

ICT-687655

Delivering Single and Multi-Screen Content Services for Immersive, Customised and Shared Experiences in Homes and Social Spaces



D6.2 Interim Report on Dissemination, Standardisation and Exploitation Planning

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Abstract

This document provides an update of the 2-IMMERSE project exploitation and dissemination activities that was previously described in deliverable D6.1. The exploitation assets that have been identified in D6.1 are updated and enhanced with partner specific exploitation plans.

An overview of dissemination activities to date is given together with a plan for future publications, talks and presentations of project results.

From the standards perspective we regard the relevant parts of DVB and HbbTV standards for multi-screen applications as being stable, with a focus on supporting-actions like the test suite. A related activity in MPEG has emerged since the publication of D6.1, MPEG MORE - Media Orchestration. Based on an internal analysis of current drafts, the standardization section gives a brief summary about where we, may contribute to MPEG MORE, though we only anticipate such contributions being sensible towards the end of the project.

This is the second report of 2-IMMERSE work package 6. A final update of this document will be issued before the end of the project.

Target audience

General public. Everybody interested how results from 2-IMMERSE are planned to be exploited and disseminated.

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Executive Summary

This document is an update of D6.1. It provides an update on our plans for the exploitation and dissemination of project results. It also includes project achievements in those two areas to date.

- The exploitation strategy and plans have been revised, by adding detailed plans per partner, including a mapping to a number of asset categories. Whilst the plans relate (of course) to the assets the project expect to create we recognise that sometimes value can come from unexpected sources; we will take additional exploitation opportunities as we recognise them.;
- The dissemination list has been updated, and reports on early publications, an updated digital ecosystem (improved webpage and new Twitter account), as well as workshops and dissemination events carried out by our partners;
- The standardization section includes a more detailed list of relevant standardization bodies and their particular working groups. An assessment is given where project partners see potential for contributions of project results, and where an existing activity may influence the 2-IMMERSE architecture.

This document presents the innovation management for the knowledge created in the H2020 Project 2-IMMERSE. Besides being a source of information for the public, it also serves as a guide for the 2-IMMERSE consortium partners and as information source for the European Commission.

Innovation management in 2-IMMERSE includes the exploitation, dissemination and potential standardisation of project results within and outside the member companies. The aim of 2-IMMERSE is to build four different pilots on a novel platform for multi-screen services. The expected assets that shall be exploited from the project are grouped into the following categories:

- Exemplar productions
- Production Tools and Workflow Insights
- Reference Architectures
- Reference Implementations
- Design Specification and Insights

We provide reports per partner of how such assets will be exploited.

In terms of dissemination our key target audience is people in the broadcast value chain including public venue owners and the technology developers who will extend our platform to deliver new experiences in the future. The main dissemination channels are the web site, deliverables defined in the technical annex, workshops with practitioners. e.g. programme makers, trade fairs, etc.

The 2-IMMERSE architecture will build on open standards recognised and deployed by the broadcast industry. The project will evaluate their applicability for its four pilots, extending or modifying specifications if necessary. This shall be fed back into standardisation. New specifications arising will be evaluated for their applicability for the project, e.g. as happened with MPEG MORE in year 1 of the project. Active membership of 2-IMMERSE partners in relevant standard bodies are documented and updated from D6.1

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1 Introduction

2-IMMERSE is funded under ICT-19, with the following scope:

The focus is on research, development and exploitation of new or emerging technologies (e.g. 3D and augmented reality technologies) for digital content creation to support the creative and media industries and for unlocking complex information and media and interacting with them.

2-IMMERSE is an Innovation Action, as opposed to a Research & Innovation action. Its focus is more on taking ideas and concepts out of the labs and into trials than on developing concepts within labs. The Work Programme describes innovation actions thus.

Innovation Actions

Demonstration of the viability of new technologies and validation of innovative solutions through large scale demonstrations, pilots or testing of use cases so as to guarantee sustainable deployment that facilitate convergence and integration between broadcasting, broadband Internet-based services, audio-visual and social media. Multimodal and multidisciplinary approaches for searching technologies responding to the new demands from the content side (3D, user-generated, real-time media, social media, ...) and from the user context (context-centric, semantic, relevant community feed-back, ...). This also includes new forms of experiencing environments (immersive, surrounding, multi-sensory and interactive, in any device, always connected).

