One4HDD Commercial Sustainability

7th April 2025

Commercial sustainability

The One4HDD project is required to produce a business model for sustainability, either sustaining the project and/or its benefits. To support this, Horseguards Consulting* has been engaged to develop this report, providing a structured analysis of commercial opportunities, sustainability pathways, and next steps.

This report is intended for 3 audiences and purposes:

1. DSIT (Project Sponsor): To demonstrate how the project translates into sustainable commercial or societal benefits.

2. **Project Partners:** To provide recommendations on the continued commercialisation of the work and sustaining the benefits already achieved.

3. **Future Investors, Sponsors, and Clients:** To demonstrate market potential and scalability, along with a clear blueprint of how the solution can be adopted and grown.

Grant Funding Agreement 2.3.5 - Business model for sustainability: the continuity of the Project and/or the benefits delivered by the Project following the Term and/or any Extension Period is an important consideration to the Authority's acceptance of the Application. In this light, the Recipient will develop and implement (once approved by the Authority) a business model for sustaining the Project and/or the benefits delivered by the Project beyond the Term and/or any Extension Period.

**Horseguards Consulting is a strategic advisory firm that helps private sector clients maximise the benefits of working with government, bridging the gap between cutting-edge technologies and scalable market adoption. In the ONE4HDD project, Horseguards Consulting has developed the commercial sustainability plan—conducting market analyses, providing strategic recommendations, and ensuring the project meets its commercialisation objectives and DSIT requirements.*

Executive summary

Limited commercial drivers have held back deployment of 5G broadcast to date

The standards for 5G broadcast are mature and have been in development and subject to trials for some time. Widespread deployment has been low as the key industry stakeholders, MNOs and handset manufacturers have lacked commercial drivers.

There is however clear demand for content consumption on the move and at major events, this is currently being fulfilled by dense 5G coverage and smartphone engagement apps, but only at the largest venues.

Disruptive innovation was tested in the project

By enabling multicast to any handset in a non-standard way, the project sought to address a key inhibitor in terms of smartphone availability. By delivering this through a tier two RAN, portable cell on wheels, video content in high density environments could be enabled in a cost-effective way.

Clear market gap identified

Focus groups, market research and demonstrations identified that the unaddressed mid-tier market for sports and cultural events was a current gap but required the right business model proposition to be successful.

Despite obstacles, the project delivered successful demonstrations

It was not possible to get the complex interaction between handset, air interface and base station to support an alternative multicast solution to work in the timescales of the project. However, the tier two RAN cell on wheels and integration with broadcast streams and delivery to handsets was trialled with potential customers. Active interest from venue owners has been identified as an opportunity for future business.

The project participants validated demand and identified revenue enablers

The project participants were encouraged by the demonstrable demand, focus group and demonstration feedback from venue owners. They felt that the technology needed to mature, and that the ecosystem needed further development to support revenue generation, and to be demonstrated to more customers.

5G broadcast interest is growing

In parallel to the project, high profile events such as the Olympics were used to trial 5G broadcast on UHF spectrum, encouraging high profile manufactures to produce prototype handsets based around standards.

Future focus on standards and supporting commercial deployment

As interest in standards-based 5G broadcast is increasing the two main factors to address are the deployment of standards-based technology in handsets and building features that enable revenue generation (e.g. Dynamic Ad Insertion) into the ecosystem.

Contents

- Concept definition
- Market context
- Market validation
- Commercialisation options
- Recommendations & next steps

Concept definition

An agreed definition of the service concept was required to test with industry stakeholders and to compare with other industry developments. We based this definition on the use case terms used in the focus groups.

Concept definition

The following definition was used to define the product/service

Product

The project set out to deliver a service capable of providing ‘multicast’ video to many concurrent devices from a private network base station.

- Using an air interface modification to avoid the need to use 3GPP broadcast mechanisms (MBS)
- This modification being applied to a local, private base station
- As a result, with the right software in the handset, any handset could receive the broadcast content, supporting many concurrent users

Support for previous generations of 3GPP broadcast technologies has been low with operators reluctant to roll it out, and not many handsets enabled.

The prospect of **working on any handset** together with the ability to **avoid the need to require undeployed features** in the operator’s network is a potential game changer.

Use cases

Use cases centre around live events with many attendees benefiting from a video or rich content feed. These events can quickly swamp existing networks attempting to provide multiple high bandwidth unicast content streams.

Examples of such use cases are:

- Live sports events – Golf, Football, motor racing horse racing etc
- Cultural events – Festivals, indoor and outdoor concerts, esports

These use cases are a good fit for local, high density coverage, potentially on a temporary basis.

ONE4HDD Sport – Focus Group use case definition

ONE4HDD is set to revolutionise the experience of watching live sports in different venues and locations all over the UK. Using advanced 5G streaming technology on an app on your smartphone or tablet, 1.4 HDD will give you real-time access to multiple high-definition video streams plus synchronised audio options, all while the action is unfolding live in front of you.

ONE4HDD will bring you closer to the sport event via your device, so that you'll no longer be restricted by the view from your seat or vantage point.

For stadium sports, like football and rugby, you can see the game from different angles, watch replays and access information at half-time from other matches or exclusive content from the team before kick-off.

For distributed events like athletics, racing, golf or F1, you can see live action from areas that can't be seen all the time from your vantage point, plus see additional viewpoints like on-board cameras.

To accompany the video, there’ll be access to a range of audio options to compliment the live action bring an insight from behind the scenes, onboard mics, commentary, so you’ll no longer have to guess what’s happening on the other side of a racetrack or wonder what the commentators are saying about the goal your team just scored – you’ll have it all in the part of your hand.

Thanks to the 5G technology behind ONE4HDD, unlike at most busy venues where accessing mobile services can be difficult, you won’t have to worry about issues such as buffering stuttering and poor picture quality that often happen when you’re trying to stream video in public places and venues. It won’t matter how many people are trying to stream video via ONE4HDD at the same time, your viewing experience won’t be affected. Additionally, the data used will not impact your allowance.

