across the networks, especially road. As capacity limits are reached, Transport 3.0 will use digital technologies (data, AI etc) to optimise the planning and operation of physical networks.

We are at a multi-dimensional turning point in mobility: not only does the technology change, (from combustion engine to electromobility or from cars with driving assisting systems to self-driving cars) but the way people experience mobility is changing.

In many modern countries, the number of people owning a car is declining and the use of multimodal transport combining public transport (Mass Transit), semi-public transport (e.g., car sharing/car clubs), and private vehicles is increasing. As in many other areas of our modern life, mobility services are generating a multitude of data from sensors as well as from business transactions and new players from the digital world, such as Google and Uber, are entering the sector.

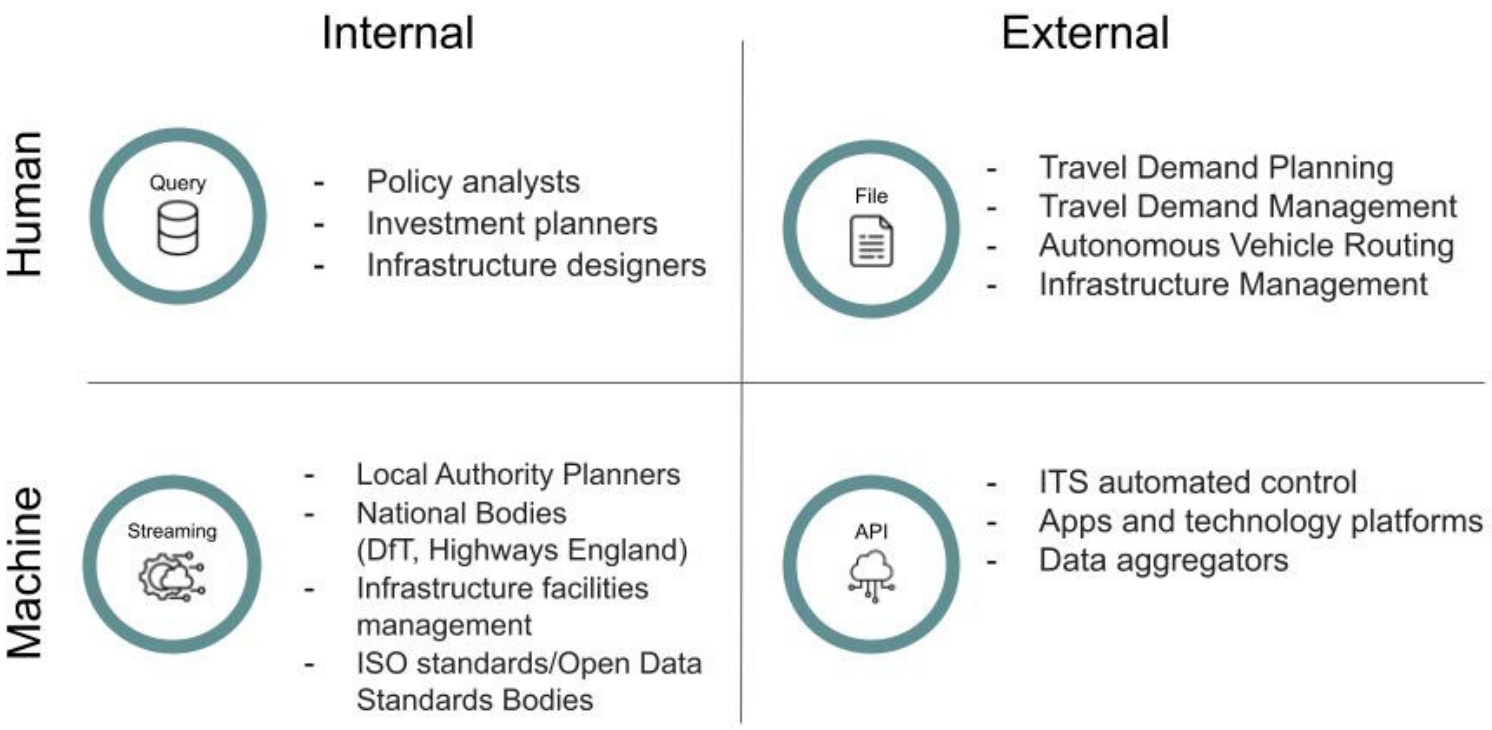
In this new world of mobility, various digital devices assist and direct movements as we travel from A to B. Many different (multimodal) vehicle and service providers cooperate to ensure our journey is seamless as well as give the best user experience. Each of these participants in our journey collects data on individual movements. The transport sector has before it a great opportunity to capitalise on the sharing and analysing of movement data, the enablement of which will be a common platform to collect and analyse data.