2-IMMERSE seeks to develop more immersive experiences that bring together TV and on-line services based on the use of multiple screens and an adaptation in the way content is delivered to those screens that enables customised and personalised delivery of content.

This document describes the framework and initial thoughts and activities through which 2-IMMERSE will manage the innovation within the project and seek to maximise the impact of its work and results.

Section 2 of this document describes the framework we use to manage innovation and exploitation. It introduces our attempt to categorise the different types of asset we expect to exploit and includes reports from each partner about the steps they have taken and the steps they expect to take to exploit them further.

Section 3 describes our dissemination approach with an initial analysis on our target audience and then a breakdown of the different channels we use to reach these audiences. It includes early successes in terms of dissemination.

Section 4 describes our approach to standardisation, highlighting the standards bodies to which we have access and the ways in which standards influence the 2-IMMERSE architecture and how results from 2-IMMERSE may be fed into the standardisation process.

2 Innovation Management and Exploitation

In the first version of this deliverable “D6.1 Innovation Management and Initial Exploitation Plans” we identified six categories of asset that project partners may exploit and five mechanisms that might be used to exploit them. The initial categorisation of the asset types was a best guess. As with most categorisations, it is not perfect and in this new version of the deliverable we have slightly updated the taxonomy. Specifically we have refined “New forms of multi-screen programming” to be “Exemplar productions”. This is because the former suggests too strongly that the service prototype we develop in the project should become a new service. The service prototypes may be directly transposed as new services but they have more general value when seen as exemplars – i.e. good examples of what is possible.

Standards related assets will be discussed in the standards section and will not be directly referenced in the exploitation section of this document.

We also anticipated that the project might create design specifications but failed to note that there would also be *design insights* – the difference is that the latter feels more like a craft practice knowledge, a bit of know-how or guidance rather than an attribute that can be tightly defined.

D6.1	D6.2
New forms of multi-screen programming	Exemplar Productions
Production tools insights and workflows	Production tools insights and workflows
Standards related	<i>(Standards activity will not be repeated in the exploitation section but is described in the standards section.)</i>
Reference architectures	Reference architectures
Reference implementations	Reference implementations
Design specifications	Design specifications and insights

Figure 1 Showing how the categorisation of assets has changed between D6.1 and D6.2

In D6.1 we also identified seven mechanisms through which we thought assets might be exploited. In this deliverable we eschew a strict categorisation and try to focus more pragmatically on what 2-IMMERSE partners are doing, plan to do and hope to achieve as a result of involvement in 2-IMMERSE.

This update of the initial deliverable provides in section 2.1 more detailed descriptions of the assets. Sections 2.2 to 2.8 provide updates, on a per partner basis, of the steps being taken to effect exploitation. Finally, 2.9 discusses IPR management.

2.1 Assets – short descriptions

The section highlights the assets that we know 2-IMMERSE has created (or is creating). We categorise the assets as:

- Exemplar productions
- Production Tools and Workflow Insights
- Reference Architectures
- Reference Implementations
- Design Specifications and Insights

2.1.1 Exploitation of Exemplar Productions

A key asset that 2-IMMERSE will develop is the set of exemplar prototypes, i.e. the four prototype service use cases described in D4.3¹. These can be used to help ‘sell’ both the concept of Object Based Broadcasting and the platform we use to distribute the productions

The assets will work best when they are compelling and persuasive and enjoy the best craft design in terms of normal TV attributes – content quality, framing, editing, graphics, animations etc. It helps that the project is working with first class, valuable content sources from RSC, the Football Association and Dorna Sport. It will also help that the assets we are developing are being trialled in highly situated deployments and that the feedback we receive will, as far as is possible, reflect the users’ experience in a normal viewing situations.