Music features/benefits – focus group briefing

Concert venue experience (e.g theatre, arena, stadium)

- Multi angle views of stage
- Close ups on band members
- Concert info (e.g. set lists, band members)
- Pre-show behind scenes footage
- Venue info
- Advertising

Distributed events experience (e.g. festivals)

- Live streams and audio from across the event
- Multi angle views of stages
- Concert info
- Behind the scenes
- Event info
- Advertising

Technical features

- 5G technology
- Guaranteed capacity: visual/audio quality assured irrespective of crowd size
- No impact on users’ data allowance

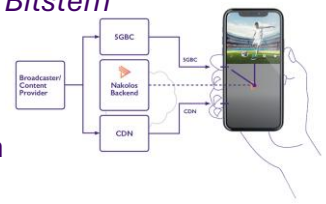
Market context

In this section we carried out primary research, spoke to industry stakeholders, and reviewed analyst and project materials to get a wider context of the progression of 5G broadcast, including inhibitors to deployment and uptake.

5G Broadcast trials

Trials are progressing from proving technology to demonstration at major events

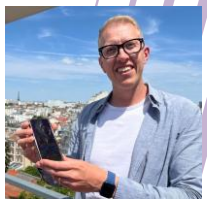
Nakolos
ORS Group
Bitstem



Television de Galicia
Telefonica
Nokia

5G Media2Go
Ateme
France Télévisions
Orange

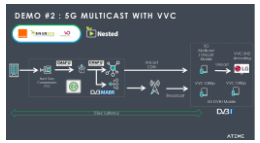
Free to air Vienna
ORS
Kronehit
ProSiebenSat.1 PULS 4
Servus TV
Vienna University of Technology



Paris Olympics
Rohde & Schwarz
Ateme
Xiaomi
Qualcomm
TDF
France Television

2021 | 2022 | 2023 | 2024 | 2025

Free to air Barcelona
RTVE
Cellnex
Rohde & Schwarz



Roland Garros
Ateme
France Télévisions
Orange

Eurovision Song Contest
Ateme, EBU, France TV
ORS, Qualcomm, RAI, SWR

WWOO 5G TV Station
WWOO
Ateme
Westpond Technologies
Rohde & Schwarz
Qualcomm
Nakolos

One4HDD Brands Hatch
Ateme
DTG
Imaginary Pictures
University of Surrey
VMO2

5GF Tours
Ericsson, Samsung, Nokia
TIM, OTE, Orange
RAI

MotoGP Austria
Nakolos
Dorna
Qualcomm
Bitstem
Insys VT

Multi/broadcast standards have been around for a long time but issues with device and operator support have held back deployment.

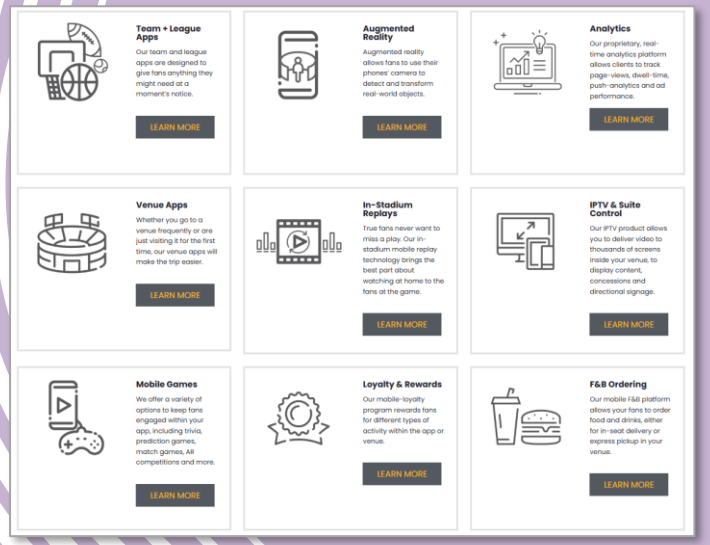
- Industry tests identified a threshold of 3 concurrent users where it becomes more spectrally efficient to use multicast
- Unicast can deliver a good video experience through Adaptive Bit Rate. However, this can impact cell capacity for others.
- Widely known that getting a usable signal in stadia is a problem. Lots of interest and investment in that is going on today.
- Standards and industry bodies such as 3GPP, 5G Xcast, EBU continue to look at developing content and uni/multicast enhancements. The problem has always been device and network support.
- Mainstream take-up for new features has been dependent on Apple to put MBMS on their roadmap. Still no support announced as of today.
- Hard to dimension a public network for big events, however the networks have developed their mobile, temporary ‘cells on wheels’ solution, has been in place for some time for key events.
- Interoperability is key, do you need an eSIM and how does that effect the experience?
- Standardisation is key - no interest from OEMs or operators in anything non-standard

Deployment issues have held back use of multicast. A technique that works on existing networks and devices could be of interest, but there’s no interest in non-standard approaches

ONE 4HD DTG Virgin media O2 ATEME IMAGINARY PICTURES UNIVERSITY OF SURREY

Dense 5G connectivity and multi-functional fan engagement apps and platforms are a reality today

- Dense 5G connectivity seems to be a reasonably established reality for the top tier events / venues
  - ‘Saturation’ coverage in Stadia common in the US and becoming more common in Europe, eg Tottenham, Wembley, Principality, Twickenham, Anfield, Allianz, Wolfsburg
  - UK MNOs have a full schedule supporting major events with ‘cells on wheels’ such as Glastonbury, Badminton horse trials, Wimbledon, Royal Ascot, Silverstone, Reading and Leeds festivals, Scottish Open, London Marathon etc
  - Bespoke solutions for the Coronation, Taylor Swift, Qatar World Cup, PGA etc
- However, the infrastructure for permanent high density coverage is very expensive and difficult to justify for occasional demand. A reduced cost and/or temporary solution could open the opportunity to more venues and events.
- Fan experience apps and enhanced connectivity seems to be a reasonably established reality for the top tier events and venues.
  - Yinzcam app platform used for F1, Golf, Olympics, horse racing, NFL, NHL, Premier league etc
  - Singtel F1 multi-camera solution deployed over locally enhanced 5G SA, network slicing for premium app users
  - PGA Championship app, PGA Tour app, tension.se, Onsite Sport



Enhanced fan experience is being delivered today, but mostly at the top tier venues and events. Dense 5G is capable of delivering a unicast solution, and functionality beyond streaming. However, the cost dynamics mean this is a solution only for the largest venues.

