oneM2M and oneTRANSPORT — a global approach to Intelligent Mobility


INTRODUCTION

The April 2017 Transport Systems Catapult Briefing Paper “THE CASE FOR GOVERNMENT INVOLVEMENT TO INCENTIVISE DATA SHARING IN THE UK INTELLIGENT MOBILITY SECTOR” consolidates much recent research as to the future potential value of the Intelligent Mobility sector, and the central role that Open and Shared Data plays.

“The free flow of transport data underpins the development of new mobility solutions that provide integrated, efficient and sustainable transport systems for people and goods.” [Executive Summary]

The Briefing Paper outlined the key barriers to data sharing in the sector, and the measures that must be taken by government to remove these barriers and position the UK at the forefront of developing world-leading globally-exportable Intelligent Mobility solutions. Essential infrastructure is required to support Open Data. With the right approach, this infrastructure can rapidly accelerate the realisation of open data sharing across the transport sector, creating conditions that encourage innovation, growth in UK skills & jobs and in new and improved transport services that deliver value. We estimate that if transport-related data from just 25 Transport Authorities (representing 1/3 of UK population) is “opened”, £732m of value (see chapter 2) can be realised in the UK over the next 6 years (using 2016 base year). This figure can be extrapolated upwards when more Local Authorities adopt an Open Data approach.

Such open data infrastructure must maximise incentives for sharing data (in between transport sector entities and with other sectors) and lower barriers, including costs, required expertise and risk. With the right infrastructure in place, Local Authorities, transport operators, vendors and app developers can focus on selecting data to be shared and on developing applications and end solutions without needing to understand underlying networks and individual city IT systems. Additionally, vendors and application/service providers will find a much wider addressable market for their solutions than if they were developing for multiple individual smart city platforms, enabling new business models for Intelligent Mobility services that benefit travellers & citizens.

There is a danger that such essential UK infrastructure for open data sharing will emerge which meets the objectives of the organisations involved, but which fails to maximise the potential value that the UK could exploit. By not adopting an internationally standardised and harmonised approach to open transport data across the UK, the risk is that individual bespoke smart city data platforms continue to be funded through local public authority & transport authority budgets, creating islands of under-exploited data that remain in (albeit larger) closed siloes, preventing the free flow of transport data.

oneM2M (http://www.onem2m.org/) is an international response to the growing demand for a smarter approach to smart cities and open data. Developed in partnership with over 230 member companies worldwide (and growing), including continental standards bodies, oneM2M global standards define a “horizontal infrastructure” approach to implementing open data portals and open data marketplaces across multiple cities and sectors, combating fragmentation and vendor lock-in.

oneTRANSPORT is the first UK oneM2M-compliant Open Data Marketplace for Smart City Transport data. Conceived in the UK in 2013 and implemented through InnovateUK and private sector funding, it provides a 4 year head-start in implementing a standards-based Open Data infrastructure for the UK Intelligent Mobility sector.

Chapter 1 defines the broad value proposition that a oneM2M-based open data marketplace brings to the UK, by enabling Open Data to positively disrupt the UK transport eco-system. Chapter 2 details specific benefits that a oneM2M Data Marketplace provides to Local Authorities, and Chapter 3 outlines the key characteristics of oneTRANSPORT that are supporting new data-powered Intelligent Mobility services based on oneM2M.
Chapter 1 Benefits of a oneM2M Open Data Marketplace to UK plc

In order to provide the biggest positive impact to all stakeholders, an open data marketplace needs to be deliberately positioned as neutral national infrastructure; neutral in its provision of data marketplace services between organisations of all types and in all sectors offering or consuming data and related services, and neutral in its handling of the data itself. Open Data infrastructure needs to operate in a similar manner to the mobile network eco-system; devices, networks, infrastructure services and end applications from any organisation inter-operate through compliance to a standard architecture and interfaces, maximising potential inward investment, enabling organisations of any size to participate and preventing vendor lock-in or monopolies.

The oneM2M global standards define an infrastructure architecture that enables data, collected from any Internet-of-Things device or IT system, via any type of communications infrastructure, to be discoverable and consumable via open, standardised APIs. OneM2M’s provision of a standardised set of “application enabling services” including real-time data discoverability, network abstraction, security, federation and semantic interoperability make oneM2M a comprehensive and internationally compatible approach to realising a national open transport data marketplace [1].