2.1.2 Exploitation of Production Tools and Workflow Insights

Having developed a micro-services based platform for object-based media, 2-IMMERSE recognises some implications for workflow changes required to achieve object based media delivery for multi-screen entertainment experiences. We hope to generate some tools that will make the workflow for object-based media simpler. In the meantime we have sought to identify how an object based media approach could be useful in current media practice.

2.1.3 Exploitation of Reference Architectures

The architecture used within 2-IMMERSE is a reference architecture for Object Based Media Delivery. The Architecture description has been kept quite high level and is presented in a way that highlights the similarities and points of difference between the current platform and the approach 2-IMMERSE is taking. The motivation is to emphasise the similarities of the two platforms and to help current technology platform operators assess the technical migration that might be necessary to support object based media delivery.

2.1.4 Exploitation of Reference Implementations

The project is the custodian of a specific implementation of software relevant for multi- screen synchronisation. Two libraries relevant to multi-screen synchronisation in particular should be highlighted.

- The "dvbcss-clocks" library, which provides a convenient abstraction for accurately modelling timing and the relationships between multiple related timelines in real-time without having to do all the maths yourself. It is useful for applications that want to do frame accurate sync and/or represent complex timeline relationships between the elements of a presentation (e.g.

¹ Deliverable D4.3 can be downloaded from the web site www.2immerse.eu

videos that start and different times, text/graphics scheduled to appear at particular moments etc.).

- The library provides a software abstraction of a "clock" that represents a position on a timeline, and allows the application to set its relationship to another timeline. The clock objects then do all the maths needed to calculate current time positions, or to schedule call-backs when the timeline reaches a particular position, etc.
- The "sync-protocols" library. This implements clients and servers for the DVB CSS synchronisation protocols. It uses the clock abstractions from "dvbcss-clocks" to model the timeline of the TV or the companion's estimate of the TV's timeline position.

Note: These two libraries combined basically a reimplementaion (in Javascript) of the python "pydvbcss" libraries the BBC released in 2015 [1]

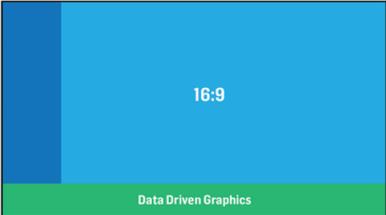
[1] <https://github.com/bbc/pydvbcss>

2.1.5 Exploitation of Design Specifications and Insights

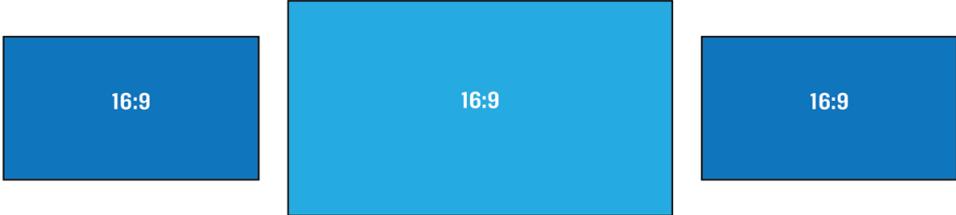
2-IMMERSE is generating design insights required to develop object based broadcasting. Such insights may be gained from experiments that did not work, as well as insights from experiments that seemed to be more successful. These craft insights are slowly appearing but have not yet been rigorously documented. They will include craft practice guidance from practitioners. We have already identified the following examples of design guidance:

- Candidate guidance (Being tested): Attending Theatre is ritualised and a general working approach in developing mediated versions of highly ritualised experiences is to adopt and reflect the rituals in the multi-screen representation. In the case of the representation as-live of theatre productions this has been approached by not allowing viewers to use video chat whilst the play is running and to not allow the play to be paused or rewind. It also embraces the familiar interval.
- From the Football experimentation, the project has gained a clear sense that in designing multi-screen experiences based on fixed screens in public spaces it is sensible to consider a 'primary viewing area' – an area that a viewer can view without moving their head(Figure 2.)