Today's digital mobility platforms are proprietary, often operated by one company that wants to control (parts of) the mobility market end-to-end (e.g., Google envisioning collecting data with their own autonomous vehicles and, at the same time, providing services using this data).
This makes it hard for new software companies to enter the market as well as makes many new business models nearly impossible e.g., city council using data collected by sensors of privately owned vehicles to assess the conditions of their roads, or for improved disaster management, or companies offering novel multi-modal transport solutions using live data).

To facilitate broader collaborations amongst the existing partners within the transport industry, as well as to foster new business models, we suggest building an open and secure platform for sharing mobility data – regardless of source. These will include geospatial use cases, infrastructure sensors, vehicle movements, and human Location Based Services (LBS e.g. SatNav, smartphones, fitbits, strava etc).

Challenge:

To serve a collective intelligence ecosystem comprising the travelling public, transport & infrastructure planners, mobility providers, and service operators.



The platform should be open in the sense that it allows connection to new data sources based on open standards, enabling third parties (apps, software etc) to build new services on top of the platform using open standardised application programming interfaces. The platform is secure

not only in that it needs to guarantee common data protection standards, it also will provide novel ways of secure collaborations,(e.g., based on data anonymisation, data pseudonymisation, blockchain technology, or multi-party computation).

Transport, more specifically the car industry, has a long history of collaboration dating back to 1911 when Henry Ford won a challenge to the Selden engine patent. This led to the setting up of the Motor Vehicle Manufacturers Association followed by an era of open collaboration in the automobile industry as it enabled the sharing of patents without financial exchange. This resulted in massive technological innovation and expansion in personal mobility that we benefit from today.

The UK led (Fujitsu/ICL) in the European standardisation and collaborative growth of IT open systems through the 1980's. The markets and customers benefited hugely as the range and rates of software innovation grew exponentially. Fujitsu/ICL in leading the technical and political aspects of standards, were able to make substantial R&D cost savings.

Collective Intelligence (Data) Opportunities

A range of commercial scenarios and opportunities will open up as the 'Open Data Mobility Platform' (ODMP) evolves through time. The most common commercial model at present is data is built and held on a platform by the 'host' service provider, the data is presented via an API, the use of the data is then paid on a per transaction basis by the third-party software provider. There may well be a monthly charge to cover the costs of the 'hosting' service, who have all the upfront costs to locate, test, import and store data from assorted data sources (e.g. public and private, multimodal data sources) in a secure 24x7 availability service environment.

Trip or Journey Origin-Destination Data

Future transport will increasingly see multi-modal travel (trips or journeys) combine and integrate public and private services using several means of transport modes (e.g., cars, buses, trains, bicycles, planes). Restrictions on road capacity, parking, emissions, and escalating single use vehicle costs will drive the trend toward shared transport. Joining up the trips or journeys for each individual will become the focus for private and public operators as they transport passengers seamlessly from Origin to Destination (O-D).

The 'Open Data' platform will initially capture data on the O-D's of the travelling public. The individual data and travel patterns will come from a wide range of multi-modal sources, including SmartPhones, SatNav, in-vehicle GPS trackers, Fitness Apps, cycling/walking Apps, and new personal devices such as SmartKey.