Initial views from industry stakeholders across the value chain validate the analysis

- History of non-deployment (broadcast / multicast) despite technically working in the 3G/4G/5G world.
- ‘5G broadcast is in its infancy’ (GSA) 23 trials and pilots in 12 countries tracked.
- Deployment and commercial issues have held back broadcast / multicast, network and device support being a critical factor.
- Smartphone fan engagement demand is substantiated by reports and growing usage but is being solved in different ways.
    - Smartphone fan engagement is an opportunity that many clubs and sports are pursuing aggressively. Platforms and provider ecosystems are developing.
    - Dense coverage for top tier events is being achieved through traditional public networks and supplemented by temporary coverage. There may be space for mid-tier solutions.
- Interoperability is a key factor.
- Potential route to standards, with a major name, *IF* something special (i.e despite all the hard work that’s gone into standards)
- Standards support will be critical to the operators and device manufacturers. A route to standards is best pursued through organisations with the links and experience in the standards world.
- Broadcasters have trialled both broadcast on UHF and Multicast on higher spectrum.

Proof points exist for the demand of smartphone fan engagement at events, from research to real world usage.

- **One4HDD** focus groups identified distributed sports and music events as the best venues for the proposition, with some scepticism on pricing
  - Notably, participants did not question the feasibility of the technology, instead demonstrating full acceptance of features such as replays and multi-camera viewing options.
- The focus group outcomes are supported by analyst reports such as **Deloitte.**
- Research from **Ericsson** calculates that arena venues are seeing a 67% growth in data usage year over year, noting that fans in stadia now demand high-performance, robust and reliable mobile coverage to share, interact and stream content. (Ericsson)
- 5G-powered tech across UK rugby and football matchday ecosystems – from hospitality to broadcasting – could add £250m+ to UK sports economy per season from 2029, whilst also boosting the fan experience in and outside stadia. (**Vodafone**)
- The **GSMA** 5G User Behaviour survey found that 25% of smartphone users consider enhanced user experiences in venues an attractive proposition that they might pay for.

"When asked about what additional capabilities they would want on their mobile device while attending live professional sporting events, 77% said they would like to watch replays, 68% would want the ability to view the action from a different angle, 59% want to watch the game from a player's point-of-view, and 35% of respondents would want to look at augmented reality overlays with player stats.

Unsurprisingly, younger sports fans (Gen Zs and millennials) are more likely to be interested in these enhanced capabilities. Some leagues, teams, and stadia are ahead of the game–so to speak–with platforms and apps that allow fans to watch replays, see live stats, play interactive games, and chat with other attendees."

Source Deloitte In-Stadium Experience

There is a substantiated opportunity for fan engagement by smartphone

Market validation

Market size

In this section we took the high potential use cases identified in the focus groups and analysed the size of the relevant events to identify suitable, mid-tier opportunities. From this we derived a UK market sizing for the relevant segment of opportunity.

Market size - methodology

- We started with the defined concept, delivery of video content at high density events to many handsets at the same time.
- We looked at the areas of high and medium potential as identified by the One4HDD focus groups.
  - Distributed and stadium sports
  - Festivals
  - Stadium / arena shows
- For sports we analysed in-person attendance in the UK, then for the sports which may be suitable for smartphone content identified location, capacity and frequency of events.
- For music we identified the key festivals in the UK, attendance figures and noted those which already have mobile operator temporary coverage using Cells on Wheels.
- We haven't looked at stadia and arenas as these are best suited to fixed infrastructure.

Different levels of potential by sport and music event

	Sport	Music
HIGHER POTENTIAL	Distributed sports, Cricket	Festivals
MEDIUM POTENTIAL	Stadium sports	Stadium/arena shows
LOWER POTENTIAL		Theatre/club shows

Strongest role for One4HDD within distributed events. Sport has greater relevance than music overall

"One4HDD lends itself best to sport, particularly distributed events, and cricket. Music festivals also provide a good fit.
- More realistic use cases
- Greater relevance of more functions
- A real enhancement of event experience"

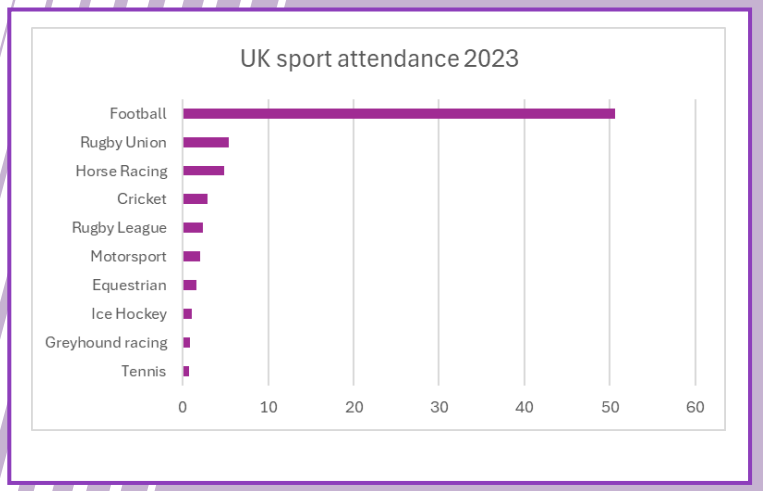
One4HDD Focus Group Research

Using assumptions on the relevant type and size of event enables us to estimate the number and scale of events relevant to the One4HDD proposition

Potential market - sport

- **Football** has high attendance and many events per venue with broadcast deal and content blackouts, though more suited to permanent infrastructure.
- **Horse racing** attendance is focused on a smaller number of big events. Bookmaker streaming and broadcast deals for bigger events. Major events covered by operator CoW.
- **Rugby union** attendance is dominated by internationals, but these are mostly operator 'covered' stadia. Broadcast and streaming options for internationals. Similar infrastructure requirements as football.
- **Cricket** has a low number of high attendance events. Broadcast video and audio for major matches.
- **Motorsport** attendance varies widely, events concentrated in Summer. Main events have live stream or broadcast deals. Supplemented coverage at Silverstone for the Tier 1 events.
- **Golf** has a few major events, mostly with broadcast options .
- **Cycling** has small number of events, but huge viewing figures and comprehensive content production, broadcast and streaming options. Very large event space makes it unsuitable for event coverage.
- **Tennis** is dominated by Wimbledon, which has operator temporary coverage and broadcast rights.

Assuming that Football, Rugby are best suited by permanent infrastructure and cycling is too large an area, that leaves **Horse racing, Cricket**, **Motorsport** and **Golf** as potential sports.



Source Statista / Two Circles

	Tier 1 Locations	Tier 2 Locations	Events per location
Horse racing	10	47	30
Cricket	18		10
Motorsport	10		*31
Golf	9		9
Football	18	20	36
Rugby League	12	14	22
Rugby Union	4	11	22
Cycling	4		*4

* Total events across all locations

Source primary research

Potential market – festivals

- There are 29 major festivals with an average attendance of 68k
- Events are very concentrated over three months in summer
- Glastonbury is densely covered by all operators with multiple cells, experimenting with dedicated apps, esims, and 5G slicing
- About half of the festivals have one or more operator CoW solutions

Mobile operators have an active schedule of temporary coverage

UK mobile operator EE has confirmed that 125 network upgrades are being installed on temporary 4G and 5G masts across the country this summer.

