Department for Digital, Culture Media & Sport

Department for Transport

Commercial options for delivering mobile connectivity on trains: Call for Evidence

December 2017

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Joint ministerial foreword

Over the past few years, the Government and train operators have invested in equipping trains with improved Wi-Fi and worked with mobile network operators to address some rail ‘not-spots’. To improve the passenger experience, we are also introducing minimum mobile connectivity service levels in future rail franchises that will improve connectivity on rail routes across the UK.

But we know there is more to do. The rapid growth of mobile data requirements and the prevalence of smartphones and tablets now means that consumers expect high quality, reliable connectivity everywhere. This is why in our 5G strategy earlier this year the Government committed to improving coverage where people live, work and travel. Trains are a key part of that commitment.

Our ambition is to have a rail transport system with mobile connectivity that is world-class and fit for the future. This will not only make journeys more enjoyable and productive for the passenger, but will help improve the operation and safety of the railway and deliver economic benefits for the whole of the UK.

We need solutions which work across the challenging rail topography in urban and rural areas. This is likely to require new dedicated trackside digital infrastructure on busy mainline routes to deliver fast, reliable mobile and Wi-Fi connectivity, whilst preparing for the launch of 5G technology.

We are keen to seek your input on the different commercial and delivery models to meet this goal. Understanding industry’s appetite to engage with Government and Network Rail and meet this challenge is crucial. This call for evidence will help shape our policy-making and delivery plan, and support the Government’s ambitions to have a digitally connected railway that meets passenger expectations and for the UK to be amongst the world leaders in 5G.

Rt. Hon. Matt Hancock MP
Minister for Digital

Paul Maynard MP
Minister for Rail, Accessibility and HS2

Introduction

Railways face particular challenges in meeting passengers' expectations for high quality, reliable connectivity. Existing mobile masts are primarily placed to provide coverage in populated areas and not necessarily along rail routes. Deep cuttings, tunnels, and the 'Faraday Cage' effect of train carriages also make it harder for rail passengers' mobile phones to connect. Additionally, rail safety requirements mean it is not straightforward for industry to access trackside assets to deploy connectivity infrastructure. This has led to a prevalence of 'not-spots', where there is either no signal or insufficient signal capacity to provide connectivity for passengers. These problems affect both mobile phones and on-train Wi-Fi, which typically uses mobile phone networks for 'backhaul', i.e. to connect the on-train service with core telecoms networks.

Both Wi-Fi and mobile signal can contribute to a good quality user experience. Phone users expect a similar range of services available to them over their mobile network to be accessible on trains, while Wi-Fi supports a larger range of portable devices. Through investments in on-train Wi-Fi, the Government and the train operators are enabling passengers to have access to common applications such as email and web browsing - regardless of their mobile service provider. Although current policy is improving mobile phone services over Wi-Fi networks, it needs to be further developed to meet passenger expectations today and in the future.

Addressing the connectivity challenge

The Government is exploring how to improve connectivity for users of mobile phones and other connected devices on mainline routes by 2025, in line with the recommendation of the National Infrastructure Commission. This call for evidence considers the potential revenue streams and models for commercial funding of such a solution.

Rail passenger connectivity is currently largely delivered via mobile phone networks operating from remote (non-trackside) masts, though some other backhaul solutions are also used for on-train Wi-Fi.

Trackside infrastructure is likely to be required to provide reliable connectivity in areas of high passenger demand and in other areas such as tunnels that cannot get line of sight to a radio signal provided from a remote mast.

A trackside model would combine the following elements:

- dedicated trackside infrastructure comprising base stations/masts, fibre to backhaul the signal from the masts to the core telecoms network, and access to power for these systems;
- a radio system external to the train that links it to the trackside system. The radio system including spectrum must be capable of meeting growing passenger demand; and
- in-carriage systems that provide Wi-Fi and/or mobile network connectivity.

Benefits of trackside infrastructure

Delivering a trackside model will involve laying fibre along the rail corridor to provide high speed backhaul for mobile data; mounting wireless devices on masts (and other trackside infrastructure) to transmit the signal to the train; and providing power supplies to these masts. Approaches will need to determine the radio access needs for delivering uninterrupted mobile connectivity, ensure suitable spectrum is made available, and have necessary on-train equipment installed to deliver Wi-Fi and mobile services.