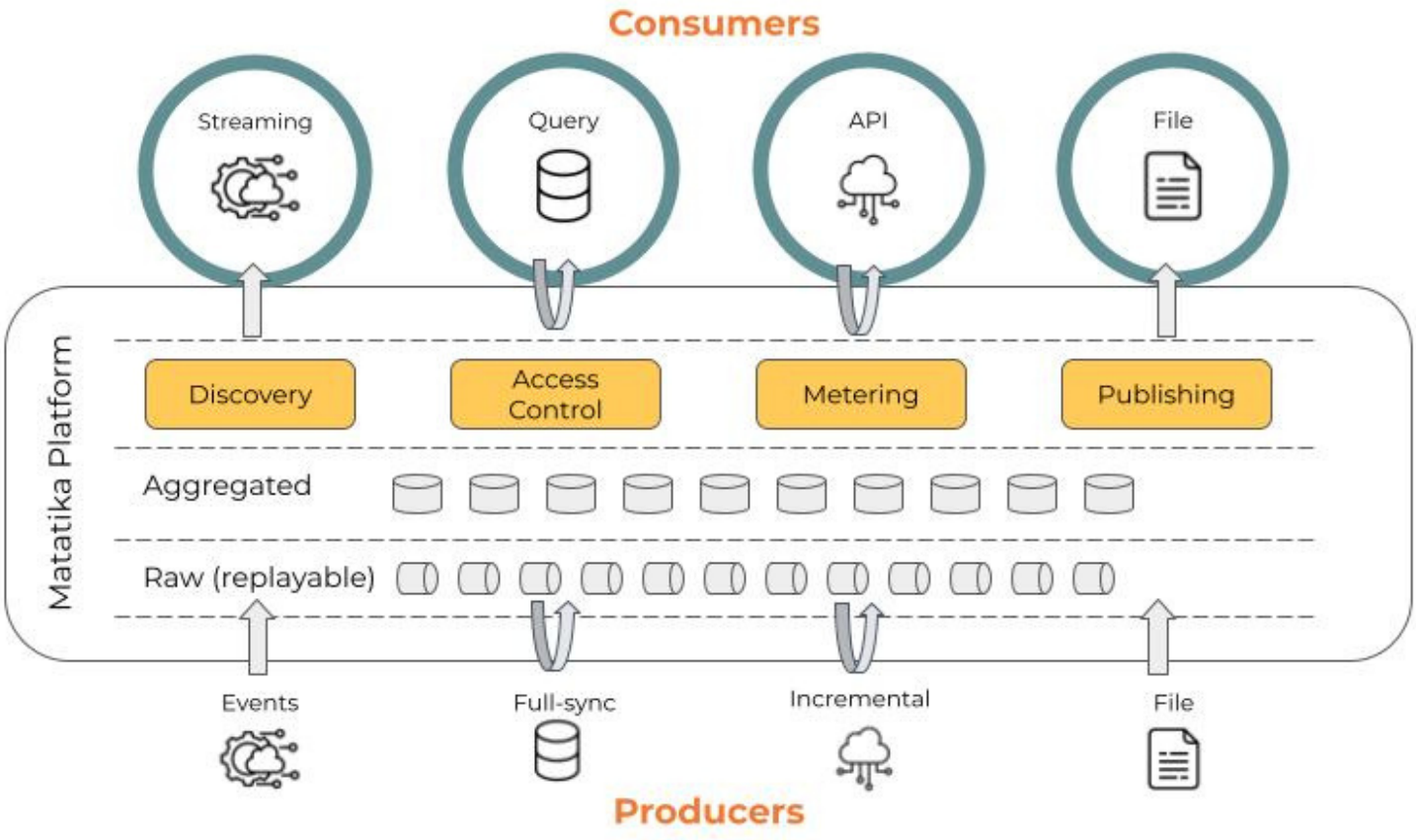
For movement data to be universally shared and open, the public will have to be reassured their data will be anonymised. Typically the tech industry captures movement data covertly through Apps - the user generally fails to understand, appreciate the implications, or particularly care in the moment they give their personal 'approval' to the App provider.

On the surface, this is very challenging. However, a randomly generated code or number could be allocated to each

individual (not unlike a PIN) that has no bearing on the individual's name, address, or any other personal information. The key data is not the 'who' but 'what' journey or trip is being taken – the Origin and Destination at what time.

Key to the successful sharing of data is the integrity of the platform and services:

- Transparency and proof to the individual that their data is anonymised (encoded)
- There is a breadcrumb trail (audit) showing where that data is stored and being used;
- The data is monetised such that there is a collective benefit, or benefit specifically monetised to the individual.



The value to the public and private transport sectors is quickly obvious. A more complete set of trip or journey data will reveal patterns of movement as a time series never before seen. At every level from urban streets, to rural areas, from the smallest villages to cities, local to national networks, there will be movement data for every anonymised traveller.
Strategic planners and transport planners in national organisations such as DfT and Highways England, Local Authorities, and Developers will have access to an accurate, up to date, reliable set of data on which to base capacity calculations when making key investment decisions.

Travel Demand Management - Mobility-as-a-Service (MaaS)

Travellers or passengers function like any other consumer, ease of access, and ease of use (timely, clean, reliable etc) is essential to personal choice. Companies offering mobility services need to know the patterns of actual demand and predicted demand. With accurate demand data, they can invest in the necessary infrastructure and services required to meet peak demand

or manage travel demand according to capacity.

A further complexity is modern passenger service providers no longer necessarily invest or operate infrastructure and capacity e.g. vehicles. They instead provide a seamless experience to the travelling end customer (including only one payment). Moreover, the service can easily be dynamic, i.e., adapting to changes as they appear. For example, by accessing the current traffic data as well as the current position of the customers, a dynamic re-routing of the customers (including necessary re-booking on third-party transport providers) might be triggered.