1. Single screen



2. Landscape – Landscape - Landscape



3. Portrait – Landscape - Portrait



4. 3x2 Video Wall



Figure 2 Illustration of different screen layouts that may constitute a primary viewing area. Of these option 3 is the only one we have not seen in UK bars carrying sport.

- It is bad practice to offer more than one representations of the game as a whole within the primary viewing area. This is why the design choices iterated towards offering additional shots of the manager and the crowd.

- The choice of shots of the manager and the crowd plays to the tribal nature of the occasion and helps build empathy, for the partisan viewer with their ‘tribe’ placed in the stadium by allowing you to observe and mirror the behaviour of the leader (the manager) and of your supporter peers.



Figure 3 A screen grab from a render of showing three synchronised shots taken from the match. Whilst not obviously incomprehensible as an image - the video version soon becomes very uncomfortable to watch.

- From the MOTOGP experience the lack of responsive design for TV screens has become apparent. With normal broadcasting a single render of a screen design is broadcast to all viewers. This means that viewers receiving on a handheld device or on 65” TV screen receive the same image – just scaled. Object based broadcasting approaches provide broadcasters with an opportunity to adopt responsive design techniques borrowed from web page design world (see Figure 4 and Figure 5). To do so the clean feed of, in this case the race, needs to be accompanied by the objects such as the data and rules required to render the leader board in the way most appropriate for the screen on which the flattened composite image will be displayed.



Figure 4 Showing the leader board scaled from a size readable on 32” screen (the left hand screen). When scaled to the 65”, the TV on the right, the text becomes unnecessarily large and occupies too much screen real estate. (The example is more convincing on actual size screens)



Figure 5 Showing how a leader board remaining the same actual size on screens of 32” and 55”. It remains readable but releases additional screen real estate which could be used for PiP of for example the bike cam (The illustration is more convincing on actual sized screens!)

- From synchronisation experiments carried out in WP3 we have found that, when watching a theatre production in which words spoken are being highlighted within a transcript displayed on a second screen delays between the text being highlighted and spoken between -0.5 and +1 second were within the tolerance of audiences (-ve implies highlighting leads the audio). See Figure 6.

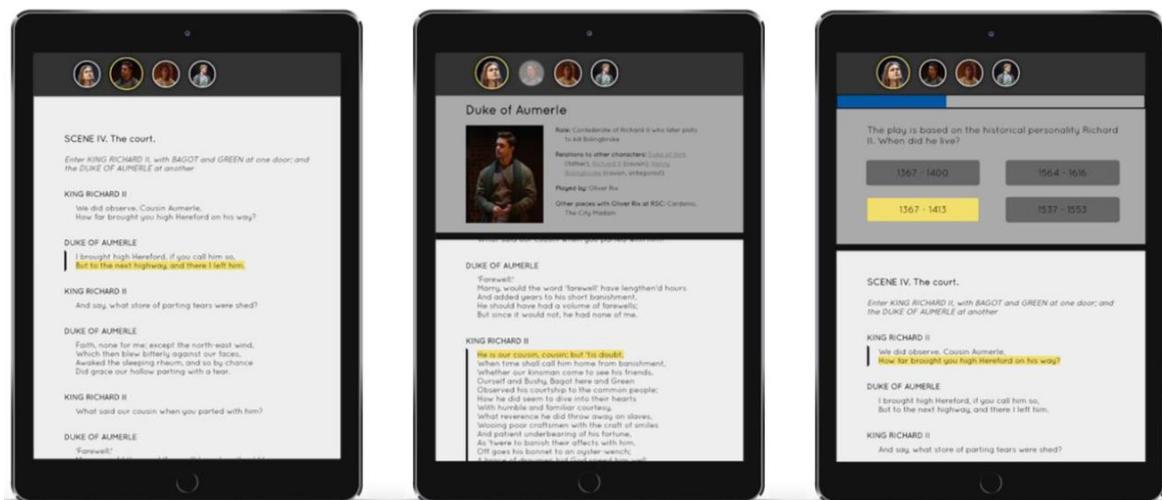


Figure 6 Showing the three modes of transcript highlighting used in our multi-screen synchronisation experiments. No differences in the reported assessment of coherence between the two screens was observed provided synchronisation was between -0.5 and +1 second.