Since oneM2M also defines mechanisms for federation between infrastructure systems, a single marketplace for open data could be provided by more than one entity, creating competition and efficiency in the provision of open data infrastructure services.

The realisation of a UK-wide oneM2M Data Marketplace for Open Transport Data provides direct benefits to five primary stakeholder groups listed in Table 1 below.

**Table 1 Benefits of oneM2M Open Data Marketplace**

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<tr>
<th>Stakeholders</th>
<th>Benefits of oneM2M Open Data Marketplace</th>
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| Local / Regional Public Authorities & Transport Authorities | • Enables Local Authorities to distribute real-time and reference data to any interested party via a single open globally-standardised system — “Publish once, Distribute to many”.
  o This hugely more efficient and effective than if each Local Authority builds their own individual IT systems capable of data sharing. It negates the need for Local Authority investment in IT systems, technical expertise to operate and multiple legal “point-to-point” agreements, dramatically reducing data sharing barriers and cost.

**EXAMPLE:** The typical one-off cost for an individual Local Authority to define and build an IT system capable of ingesting and storing real-time data and its use through front-end visualisation / application services is £100K - £300K. Ongoing operating costs for such a single-purpose system (including both skills and technology costs) is typically £75K - £150K per year (based on a review of national and regional data access points in Europe). Provision of a national data marketplace infrastructure which negates the need for each local authority to duplicate such capabilities prevents over £100M of Local Authority spend nationally over 6 years.

• Authorities are offered innovative new region-specific data-driven Intelligent Mobility services and solutions that are developed from Local Authority and other data sources, without needing to invest in or drive the creation of these services or make individual data sharing arrangements with each new service provider.

**EXAMPLE:** A number of Intelligent Mobility service providers indicate that if a sufficient number of Local Authorities were sharing data openly through oneTRANSPORT, this provides a source of data and an addressable market of adequate size to justify building and offering new “freemium” services. Freemium services provide a layer of “free” services, with optional premium services available for an additional charge.

• An open data marketplace enables real-time data from across multiple local authorities to play a greater role in the management of transport operations and future transport network planning.

• Authorities can deploy new sensors, collect new data and access new services without being locked to a single technology or service provider and without duplicating IT infrastructure.

• Provides Authorities with a cost-effective route to follow central government’s momentum for Open Data.
Transport Technology & Service Providers and Transport Operators

- A oneM2M Open Data Marketplace provides transport technology, services provider and transport operator companies access to previously inaccessible real-time and reference data, allowing these organisations to better understand transport operations and travel needs and unlocking innovation and private investment in new Intelligent Mobility services, applications and solutions.
- A Single Marketplace dramatically lowers market-entry costs for the provision of new data-based services by negating the need for individual data/system integrations and data sharing agreements with each regional/transport authority, boosting start-up/new entrant/SME growth. Provides private organisations with a new marketplace and channel to distribute Intelligent Transport related data, massively increasing visibility/discoverability of data and related services and enabling monetisation of valuable data.

EXAMPLE: Pioneering open transport data in the UK in general and especially in London has triggered the creation of a number of businesses that are improving offered transport services. Citymapper (a London based company that was recently valued at £250 million) is a good illustration of the value of innovating in open data provision. Citymapper general manager Omid Ashhari said: “Citymapper was created [in the UK] because of the existence of open data. It’s the essential backbone of what we’re working on.”[2]

Adjacent Sectors – Healthcare, social services, environment, education, ...

- Open Data through a oneM2M Data Marketplace enables cross-over of information into adjacent sectors, boosting innovation and associated investment in new technologies, services and solutions in these sectors.
- Cross-sector data sharing reduces inefficiencies in service delivery, reducing the cost to deliver core services in healthcare, environment and education and improving outcomes for citizens.

Dept for Transport, National Gvnment & wider UK Economy

- Adoption of the globally agreed oneM2M standards enables private and public sector organisations to share data without being locked in to a proprietary technology that prevents competition and stifles innovation and growth. Rather, it presents a forward-thinking and collaborative solution for enabling Open Data across sectors and internationally.
- High-level/professional UK jobs are created via growth in small and large organisations operating with transport data and related services, as well as in the operation of a oneM2M Data Marketplace itself.
- Adoption of the globally agreed oneM2M standards enables the UK to capitalise on the growth of a Open Transport Data eco-system internationally. The growth of globally applicable intellectual property, skills, technology and services enables the UK to take a leading role in global Open Data and Smart City initiatives, delivering new export revenues, further new UK jobs and positioning the UK at the forefront of a global internet-of-things economy.