Virgin Media O2 will be deploying temporary masts at 29 major events and festivals as well as in 12 of the UK's most popular staycation destinations this summer.

UK operator Three is using temporary masts to improve coverage during summer festivals. The UK telco has been named official connectivity partner by Live Nation, an entertainment company that organises many festivals in the country.

With over 120 deployments planned, Vodafone's fleet of COWs will be kept very busy throughout the year. Some events will receive more than one unit, depending on terrain, the size of the event area and estimated number of attendees.

Festival	Attendance	CoW
Glastonbury	210,000	Y
Wireless	135,000	Y
Download	130,000	Y
Trnsmt	120,000	
Reading	100,000	Y
Leeds	100,000	Y
Carfest	100,000	
Parklife	80,000	Y
Victorious	80,000	
Radio 1 Big Weekend	80,000	
Secret Garden Party	80,000	
Summertime Ball	80,000	Y
Boomtown	75,000	Y
Creamfields	70,000	Y
Godiva	69,000	
Green Man	60,000	
Boardmasters	53,000	Y
Isle of Wight	50,000	
Kendal Calling	45,000	Y
Bestival	40,000	Y
WOMAD	40,000	
Latitude	40,000	Y
Bluedot	25,000	
Truck Festival	25,000	
Slam Dunk	23,000	
Lytham	20,000	
End of the Road	20,000	
Whitby Gothic Weekend	8,000	

Source: primary research

Potentially 15 festivals that don't currently have one or more operator temporary solution

Market sizing

We've used the following assumptions to estimate the addressable market:

- Event types indicated from Market research (relevant outdoor sports, music festivals)
- Exclude events where operators already provide temporary coverage, both sport and festivals, usually tier 1
- Large crowds (generally >20k to 50k)

Catgegory	Addressable market	Content	# events
Horse racing	Biggest events (eg Cheltenham) have temporary operator coverage. Assume 2 big events at each tier one track per year. Year round.	Content is produced at track, broadcast rights via bookmakers and TV broadcast.	100
Cricket	Only internationals and major competition events have sufficient attendance. Summer.	Broadcast rights for content	30
Motorsport	F1 and MotoGP get operator coverage, remainder Tier 1 and 2 events are UK events of international interest, and BTCC. Spring to Autumn.	Broadcast rights for content	28
Golf	Attendance dominated by Open and PGA, 9 large attendance events. Summer based.	Broadcast rights for content	9
Festivals	28 major festivals of which 13 have temporary operator coverage. Summer based.	Biggest festivals have broadcast coverage (BBC, Sky)	15
		Total	182

100% penetration would require around 5-10 parallel events at peak

Market validation

Current solutions & competition

In this section we looked at current provision in the event coverage space identifying the broad set of capabilities required and highlighting current organisations working for the MNOs to deliver temporary coverage.

What does it take to provide a temporary coverage at an event

A service provider needs to provide the following services, together with any content feed integration.

- Spectrum
- Site survey
- Line of sight
- Access negotiations
- Event and security pass mgmt.
- Generator deployment
- Monitoring
- Fuel management
- Installation & commissioning
- Rigging
- Microwave & backhaul
- Manage, maintain, warehouse and deploy infrastructure

A multicast solution can use less spectrum and less infrastructure, but current deployments given an indication of scale.

Glastonbury

Vodafone deployed 10 masts and several small cells, experimenting with 5G slicing for operational use. EE use 9 sites, VMO2 8.

Reading / Leeds

Three deploy four sites at Wireless festival (50k visitors) 5 x 4G bands and 2 x 5G bands. Approx 50% connected with 5G, download / upload splits was 80/20 aiming for 50 Mbit/s speeds.

Providing temporary coverage is likely to require multiple cells and a set of deployment and operational services

CoWs services competition

All four MNOs provide a schedule of 30 – 150 events each year receiving temporary coverage.

Some of this work is sub-contracted to wider services providers in the event & telecoms infrastructure space

Three are communication partners with **Livenation**, who organize several festivals. **Gresham Communications** provide the CoWs service, up to 14 events in parallel in August.

Mitie, major suppliers to Cornerstone, claim to be the largest temporary mobile infrastructure provider in the UK.

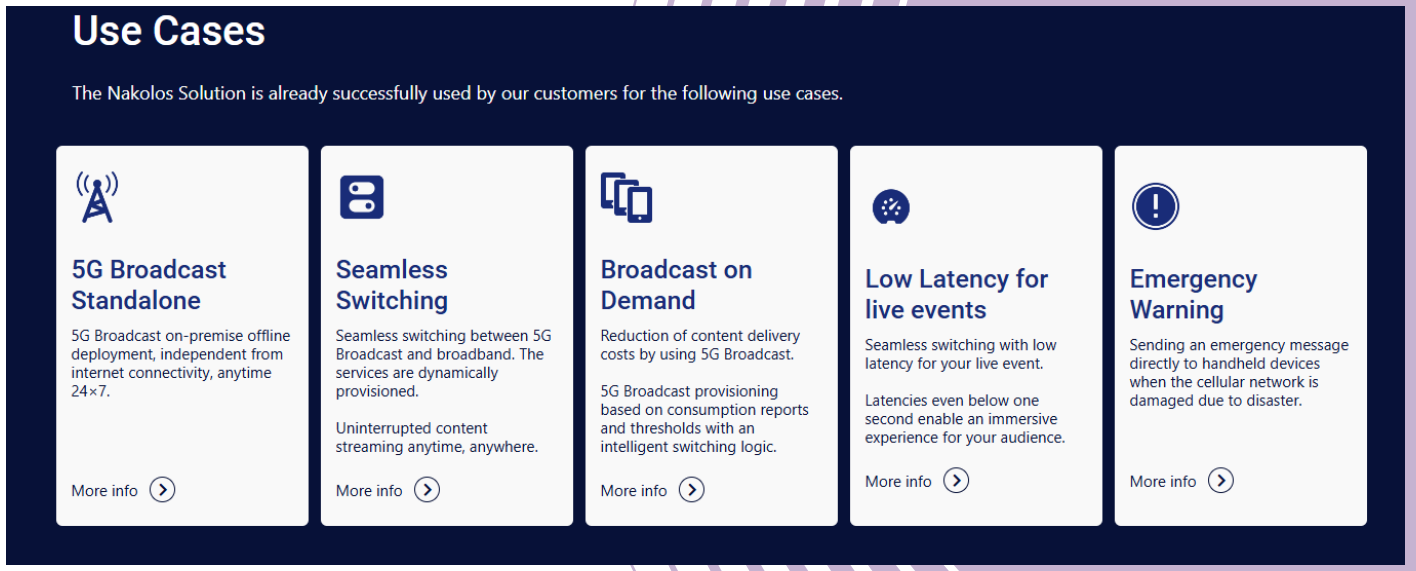
Existing broad telecoms services suppliers include CoWs services, to the MNOs. These organisations provide a wide variety of services with multiple teams and infrastructure to support the current schedule of events.