2.2 BBC Exploitation Activity and Plans

The BBC (British Broadcasting Corporation) is a public service organisation. Its core mission is to inform, educate and entertain audiences and to contribute to the success of the Creative Industries in the UK.

BBC R&D's role is to enable the BBC to fulfil this mission now and in the future through the effective use of technology.

The BBC believes that digital convergence across the technologies and processes within media production and distribution brings new opportunities for programme makers and audiences. BBC R&D has been working to imagine how the BBC and the wider industry can take advantage of these opportunities.

Internally, BBC is pursuing a project called IP Studio that provides a foundation to enable the creation and storing of the elements of a film, radio or TV programme as media objects. This allows them to be composed flexibly based on the needs and intension of audiences, producers and broadcasters, offering closer relationships with audiences, wider use and reworking of media content and tailored delivery to suit time, duration, location, mood and capabilities.

Through prototype testing with audiences in the lab and pilots broadcast online BBC R&D has been exploring the value and feasibility of object based media approaches for production and audience engagement. We believe that this offers the key to creating increasingly immersive media experiences that are:

- Personal – tailored to the requirements of individuals, changing the media experience accordingly.
- Adaptive – optimised to the media device and format to give the best experience in real time, regardless of the manufacturers.
- Dynamic and responsive – they respond to the needs of the audience during playout in terms of length, depth of interest, location, preferences, lifestyle and age.
- Interactive – the audience can select specific areas of content to focus on and on which device to view different aspects of a broadcast.

- Immersive – content presented in environments that give the audience enhanced experiences that can be perpetual and pervasive and delivered through multiple formats (audio, video, 360, VR, MR) to suit the time, location, attention and intention.

Project 2-IMMERSE supports these ambitions and supports them through collaboration – another key pillar of the royal charter as it applies to BBC R&D function.

2.2.1 Exploitation of Exemplar Productions

The BBC aims to give people across the content value chain insights from the exemplar productions through dissemination at conferences, through internal checkpoint meetings and through internal and external workshops. Workshops and presentations will be facilitated by our broader work across Object-Based Media which has been presented at festivals and conferences and made available through the BBC's Taster platform for audience review. We will also seek to involve some stakeholders that we judge to be influential and important to dissemination and adoption, in the trials themselves. This will allow them to experience the prototype multi-screen services at first hand.

We have signed up BBC R&D's Business & Innovation Development manager to the Theatre in Home trials. He is an advocate for Object Based Media Production and potentially for 2-IMMERSE within the BBC and BBC World-Wide.

All our object-based work is shared with the BBC's IP Studio team to inform the building a delivery platform for end-to-end IP Broadcasting across the BBC and its partners. BBC R&D shares all its progress with the Dir of Products and Systems (Neelay Patel) for foresight and strategy synchronisation. Meetings with BBC Sport including Technical Executive (Charlie Cope) responsible for live coverage of events such as the Olympics and the World Cup have confirmed the relevance of 2-IMMERSE where learnings from the sports exemplars will be important but the technical platform architecture and implementation insights will be of most value.

2.2.2 Exploitation of Production Tools and Workflow Insights

There is no simple path to achieving adoption of novel approaches in an industry that is generally quite conservative and risk averse. Unsuccessful experiments with live services that could reach millions of people has the potential to cause significant loss of confidence in a new format and in some cases brand damage.