UK citizens & travellers

Open Data through a oneM2M data marketplace unlocks investment and innovation in new end user services, which deliver direct benefits to UK citizens and travellers - for example improved Local Authority and Transport Operator services, and new/improved private-sector Intelligent Mobility Solutions.

oneTRANSPORT estimates that if transport-related data from just 25 Local Authorities (representing 1/3 of UK population) is “opened”, £732m of value can be realised in the UK over the next 6 years (using 2016 base year). This figure was determined by Arup in a recent WebTAG-based study for oneTRANSPORT that consolidates the value of multiple individual benefits, and can be extrapolated upwards when more Local Authorities adopt an Open Data approach. Further details on calculations are available upon request to oneTRANSPORT.

Chapter 2 Benefits to Local Authorities of a oneM2M Data Marketplace

The opening and sharing of transport related data through an oneM2M Data Marketplace will enable the development of new services and the enhancement of existing ones. Such developed/enhanced services will bring a number of economic, social and environmental benefits to travellers, local authorities, businesses and communities. Many of these benefits will be for the local authorities and can be broadly classified into two main groups:

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1. Benefits directly linked to the local authority as an organisation (e.g. improved operations & processes); and
2. Benefits linked to the community served by the local authorities which are aligned with the LA objectives.

These two groups of benefits are listed in the two tables below along with brief description of how oneTRANSPORT enables the realisation of such benefits

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<th>Benefits to LAs as organisations</th>
<th>Description</th>
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<tr>
<td>Saving the cost of commissioning and maintaining travel apps</td>
<td>Publishing data from multiple LAs in a unified data format and standardised interface attracts App developers to build services for wider geographic areas (more users) who will rely on alternative revenue models (e.g. advertising) rather than charging LAs for building such apps (similar to the TfL case). <strong>EXAMPLE</strong>: It costs a Local Authority between £20K and £150K to develop a single-purpose mobile phone app, with additional maintenance and enhancement costs incurred over subsequent years (costs are significantly higher for more complex &amp; advanced end-user apps). Open data incentivises private sector organisations to invest in creating apps that can reach citizens across multiple authorities, with potentially wider capabilities, which shifts the development cost burden off Local Authorities, avoiding aggregated costs in the tens of £millions over 6 years.</td>
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<td>Greater insight into transport operations and impact of changes</td>
<td>Local Authority data sharing via an open marketplace creates an incentive for the private sector to develop and offer new data visualisation and analytics services. Based on such new applications that consolidate and display disparate real-time data sets in one place, more Local &amp; Transport Authority staff are able to access and use data to improve every-day operational decision making and inform longer-term planning decisions. Authorities can also view neighbouring authority data and data from similar and high-performing / low-performing regions, building greater understanding of best practices and methods to manage and improve data quality amongst stakeholders.</td>
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<td>Better internal and external data</td>
<td>Publishing data helps LAs to better understand internal data issues/gaps and, to some extent, outsources data quality control. Furthermore, a data marketplace enables LAs to access a wide range of external data assets (e.g. travellers’ data from Apps) which helps them optimise transport networks and operations.</td>
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<td>Lower cost of opening data</td>
<td>A national data marketplace reduces the cost for each LA to build/maintain an open data system. Furthermore, the “Publish once, License to many” approach saves LAs the cost of establishing legal contracts with multiple data users.</td>
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<td>Reduction of transport customer complaints and enquiries</td>
<td>Open data enabled information services improves the traveller experience and reduces related customer complaints/enquiries and associated staff cost. Furthermore, the opening of data has the potential to reduce the number of Freedom of Information (FOI) requests as most of such requests are linked to closed data. In addition to lower staff costs, reducing customer complaints and making information available improves the corporate image of LAs.</td>
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<td>Complying with effective network management obligations</td>
<td>Publishing road traffic data to a data marketplace and accessing data from neighbouring LAs improves the efficiency of the road network and improves cross-border travel services. This helps satisfy the Traffic Management Act 2004 requirements of ensuring effective network management and facilitating traffic movement between neighbouring LAs.</td>
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<td>Savings in transport subsidies</td>
<td>Travellers’ data from an open marketplace helps LAs optimise bus routes, giving greater opportunity to expand profitable routes and reduce the number of under-used routes, reducing the cost of bus subsidies. Furthermore, developed multi-modal travel information services leads to a modal shift towards public transport.</td>
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<tr>
<td>Improving mutual learning</td>
<td>Being part of an LA open data community enables sharing/learning about transport technologies, suppliers, operators, and best practices.</td>
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<td>Avoiding vendor lock-in</td>
<td>Opening their data through a oneM2M data marketplace that supports multi-vendor existing and new ITS technologies creates opportunities for LAs to reduce technology costs and to avoid vendor lock-in.</td>
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### Society Benefits