Event broadcast competition

Nakolos, a project of the Austrian Broadcasting Service, provide a 5G core, transmitter and middleware for integration with streaming apps.

Being part of a broadcaster gives them access to content rights, relevant organisations and production knowhow.

They appear to still be at a trials stage, but are exhibiting at MWC and IBC.



Nakolos although still at an early stage, could be a template for the product and service model, albeit with some technology changes

Market validation

Customer personas

This section details the customer personas for potential customers to provide insight into their drivers and requirements.

Customer Personas

We identified sample personas for potential customers of the proposition.

These personas identify the motivations and requirements for potential customer segments.

Working through these personas and considering the proposition, we see:

1) Festival organisers' needs are well aligned with the proposition. However, about half are already serviced by mobile operators and there's currently no 'paid for' service.

2) Stadium owners are potentially aligned, but the more frequent events point to the use of permanent infrastructure. Top tier venues are already covered by operators, usually with sponsorship or partnership deals. A modified proposition around broadcast and fixed infrastructure might bring them into play.

3) Sports organisers are more interested in growing audiences and engagement to those outside of the event. They may be interested in making their content available more reliably at the event, although existing streaming options and improvements in public network capacity are factors against.

4) Broadcasters already have content streams and have trialled delivering alternative broadcast technologies at sports events.

Festival organisers

About

Outdoor events with large crowds, usually held in Summer. Generally younger demographic. May use organizer such as Livenation.

Attendance: 68k avg

 # events: 1 per site, about 30 total

Data Use: High (215TB Glastonbury)

Required: A few days over Summer

Goals

- Customer experience
- Safety & utility
- Efficient operations

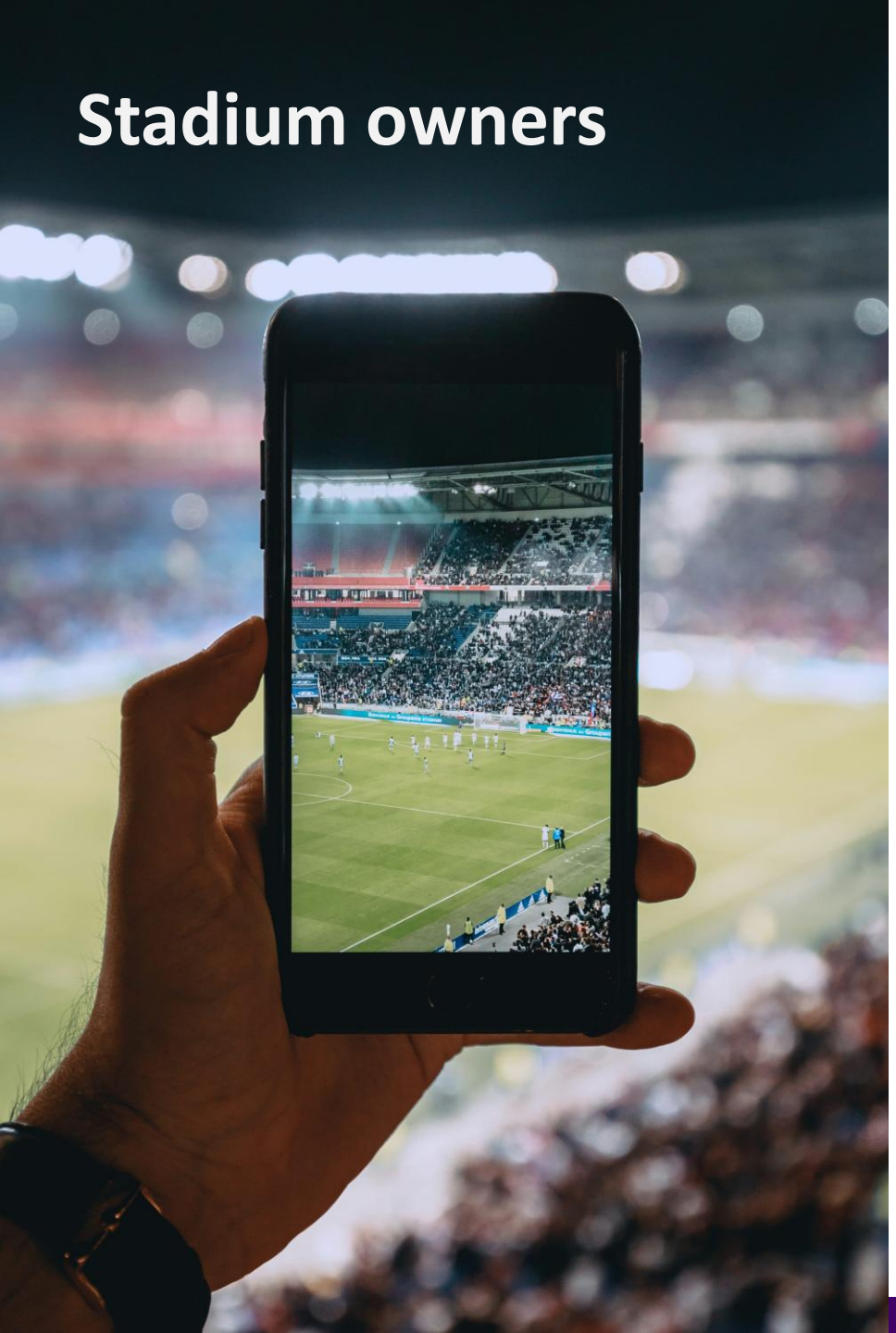
Uses

- Social media, messaging
- Event management
- Streaming broadcast?

Requirements

- 24/7 support
- Turnkey solution
- Zero touch

Stadium owners



About

Stadium owners, usually associated with a team or a sport.