The BBC wishes to encourage and showcase innovations and aims to do using:

- BBC Taster: <http://www.bbc.co.uk/taster/>
BBC Taster provides a safe space to showcase new productions to audiences – framed as an experimental zone for new ideas to try, rate and share. The Taster team provides a gate-keeping process that will support and enhance experimental productions as well as offering a destination where such experimental productions can be found and promoted. Whereas, we do not expect to house or deliver the 2-IMMERSE experimental production through BBC Taster, the rights situation prevents this but should the opportunity arise to test an experience which can be explored using other content or as part of BBC rights authorised service we will take the opportunity to get the work in front of Taster audiences
- Community of Practice (CoP)
By sponsoring and encouraging a community of Practice the BBC hopes to develop a group enthusiastic explorers of new technology and experiences and hopes to encourage producers to develop innovative ideas and to learn from each other. Earlier awareness is created through presentations and workshops describing early results and ambitions backed up by accessibility to open source software and early prototypes. As the technology and the production craft

implications mature commissioning through a sandbox-style process run by BBC's Connected Studio create polished prototype experiences. With VR examples of these have been the award winning 'We Wait', 'Home' and 'Turning Forest' https://www.youtube.com/watch?v=9kKLM_9DrYA. These and others were made available on BBC Taster.

- **Software**
The BBC recognises that software tools can be helpful and the BBC are committed to making software tools available for our growing community of practice through open source licensing agreements. In 2016 the Object-Based Media team released the second open source version of an experimental video library (Video-Context) enabling late composition of media <http://www.bbc.co.uk/rd/blog/2016-04-videocontext>. As part of 2-IMMERSE, legal representatives from partners are in discussion now (May 2017) to negotiate the licensing under Open Source of the two Java Script Libraries that may be available for use by the wider community. These are the dvbcss-clocks" library and the "Sync protocols" library described in the assets section.

Object-Based Media (or Broadcasting as it is sometimes called) is one of the top 5 priorities for BBCR&D. Regular reviews and checkpoints take place with the head of BBCR&D and his immediate staff (Andy Conroy) and the head of the Design and Engineering division which hosts BBCR&D (Matthew Postgate). As a significant project within this area 2-IMMERSE tools and workflow insights have a ready and critical audience of influential people within the BBC's technical management team. In order to influence the commissioning and production sides of the BBC Taster and Connected Studio have been significant but make progress it is also necessary to engage the hearts and minds of creative individuals, to understand their practices and to build trust in the value of new technologies and craft practice (if required).

In the same BBCR&D section as 2-IMMERSE we have a project investigating the resulting production workflows and potential changes to production craft caused by digital convergence and IP broadcasting (New Production Workflows). Through the overlap between this project, 2-IMMERSE and the IP Studio team we will share and exploit insights that help us to build a community of practice and influence the design of object-based production tools beyond multi-screen experiences.

The BBC and BT will both be present at a 'Workshop on Designing Interactive Systems', June 10th-14th 2017. This Edinburgh based event is inviting those involved with designing non-linear narrative based TV to share their experiences and will attract 'designers, artists, psychologists, user experience researchers, systems engineers, and many more, come together to debate and shape the future of interactive systems design and practice.'

2.2.3 Exploitation of Reference Architectures

The development of the 2-IMMERSE platform architecture and its evolution as a result of the pilot service trials feeds into BBCR&D's Object-Based Media technology and narrative and its view of the requirements for the new IP Broadcasting system. 2-IMMERSE is testing the idea of distributed media apps as the basis for experience design, delivery and engagement. This goes beyond the notion of single companion devices and associated on-line material to accompany a TV broadcast and is significant for the evolution of BBC iPlayer.

2.2.4 Exploitation of Reference Implementations

It is hoped that the implementation of the platform will form the core of a scalable, extensible and sustainable tool for exploring flexibly composed services. The challenges of implementing the platform are already informing broader R&D thinking about the scalable IP delivery of multiple streams to multiple devices and multiple people.

Within the BBC there is an initiative to design a more open platform for the delivery of live events. 'More open' in this context means more open for the delivery of content from outside the BBC. This notion was a topic covered in the recent Royal Charter review and emphasises the BBC's broader role to help the creative and cultural sectors to reach their audiences. 2-IMMERSE comes at a timely moment when the BBC business units are responding to this challenge and open to input from R&D. At our last meeting with BBC Sport the idea of a live events platform was discussed. Our intention to build a platform extensible enough to support further experiments across sports and genres was well received. Currently there is more interest in the platform and the distributed media app implementation than the service pilots per se within the BBC. A success for the 2-IMMERSE project would be to deliver an 'on-boarding' module as part of a live events platform or at least design specifications and the insight which lead to them. By on-boarding we mean the system and processes that enable audiences to sign up for and share an experience with family, friends and others.