Across the rail network, delivery of reliable and uninterrupted connectivity is likely to involve a mix of:

1. *new trackside infrastructure* along busy mainline routes, where the high aggregate density of passenger demand justifies the required investment; and
2. *mobile phone macro networks* for less busy parts of mainline routes, where the high cost of trackside infrastructure would be disproportionate given the lower level of passenger demand.

Network Rail already owns trackside fibre along parts of the rail corridor. Where possible, it will make available access to trackside assets (e.g. fibre, underground ducts, masts and power) on an appropriate basis, to support commercial models. In those areas where existing assets are not fit for purpose, it will be necessary to build additional trackside infrastructure.

Aside from delivering connectivity to rail passengers, this trackside infrastructure could deliver additional benefits. We are aware there may be a range of benefits beyond the rail corridor, as well as advantages to train operating companies (TOCs), freight operating companies (FOCs), and Network Rail; some advantages could be improvements in transport security, enabling predictive maintenance, or the delivery of rural broadband. There may be an economic case for building additional access points to any new fibre for such purposes.

To help us understand some of the technical and practical deployment challenges of trackside infrastructure, we have announced up to £30 million of funding to initiate a trial on the Trans Pennine route between Manchester and York, in partnership with Network Rail. This will ensure we know how best to make use of existing trackside infrastructure and utilise Network Rail assets, as well as testing suitable track-to-train radio systems to deliver services to passengers under real-life conditions. The learnings from the trial will be made available to all interested stakeholders.

Q1. What do you see as the benefits of deploying trackside infrastructure for rail passengers, the rail industry, and beyond the rail corridor? How can those impacts be quantified?

Q2. To what extent would Network Rail's existing assets be a useful contribution, and what commercial arrangements could be established to encourage this?

Track to train connectivity

A high-capacity radio link and access to radio spectrum is needed to provide connectivity between the train and trackside transmitter/receivers.

We want to provide a model that can effectively meet growing passenger demand on busy trains. Delivery of 100 Mbps to each train, as currently required in some TOC franchise agreements, is unlikely to meet growing demand for data.[1] High quality services on heavily loaded, high capacity trains, would require at least 1 Gbps to each train today - this would support video-streaming to several hundred passengers. Given the expected growth in passenger demand, a realistic, future-proofed approach would be to target backhaul of tens of gigabits per train, particularly on the busiest routes. This is in line with the approach suggested by the National Infrastructure Commission.[2]

The Government will ask Ofcom to identify the bandwidth needed per passenger and per train that passengers ought to expect as a minimum, as they do for households. This should be revised upward as expectations and usage grows. We will base policy requirements on this analysis. Further we will ask Ofcom to set out the spectrum bands that can deliver the data requirements per train described above, and how the bands can be made available for this purpose. The prospects for finding suitable spectrum for trackside connectivity are encouraging, but the time taken to license it under appropriate technical conditions may impact on delivery timetables.

The adoption of a single technical solution across all routes could aid interoperability for trains, but a hybrid model (i.e. different train-to-trackside solutions on different routes) could be the most cost effective if routes have different levels of passenger demand and topography.

Q3. Do you have a preferred radio link solution? Please outline it with details of its likely performance and costs, including mast height and spacing and the radio frequencies it would operate at, and say why you think it is a realistic, future-proofed solution. What other infrastructure would you require?

Q4. What do you think is the appropriate level of connectivity to meet passenger expectations for high quality, reliable voice and data services on busy trains over time? Do you have evidence of this?

[1] Mobile data traffic is set to increase at a rate of 25% to 42% per year (Mobile Digital Strategy, Ofcom, June 2016)

[2] https://www.gov.uk/government/publications/connected-future

Potential revenue streams

Currently TOCs are required to buy connectivity from mobile network operators (MNOs) and others under the terms of their franchises. Those providing 100 Mbps+ can charge for premium Wi-Fi services and passengers' mobile phones are charged as normal where there is service.