Attendance: 40k – 25k (avg)

 # events: 30 – 40 per site

Data Use: High (5 TB Wembley)

Required: Most of the year

Goals

- Customer experience
- Safety & utility
- Efficient operations

Uses

- Content production
- Safety cameras
- Half time results

Requirements

- Permanent infrastructure
- Private networks
- Around the stadium coverage

Sports organisers

About

Governing body, for example Golf, Cricket, Horse Racing, Football. Own the rights to the content, negotiate broadcast fees.

Attendance: 12k to 250k

 # events: 5-20 events per day

Data Use: medium to high

Required: Most of the year

Goals

- Customer experience
- Fan engagement
- Fan insight
- Growing audience
- Growing sponsorship

Uses

- Content distribution
- Promotion & marketing
- Directions & discounts

Requirements

- Permanent infrastructure
- Private networks
- Around the stadium coverage

Sport organisers / bodies are more focussed on audience growth and accessibility away from the event.

Broadcasters

About

Broadcast and streaming content owners. Have content they want consumed as widely as possible.

Subscribers: 6m*

 # events: thousands

Goals

- More places to view
- Consistent video experience
- Wide availability
- National deals

Uses

- Proprietary app
- Broadcast
- Streaming

Requirements

- Wide availability
- National deals
- Standard devices

Commercialisation options

We worked with the project participants to map their commercialisation options against a taxonomy developed in DSIT. This helped to identify the different methods of commercialisation open to them, and to focus on future opportunity.

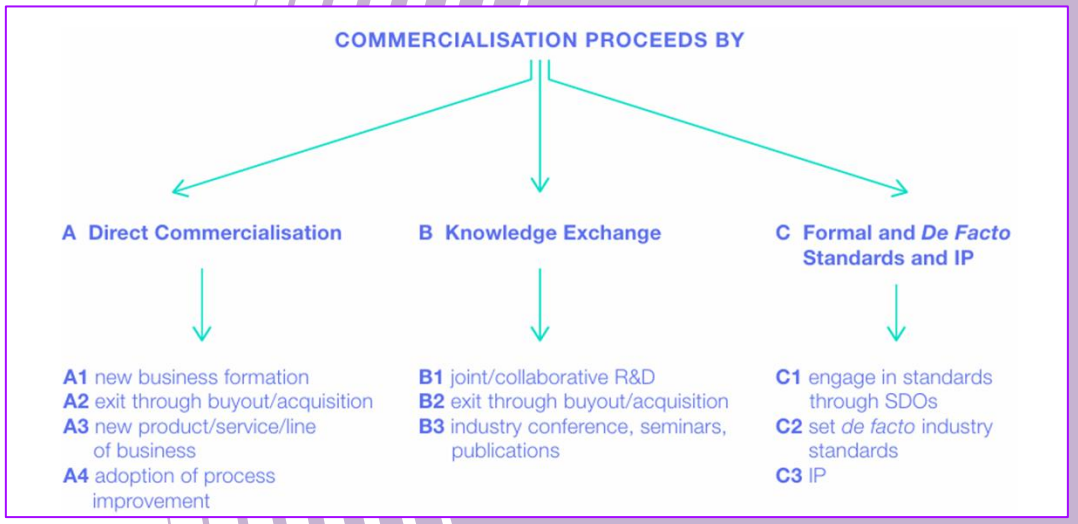
Commercialisation options

The potential commercialisation routes for the project were examined against a DSIT taxonomy for commercialisation:

Although the project demonstrated evidence of market demand and positive feedback from events and trialists, participants concluded that the technology is not yet sufficiently mature for immediate Direct Commercialisation (route A).

However, the individual participants identified commercialisation options for their own organisations to take from the project and expressed interest in working together to promote performance, scalability and commercial models, all of which are needed to realise the opportunity presented. Recognising the opportunity, each organisation has committed significant funding to any extension.

They also identified potential customers who are willing to explore the opportunities presented, providing the opportunity for a new service / line of business (A3).



Each organisation has driven commercial benefit from the project, and there are many opportunities to ‘fill in the gaps’ to support commercial adoption on a wider basis

Imaginary pictures

Overall Imaginary Pictures has learnt more about the market's requirements and customers. They see the potential for their services, enabled by a new class of technology for use between the existing high-end broadcast content production and UGC. However, the technology is not yet mature enough to support this as a commercial service and they have realised that the ecosystem needs further stimulation, especially with content and venue owners.

Commercialisation through the project

1) Have developed market and technology understanding through **knowledge exchange** via collaborative R&D
2) Still interested in the intersection of new technology, mid-tier events/production, but needs a full ecosystem to be market ready

Potential future commercialisation

1) **Potential future new (or extended) service**, when the technology is more mature

Participant feedback on commercialisation

- There is interest in the idea (from the right venue / rights owners), and opportunities (if it did work) for Imaginary Pictures services.
- The core technology (multicast over adapted air interface) hasn't worked, but the appetite to deliver content to handsets is there.
- There is potential to connect mid-tier production equipment over 5G, which could be a valuable solution if successfully implemented. However, at present, deploying fibre remains a more cost-effective and practical option, and several organisations are already focused on this approach.
- High end broadcast production is growing, but is owned by large established companies today
- Content production in the mid-tier is a possibility, something less than broadcast production, but greater than UGC. However, it needs to be fully working and cost effective. Cost and timeline to deploy needs to be clear and reasonable.
- Through the project, we gained valuable insights into user needs and the feasibility of various approaches. While some aspects show promise for future development, significant progress is still required before they become viable for commercial use.

Ateme

Ateme has learned about the market and are developing functionality to support revenue generation through Dynamic Ad Insertion and ‘error correction’ for broadcast. These features are required across the value chain, not just in Ateme products, but to grow the overall ecosytem. They see these features as fundamental enablers of revenue streams to support takeup.