2.2.5 Exploitation of Design Specifications and Insights

Design implications arising from the technical and the human interaction and information needs of audiences are currently being shared with BBC Sport, the broader Object-Based-Media team and the IP Studio team through meetings at MediaCityUK. We will also pass on our conclusions through the 2-IMMERSE website and at events aimed at building a Community of Practice amongst developers and producers. As the results of the pilots and software releases become available, 2-IMMERSE content will become a feature in our internal and external presentations and workshops. The rolling agenda for this year's events are:

- Newcastle 'Startupweek' May 18th;
- DIS 2017 10th June
- Bristol Watershed June 22nd
- Tech Open Air Berlin July 11th
- BBC Cardiff Sept 18/19th
- 'Mozfest' Fringe 23rd Oct.

Through these events we share our insights and experience and connect a community of enthusiasts and hopefully inspire others. To date these events have focused on our work prior to 2-IMMERSE.

2.3 BT Exploitation Activity and Plans

BT's purpose is to use the power of communications to make a better world.

One of BT's more successful businesses is our UK consumer business through which we sell TV and broadband services. The role of the BT Research and Innovation team involved in 2-IMMERSE is to help BT's operational teams to understand, and make use of, innovations relevant to TV. This includes offering both technical insight but also in helping to frame and articulate the commercial benefit that such innovations may bring.

In 2-IMMERSE, a core focus is on showing how emerging specifications such as HbbTV can enable our TV business to create compelling new experiences for audiences in different contexts using an object based approach to TV production and delivery.

Our exploitation plans will seek to use the assets generated in 2-IMMERSE to progress the aim of enabling the commercial production and delivery of object based media productions.

2.3.1 Exploitation of Exemplar Productions

Whilst we will not shy away from sharing our findings, our primary focus will be on influencing the operating division within BT. We have channels to BT operational teams, to BT TV platform teams

and to BT TV commercial sales teams. We will work with each of these teams to make the case for object based media productions.

Our working relationship with the BT Sport operational teams is currently centred on 360 video capture opportunities; these are outside the scope of 2-IMMERSE and, in any case, pretty much business as usual. The relationships developed here help us to promote the ideas that 2-IMMERSE has, and to gain help in accessing the content resources we need to enable the 2-IMMERSE vision.

The two use case of most interest to BT are MotoGP and Football and these have yet to come to trial. In anticipation of these trials and in an attempt to build support necessary to execute the trials well, we have developed mock-ups of the service experiences and share these at appropriate opportunities.

The MotoGP mock-ups form the centre piece of interactions between Andy Gower from 2-IMMERSE, BT Sport and, on rarer occasions, DornaSport. The mock-ups are designed to create interest in the work we are conducting and have been central to 2-IMMERSE being granted access to content assets to which we do not have rights under the existing rights agreements under which we broadcast the MotoGP races.

The Multi-Screen Football experience is aimed at enabling pubs and clubs to offer their clients a better more engaging experience. We are working, through our BT TV commercial sales team, with a particular UK pub chain. We have held sessions with them and this has helped us understand their needs and the way they use football to support their goals. Turning this interest into a solid business proposition is a significant task and there is considerable uncertainty around the business case. Developing a business case is not in the scope of 2-IMMERSE; for the BT project partners in 2-IMMERSE encouraging BT to develop a business case would be a success.

On January 11th 2017 we demonstrated to a pub chain and to BTTV producer editors the mock-up of the multi-screen football experience. The representative of the pub chain were extremely interested in the idea of uplifting the way they present sport in pubs and the BT Sport producer and the BT TV Commercial sales teams immediately started ruminating on the commercial framework that could support such a development. Due to the nature of current distribution of sport to pubs (i.e. via satellite, a mechanism that is not well suited to object based delivery) no plans are yet in place to seek more robust business models.