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<td>Improved road safety and congestion</td>
<td>Opening weather, accidents, roadworks, road surface conditions, and car parks occupancy data enables building information services which can enhance drivers’ awareness and reduce accidents associated with relevant causal factors. Furthermore, such information will help drivers make informed decisions about routes and parking, and hence reduce some of the impact of associated congestion which can in turn improve air quality and reduce the overall strain on the NHS.</td>
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<td>Optimised multi-modal journey decisions</td>
<td>Opening public transport and traffic data as well as user data (through app developers) supports real-time journey planning apps that help travellers optimise their multimodal journeys when public transport services are running on time or in the cases of delays and/or cancellations.</td>
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<td>Reduced environmental impact of the transport sector</td>
<td>Reducing accidents, roadworks and parking related congestion; and encouraging shift towards greener transport modes leads to positive environmental impact.</td>
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<td>Increased interest in local investment and stimulating local economies</td>
<td>Opening transport data leads to an efficient transport system which is an important enabler of sustained economic prosperity with benefits such as improved business/labour market efficiency and agglomeration economies.</td>
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EXAMPLE: Analysing the impact of these causal factors from DfT published statistics on road casualties along with a set of assumptions about the expected reduction of such casualties due to data-driven services and the monetary values associated with such savings (from DfT WebTAG) resulted in a benefits value of £35-58 million (2010 prices) for 25 local authorities over 6 years.

We estimate that by sharing it’s transport data in an open data marketplace, a typical local authority will enjoy an estimated £1.3M of benefits in the first year, steadily rising to £12.8M per year in the 6th year (based on 2016 prices), and continuing to rise thereafter, through the combined categories of benefits in the table above. Further details on calculations are available upon request to the oneTRANSPORT project.

### Chapter 3  oneTRANSPORT: a oneM2M Data Marketplace for the UK

oneTRANSPORT is the first realisation of a oneM2M-based Open Data Marketplace service in the UK. oneTRANSPORT enables any organisation with data relevant to the real-time operation of towns, cities, regions and related transport services (including Local Authorities, Transport Operators and Businesses) to publish this data on Open terms (for example via OGL or Creative Commons licencing), making it available for analysis and use by any other organisation.

The oneTRANSPORT concept began in 2013 in response to an InnovateUK call for solutions to Local Authority transport issues. InnovateUK’s provision of over £2.5M of direct funding, plus significant private sector funding, has enabled a consortium of 11 organisations across the value chain of data-enabled transport services to develop oneTRANSPORT:

- **InterDigital Europe** (Lead organisation): oneTRANSPORT service operator, software platform provider and strong contributor to oneM2M global standards
- **Arup**: InnovateUK project management, Transport sector expertise and market intelligence
- **Buckinghamshire, Oxfordshire, Northamptonshire, Hertfordshire and Birmingham City** County Councils; and **Highways England**: Data providers and use case owners
- **Clearview Intelligence, Traak, Worldsensing** and **Imperial College London**: sensor technologies and Analytics providers

For further details, see [http://oneTRANSPORT.uk.net](http://oneTRANSPORT.uk.net)

oneTRANSPORT provides a 4-year head start in the implementation of an Open Data Marketplace that supports the recommendations of the TSC Briefing Paper in enabling Open and Shared Data in the transport sector.
oneTRANSPORT provides a cloud-based platform that is built from the ground up to manage real-time / streaming data via an Internet-of-Things based architecture, fully compliant with the oneM2M standard. The service allows any organisation to publish data on common open-licence terms, whilst retaining ownership and maintaining full control over what data is openly published. The service enables organisations to optionally charge for access to selected high-value data if desirable.