Under a trackside infrastructure model, the revenue streams may include:

- use of trackside sites to provide improved mobile connectivity to passengers;
- the sale of premium Wi-Fi services to passengers;
- fees from sale of on-train connectivity to TOCs;
- fees from use of trackside fibre for wider fixed and mobile backhaul, for example providing fibre to rural communities; and
- possible sale of capacity to the rail sector for non-safety related communications.

This list is not exhaustive and we are interested in hearing of other potential revenue streams.

Q5. What sources of revenue should the Government consider in developing a commercial case for investment in trackside connectivity?

Q6. What evidence do you have of the likely scale (relative or absolute) of these revenue streams?

Commercial funding

Any commercial model will need to factor in the complexity of the rail corridor including the operational aspects of the rail industry and the range of stakeholders needed to deliver digital infrastructure. Each route is different with varying topography, levels of existing infrastructure and Network Rail assets, and current mobile coverage. Passenger demand and potential revenue streams will also vary from route to route and within routes.

The Government's objective is to maximise the level of commercial investment in the roll-out of a trackside model. We want to consider how arrangements with stakeholders such as Network Rail, MNOs, TOCs, Wireless Infrastructure Providers and OEMs could achieve this. Our engagement with industry has indicated there is considerable appetite for an industry-led roll-out.

Options may include:

1. Providers compete to build trackside solutions and negotiate technical models with railway sector players as needed.
2. Running a competition(s) for the establishment of 'neutral host' trackside infrastructure models to provide connectivity services to MNOs and/or TOCs. A commercial partner, possibly together with Network Rail, could set up a joint venture to act as an 'Infra Co'.
3. Establishing TOC or MNO led concessions, for example, through obligations in TOC franchise agreements.

This is not an exhaustive list and we welcome further suggestions, particularly those with a significant element of commercial funding.

The length of any connectivity 'concessions' for infrastructure providers, and their alignment with the TOC franchise renewal timetable, should also be considered. The roll-out of the trackside will necessarily be on a phased basis, with due consideration of the TOC franchise timetable and other planned route upgrades or engineering works.

Q7. What commercial models would best suit the cost-effective delivery of appropriate technical and operational solutions? Please give reasons for your view.

Q8. What are the current barriers or dependencies of a commercial roll-out, and how could these be mitigated?

Q9. Do you have a view on whether a national solution or concessions would be the best approach? What is the likely payback period for investors? How could routes be divided into concessions to maximise commercial investment?

Q10. What measures could the Government take to de-risk a commercial model?

Sustainability

The Government is keen that any trackside connectivity solution for rail passengers extends as far as is possible commercially and is sustainable in the long term. We are therefore interested in not only the potential of trackside systems today but their durability and ability to meet future connectivity needs.

Q11. How would we ensure ongoing investment into the infrastructure and on-train equipment to continue to meet passengers' connectivity requirements? How will the technologies deployed be upgraded in the future?

How to respond

This call for evidence will run for 6 weeks from 28 December 2017 to 7 February 2018. Please ensure that your response reaches us before the closing date so that we can consider your evidence.

We would ask you to limit your responses to a maximum of 10 pages, with supporting evidence or data in an annex. We regard the call for evidence as the start of a dialogue with stakeholders and will want to engage further on key points.

Please indicate in your response whether you are responding as an individual or on behalf of an organisation.

Please answer only those questions that you feel are most pertinent.

Responses can be submitted by email to connectivityonrail@culture.gov.uk.

Freedom of Information

Information provided in response to this consultation, including personal information, may be published or disclosed in accordance with the access to information regimes (primarily the Freedom of Information Act 2000 (FOIA), the Data Protection Act 1998 (DPA) and the Environmental Information Regulations 2004 (EIR). If you want the information that you provide to be treated as confidential, please be aware that, under the FOIA, there is a statutory Code of Practice with which public authorities must comply and which deals, amongst other things, with obligations of confidence.

In view of this, it would be helpful if you could explain to us why you regard the information you have provided as confidential. If we receive a request for disclosure of the information we will take full account of your explanation, but we cannot give an assurance that confidentiality can be maintained in all circumstances. An automatic confidentiality disclaimer generated by your IT system will not, of itself, be regarded as biding by the Department.

The Department will process the information you have provided in accordance with the Data Protection Act, and in the majority of cases, this means that your personal information will not be disclosed to third parties.

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