Commercialisation through the project

1) **Exploring the market**, and what is needed, through **collaborative R&D**
2) Through **joint R&D** identified product features and ecosystem requirements for revenue generation

Potential future commercialisation

1) Helping value chain partners realise commercial revenue through **de facto standards** for Dynamic Ad Insertion

Participant feedback on commercialisation

- The project’s air interface modification didn’t work. This could have been a game changer in terms of handset support. This is showing that standard air interfaces (5G Broadcast or 5G MBS) are the way to go. 5G Broadcast seems the most mature, benefiting from the traction by European Broadcast Operators, but progress from 5MBS need to be monitored as well.
- The project gathered feedback and market research about some venues having potential, for example the Brands Hatch session showed that large screens are not optimal.
- This year has seen more traction on broadcast but needs more to tip adoption to the mainstream.
- The Main issue for handset broadcast is handset availability.
- Ateme considers the following additions as important for the commercialisation of 5G broadcast:
  - Dynamic Ad Insertion, important to enable revenue generation and hence uptake of service.
  - Improve broadcast robustness by retrieving missing blocks from unicast.
  - Efficient usage of radio resources by leveraging statistical multiplexing.
- Ateme is providing solutions for the head-end (encoder/packager/multicast server), not (currently) for the player or the app. Work in this project, and others, can help to drive the overall ecosystem (especially devices) and demonstrate business cases (e.g. DAI) to create pull factors to grow the whole market, of which Ateme is a part.

University of Surrey

UoS has conducted research that has been applied by commercial partners through the course of the project. This research has also been disseminated through papers and demonstrations, enhancing UoS's profile in this space.

Commercialisation through the project

1) **Knowledge exchange** through presentation of papers at Future Networks World Forum 2024 and IEEE
2) Further **knowledge exchange** through a demonstration in the Surrey testbed of adaptive, context sensitive cross domain security in IPTV delivery

Potential future commercialisation

1) Potential for Intellectual Property in the field of quantum encryption and using LKH for large scale broadcasting
2) Working with the UoS Technology Transfer Unit on further opportunities for **direct commercialisation**

Participant feedback on commercialisation

- Required integration of security technology across multiple domains, with different companies.
- Developed next generation, more robust key distribution like LKH and cryptography for presentation at conferences and seminars.
- Use of quantum algorithms could potentially be patentable. These are not yet standardised in Europe.
- Adaptive security models, based on the capabilities of the device are of future interest.
- Short projects are not conducive for feeding into standards – it takes a long time to work through and requires strong support from industry.
- The team will discuss commercialisation with the spin-out unit and industry partners.

VMO2

VMO2 already provided Cell on Wheels solutions to sport and cultural events. They were also interested in the potential evolution of equipment and services, especially as an alternative to the Tier 1 network equipment vendors. As an integrated mobile, broadband and TV provider they also wanted to understand the viability of broadcast or multicast technology for IPTV over mobile.

During the project VMO2:

1) Monitored the development of tier two RAN CoW technology from a tier 2 vendor
2) Understood more about the delivery of IPTV over mobile using broadcast techniques

Potential future commercialisation:

1) A2 some **knowledge exchange** through collaborative R&D
2) A3 **potential future new (or extended) service**, either over parts of the public network or through localised coverage for venues [1]

Participant feedback on commercialisation

- Already a provider of coverage to large events
- Provider of infrastructure and coverage at large venues, typically where they have a sponsorship deal
- Interested in neutral host and venue deployed infrastructure
- As a mobile operator with a TV business is interested in using multicast and broadcast for spectrum efficiency reasons
- Would like to see uptake of 5G MBS services by network and handset OEMs

[1] *"This (deployment of 5G-MBS) is a natural use case for operators which can either serve venues over their own public 5G networks or deploy a small private 5G network in collaboration with the venue owner."*

(ReTHINK 5G Broadcast report)

DTG

DTG has led the project, seeking to bring together a potential game-changer to allow local high density broadcast through R&D.

Although the specific innovation of non-standard air interface was unsuccessful, the overall requirement and opportunity for stable broadcast at venues and events was validated. The need for a technical solution that supports revenue generation to drive a commercial business model for deployment has been highlighted, potential customers identified and the value chain for a turnkey service clarified.

There is now an opportunity to take the proposition to early market adoption by combining the key elements available.

During the project DTG:

1) Trialled local high density broadcast delivery suitable for mid-tier events
2) Identified the key business model and technical requirements

Potential future commercialisation:

1) Set up a working group for 5G Broadcast / MBS way to continue knowledge exchange, status updates, showcase developments, coordinate demos and speaking at industry events, as well as drive further innovation **(B1 & B3).** This will support other commercialisation types for others, such as VMO2 and Ateme.

Summary


ONE 4H
DTG
Virgin media
O2
ATEME
IMAGINARY PICTURES
UNIVERSITY OF SURREY

Market and project findings

Market context

- Mobile broadcast technology has been available in standards for some time, but deployment has been held back by lack of business case.
- Deployment and commercial issues have held back broadcast / multicast, network and device support being a critical factor.
- ‘5G broadcast is in its infancy’ (GSA). 23 trials and pilots in 12 countries tracked.
- Despite prototypes from smaller companies such as Xiaomi, the large handset vendors Apple and Samsung do not have 5G broadcast planned for their products in the near term.
- Industry tests identified a threshold of 3 concurrent users where it becomes more spectrally efficient to use multicast.
- Unicast can deliver a good video experience through Adaptive Bit Rate. However, this can impact cell capacity for others, especially in dense environments.
- It is widely known that getting a usable signal in stadia is a problem. Significant interest and investment is now seeking to address the issue.

Market validation

- There is evidence of demand, and a growing supply market, for fan engagement by smartphone at events.
- Top tier sport and cultural events appear to be satisfied by dense operator coverage and app platforms today.
- The total number of events for mid tier UK events in the high potential sectors of Sport and Festivals is 182 per annum (total addressable market).
- Revenue / cost case models for this market need to be demonstrated, with current services provided by Operators for free (to the event).
- Contents rights ownership for most of these events might mean that broadcasters are the best customer segment for the proposition.
- There are existing services providers in the temporary coverage space, but not with a broadcast / multicast focus.

Project outcomes

- Multicast to current handsets through software would have been a ‘game-changer’ if it could have been made to work.
- Dense mobile coverage at events delivered with Open RAN equipment has been demonstrated.
- Market research has quantified demand and outlined the competitive situation, with a target market of mid-tier sport and cultural events.
- Focus groups and demonstrations have validated and provided feedback to the concept, and commercial options.
- Raised interest in potential customers, willing to participate in future work.
- Identified need for features to support commercial uptake, such as Dynamic Ad Insertion.

ONE 4HD DTG Virgin media O2 ATEME IMAGINARY PICTURES UNIVERSITY OF SURREY

Commercialisation summary

Exploring a Business Model for Event Video Content Delivery

The evolving business landscape of video content delivery at sports and cultural events is shaped by several factors, technological challenges and opportunities. This project has examined the business model for such a domain, highlighting proven demand, technological hurdles, market analysis, and future potential.