The oneTRANSPORT service does not require Local Authorities or other data organisations to replace or duplicate existing / legacy IT systems, nor does it replace existing or introduce new transport data standards. oneTRANSPORT interworks with existing UTMC systems and data in any format including DATEX II. oneTRANSPORT has integrated complementary sensor data with data from existing systems, providing local authorities with a gradual and economically sustainable path for adopting new technologies. oneTRANSPORT’s direct engagement and support from Local & Transport Authorities proves that the service can accommodate different geographies, local policy makers and data systems. oneTRANSPORT has also recently been selected to provide data into a European Horizon2020 Intelligent Mobility project Crowd4Roads http://www.c4rs.eu/. Additionally, various commercial entities are also exploring how to offer Intelligent-Mobility related data and services utilizing oneTRANSPORT.

Some of the Local Authorities currently using oneTRANSPORT have published specific use cases to demonstrate the benefits of openly sharing data through oneTRANSPORT. These use cases provide real examples of how an open data infrastructure can be used to reduce the negative impacts on the transport network from major (national) and local regular events, major developments and economic growth as well as traffic accidents and incidents. These three use cases represent challenges faced by local authorities throughout the UK with solutions being applicable to urban and rural areas as well as major cities.

USE-CASE: Silverstone Race Circuit (Major national event)
Silverstone hosts a number of sporting events throughout the year including the Formula 1 Grand Prix which sees over 200,000 attendees in one weekend – most of whom arrive by road. Large events at Silverstone affect a wide range of users of local roads in Northamptonshire and Buckinghamshire and the Strategic Road Network (SRN). This highlights the importance of data sharing among local and national transport authorities to the successful understanding, predicting and managing of event traffic-related issues.

By sharing data through oneTRANSPORT, an integrated real-time understanding of traffic flows throughout the multiple regions around the F1 Grand Prix was visualised for the first time, enabling organisers to optimise traffic in and out of the event, as well as better manage the routing of traffic to suitable parking facilities. The use case also revealed incorrect previous assumptions made about traffic patterns and availability of data from neighbouring regions, and triggered the placement of new traffic sensors to fill key data gaps.

USE-CASE: Watford Match Day (regular significant local event)
Football match days hosted at the Watford Football Club Vicarage Road stadium occur every two weeks during the football season, attracting over 20,000 attendees, and usually causing major disruption within the town centre and surrounding routes to the stadium. The car is the dominant mode of transport for match attendees putting high levels of pressure on the town’s roads and car parks. However, the stadium is served by a variety of public transport links which provides the potential for modal shift.

Data available through the oneTRANSPORT is actively being used to manage the traffic around Watford on match days through the implementation of a number of solutions. Pre-match monitoring of car park fill rates and occupancy allows for VMS around the town centre to advertise alternative car parks for visitors to use, this reduces the queues entering popular car parks prior to the match and the queues within the car park when trying to exit the car parks post match. Interventions based on insights enabled by oneTRANSPORT have significantly reduced traffic queues pre-match and created a more consistent exit rate from town centre car parks upon egress, with no significant worsening of congestion on the town’s inner ring road.

USE-CASE: Oxford Park and Ride (regular daily event)
The Oxford Park and Ride use case provides an example of transport management and promoting the use of public transport to access key urban areas. oneTRANSPORT is used to consolidate a wide range of datasets that are used to inform users of fast alternative transport options, taking advantage of the Park & Rides’ already significant pool of parking and traffic data. The core benefits are:

- Reduced congestion around Oxford’s busy city centre.
Increased usage of bus services and the Park & Rides. This use case utilises a wide range of transport data, applying prediction models created by analytics partners to provide information on the most convenient transport options for any given user. The predictions cover bus real time information, parking availability at both the P&R sites and the city centre (where data is available), and journey times by car into the city compared against those made by buses. An application is being developed that pulls this data from oneTRANSPORT and presents it to travellers journeying into Oxford, generating suggestions regarding the availability of parking and the optimal means of entering the city. The application will also assist with the creation of incentives to support change in travel behaviour.

oneTRANSPORT is rapidly expanding its ecosystem, to enable the Open sharing of transport data nationally. For further details, please contact oneTRANSPORT: Ash Wheeler [InterDigital]: Ashley.wheeler@interdigital.com