Customers or passengers are increasingly willing to recoup costs for their travel by providing access to data they source – as noted above, innovative security and transparency technologies and processes will allow customers oversight and control of their data (in compliance with current regs e.g. GDPR).

Optimising Infrastructure - Intelligent Capacity Management (Traffic-Control)

Current traffic control solutions are not well integrated: City councils control sensors on highways as well as control the traffic signs (e.g., traffic lights, configurable direction sings) but they do not have access to in-mode vehicle (SatNav) direction systems, or SmartPhone mapping (e.g. CityMapper), neither to data on the national networks e.g. smart motorways.

Combining movement data overlaid on infrastructure data will enable in real time to optimise the use of capacity e.g. traffic control to maximise throughput at peak times.

Generally traffic control is rather static, pre-programmed and decided in advance, rather than dynamically reconfiguring according to the latest passenger demand. Integrating a wide range of private and public open data will allow the infrastructure and MaaS to offer personalised routing. The routing would require AI to optimise according to loads on the network, using a range of decision support and financial incentives to re-balance the loads (similar to Smart metres and the National Grid usage/price models). A coupling of demand patterns to infrastructure traffic control will mean the service providers not only consuming individually generated data but also feeding information back to them – optimising the network for all in capacity limited areas, assisting and incentivising the individuals through a personalised routing.

The key to optimising infrastructure is linking the consumer to the collective benefits and personal benefits/monetisation of data. AI is an obvious analysis technique to 'learn' and offer added value from the combined data sets. The vast amount of sensor data across the road networks could also be used to provide an up-to-date assessment of road quality, modal performance, retail footfall etc.

Transport Open Data Platforms - Research and Innovation

As we have already discussed, there is technology precedent in the IT industry of opening up systems and data so as to speed up innovation and increase the benefits to platform providers and buyers. It should be noted this isn't without risk on the supply side participants, as invariably the lowering of the barriers (which had protected their business models) introduces new competition.

In this case, there should be no concern to the supply side participants. The costs to them of the 'data exhaust' are generally minimal, the data supply is generally a by-product of their primary services, secondary to the principal business model.

At present the UK vehicle industry faces several challenges, data services is one way of building back value in the sector. Brexit, Covid, and a technology shift to EV's, are all factors eroding the onshore manufacture of vehicles. If the trends continue (Nissan, Honda, BMW/Mini pulling out) the industry potentially faces a loss of 850000 jobs costing the UK economy £15bn, as we reduce to niche/boutique manufacture of brands such as Bentley, McLaren, Morgan, GMD etc.

In place of these traditional companies the UK could take a global lead in the digital transport economy, for UK companies this is a very welcome opportunity to take leadership and to excel in:

- Data capture, cleansing and storage using ODI-proven techniques in building and managing open data platforms;
- Data privacy, security, and transparency methods and techniques overseen by an industry body;
- Use of network sensors to capture and interpret smart infrastructure (road/rail) coupled with machine learning and AI;
- Development of AI systems for the analysis and interpretation of patterns for strategic investment business cases, transport planning, and optimising operational networks;

- The use of quantum computing and Cloud platforms (linked to infrastructure sensors and near real-time movement data)

- Network protection and security testing for connected networks (IoT/Mobility/Industry 4.0) such as IoT intrusion detection, hacking etc detection techniques..

Questions for consideration and action:

The above appraisal of the situation and opportunities raises these points for thought and action:

1. What do you consider to be the key national physical, digital, and systems infrastructure assets essential to the exploitation of data?;

2. Who are the key stakeholders, and what is the best way to bring them together to share purpose and costs, and to realise value to the UK economy?

3. Given transport is global, and with the challenges faced, what is the best course and set of actions open to the UK, specifically Government? What timing or urgency should be given to those?

Matatika

Matatika is a flexible, scalable data collaboration platform.

With a combined 150 years of data technology and marketplace experience, Matatika recognises that data innovation starts with an open and accessible platform. In 2019, Matatika created a platform for scientists and analysts to import and store large amounts of data, process and produce real-time intelligence, and share or embed data in other apps through an open API. Users benefit from this core open technology platform with more than 500 apps that enable collaboration with colleagues and 3rd parties through private, invite-only workspaces.

www.matatika.com

Aaron Phethean
Founder & CEO
aphethean@matatika.com
07714 226 151

Nick Bromley, MBA,
Innovation Programme Director
nbromley@matatika.com