Importance of Revenue Generation

The project also explored innovative factors for revenue generation, such as dynamic ad insertion (DAI) and error correction techniques. DAI enables personalised and context-sensitive advertising, which is pivotal for appealing to broadcasters and expanding market opportunities. Such features align with broadcasters' goals of generating revenue while enriching viewer engagement.

Proven Demand for Event Video Content

Video content at sports and cultural events meets a significant and growing demand. Enthusiasts seek immersive experiences and broader access to live and on-demand coverage, whether attending in person or remotely. The consumer appetite for high-quality, accessible content underscores the business case for innovative delivery methods to address this requirement.

Potential for Mid-Tier Content Production

There is a clear potential for mid-tier content production at venues. Positioned between broadcast-quality production and user-generated content (UGC), mid-tier content offers an affordable yet polished alternative that can serve audiences effectively. By leveraging broadcast and multicast technologies with high density coverage, event organizers can meet diverse content needs, unlocking new revenue streams and fan experience.

The Role of Integrators such as Imaginary Pictures and Future Projects

Imaginary Pictures' interest in technology that demonstrably works points to the importance of real-world application and customer validation. The next phase could focus on showcasing proven solutions to potential customers, developing the market through pilots and demonstrations. This iterative approach would build trust and highlight tangible benefits to broadcasters and advertisers.

Accelerating Handset Adoption

Dynamic ad insertion and other innovative features depend on widespread handset adoption. Demonstrating the revenue potential and consumer demand for such features can catalyse adoption. Organizations like DTG could play a pivotal role in accelerating handset feature integration, bridging the gap between technology and market readiness.

Game-Changer Technology and Handset Support

Our experience over many years and backed up by recent industry interviews from the likes of Ericsson, Apple and Samsung, has been that whilst 4G and 5G broadcast technology has been standardised it has been the lack of commercial drivers that has held back deployment. The opportunity to deliver multicast content to any handset through a non-standard radio air interface change, as originally intended for the project, could have been a game changer in this respect. However, the technology couldn't be made to work adequately.

Standards-Based Approaches and Market Adoption

Meanwhile adherence to standards, especially in UHF (Ultra High Frequency) spectrum with true broadcast, is gaining traction. Standardized approaches ensure interoperability, reliability, and scalability, which are vital for commercial viability. A practical demonstration of these standards at Brands Hatch illustrated the potential to deliver consistent, high-quality experiences. High profile demonstrations and interest of major players from the Paris Olympics trial have added to momentum.

The business model for video content delivery at sports and cultural events hinges on integrating proven demand, standards-based technologies, and innovative revenue mechanisms. By addressing technological challenges, exploring mid-tier content production, and focusing on market development, this approach can unlock significant opportunities for broadcasters, advertisers, and event organisers alike.

ONE 4HD DTG Virgin media O2 ATEME IMAGINARY PICTURES UNIVERSITY OF SURREY

Recommendations

By incorporating standards-based 5G broadcast into the Cell on Wheels, the service would be ready for marketing to high profile venues

- Backhaul
- Content
- Core
- RAN
- Device
- Spectrum
- Venue
- Broadcast rights

Content delivery and curation as a turnkey service for mid-tier venues

Standards incorporated into low cost and portable tier two RAN platforms to work with standard handsets

Address commercial drivers through lower cost deployment, turnkey solutions and monetization options.

The project has identified the gaps to direct commercialisation for a service aimed at mid-tier venues and events and is ready to demonstrate to high profile customers

Next steps

The project has successfully demonstrated, and validated the demand, for 5G video content multi/broadcast at sport and cultural events.

To be a fully commercial proposition requires incorporation of broadcast standards into venue network solutions and implementation into mainstream handsets. Feedback from project participants and wider industry stakeholders has demonstrated interest in developing the commercial solution rather than technology trials.

Based on the project findings and participants' strategies, the recommended next steps are:

1) Promote the opportunity and commercial drivers for high density 5G deployments at events by bringing together broadcasters, network equipment and handset OEMs and venue / event promoters **DTG/VMO2**

2) Incorporate 5G MBS standards into RAN equipment **Wavemobile**

3) Develop dynamic ad insertion and error correction facilities as part of codec integration into players and apps **Ateme**

4) As standards-based equipment becomes available, develop a content curation & production service for venues and events **Imaginary Pictures**

5) Identify opportunities for paid research into end-to-end security of 5G MBS with content owners and broadcasters for **University of Surrey**

"This (deployment of 5G-MBS) is a natural use case for operators which can either serve venues over their own public 5G networks or deploy a small private 5G network in collaboration with the venue owner."
(ReTHINK 5G Broadcast report)

References

References

5G One4HDD/Customer focus groups

Brands Hatch Customer Focus Group Results

Creating a better in-stadium fan experience | Deloitte Insights

In-stadium experience | Deloitte Insights

Consumers in Focus: 5G User Behaviour Survey Dashboard 2024

TDF and France Télévisions Broadcast DTT in UHD Quality and Test the Mobile DTT of Tomorrow – Ateme

TDF and France Télévisions trialling UHD on DTT and 5G Broadcast (broadbandtvnews.com)

5G could add millions in revenue to sports, thanks to better ticketing, payments and even broadcast, says Vodafone study | Telemedia Online

Seamlessly complex: Bringing 5G to Cardiff's rugby fans (vodafone.co.uk

Boardmasters partners with Vodafone for 2024 and beyond (vodafone.co.uk)

Vodafone launches brand new official Glastonbury app (vodafone.co.uk)

Moo-sic festivals 2023: how COWs made a summer of strong signal (vodafone.co.uk)

Technology: 5G revolution offers unique stadium possibilities – StadiumDB.com

Vodafone, Tele2 advance 5G fan offerings - Mobile World Live

UK Operators Dial Up Coverage at Major Events - CCS Insight

Keeping Festivals Connected - CCS Insight

EE PREDICTS BUSIEST EVER SPORTING WEEKEND FOR MOBILE DATA: EE

Deloitte Sports Industry Outlook 2024 | Deloitte

How The Open uses AI, digital twins and private 5G to modernise golf's oldest championship - SportsPro (sportspromedia.com)

Why special events can be a special headache for mobile operators - The Mobile Network

5G Broadcast: What can consumers expect? | Qualcomm

High speed racing and low latency 5G Broadcast distribution at the MotoGP™ in Austria - Nakolos

Towards Broadcasting Linear Content Over 5G Network (researchgate.net)

5G Broadcast : GSA

5G Broadcast Adoption Forecast 2024-2033 - Rethink