To stimulate wider awareness of and interest in the multi-screen service for pubs and clubs we will showcase our mock-up of both the football service and of the MotoGP experience at BT's Innovation 2017 event (June 12-16). The event provides an opportunity to share our ideas with the BT TV team, with BT TV commercial sales teams, and with press and investors. The specific messages we want to share include (in order of increasing technical specificity):

- That Object Based Media provides a method for delivering personalised TV
- That HbbTV2.0 conformant devices help enable personalised TV experiences
- That we are hugely encouraged by our experiences with micro-service based platforms in supporting the delivery of object based media delivery experiences.

The knowledge that the production approach can be applied to arts content as well as Sport, thus illustrating the approach has more fundamental and general ramifications for TV production, will also be conveyed through the Innovation 2017 event although from a BT perspective the Theatre based content examples are “nice to have”, not essential. They will form additional evidence for use in discussions with BT TV executives – and, as opportunities arise, these use cases can be discussed. It would be pleasing if the execs saw the value in the content format but this is not a measure of success.

BT TV is committed to remaining “on the front foot” in terms of the innovation agenda and we are keen that BT TV will, when the time is right, adopt and embrace these production exemplars as a means to maintain that brand perception and in due course to influence the way the team seeks to

develop our TV services. We have some work to do as the production method deviates too far from the current method and there is no HbbTV2.0 compliant receiving equipment installed.

2.3.2 Exploitation of Production Tools and Workflow Insights

One candidate opportunity relates not directly to BT Sport but to Dorna Sports, the rights holder and host broadcaster for all MotoGP events. Dorna Sports create race content for all national broadcasters. To do this they take their clean edited feed of the race, and for each different national broadcaster, they then overlay the national broadcaster specific graphics and uplink each of these flattened video stream to the national broadcaster. We recognise an opportunity, even at this uplink stage, to use an object based approach to reduce costs. Dorna Sports could transmit a single common clean feed and accompany that clean feed by optional layers that contain the graphic overlays for the different host broadcasters. The national broadcasters would then overlay their local graphics, and flatten the video before retransmitting it through their own distribution networks. This would save Dorna Sports uplink costs but does not fit perfectly with current end-to-end system.

2.3.3 Exploitation of Reference Architectures

The high level 2-IMMERSE architecture has been presented to key members of the team who specify and deliver BT's IPTV delivery platform. This is very early interaction designed to provide early warning and create awareness of the challenges and opportunities that Object Based Media delivery may pose. We have regular contact with the TV platforms team and keep them aware of the projects progress.

2.3.4 Exploitation of Reference Implementation

In terms of promoting the use of micro service based platforms for object based delivery we have held (May 2017) an internal knowledge call, with 2-IMMERSE partner Cisco presenting, to share our experience of using a micro service based platform for TV delivery. We are working to understand the next steps and to understand how the software approach might apply to the current TV delivery system. This is a work in progress.

2.3.5 Exploitation of Design Specifications and Insights

Andy Gower has shared the insights on responsive design considerations for different sized screens with Dorna Sport. They were interested in the aesthetic implications of the approach and sought to try out for themselves the different layouts. The lack of an end-to-end object based media delivery chain means that it is not sensible, at this time, to consider the approach for TV broadcasts. The thinking may be adopted for their own Dorna Sport MotoGP app which is distributed to handheld devices – although the size difference is less marked.

2.4 ChyronHego Exploitation Activity and Plans

We are a global leader in broadcast graphics creation, playout, and real-time data visualization and offer a wide variety of products and services for live television, news, sports, corporate and government video production.

Services similar to the multi-screen presentation of Sport being developed by 2-IMMERSE should increase demand for our products and may affect the work flows we use to develop and distribute them.

As ChyronHego are today involved in the creation of live sports data and also the visualisation of such data onto TV screens, one of the issues we face is that too much data is produced for a consumer than they can comprehend through ordinary broadcasts. Therefore, by using auxiliary devices, we are able to expand the canvas for visualisations which increases the value of our sports data products. Within the 2-IMMERSE project, we will showcase:

- Live tracking data of player positions married (and synchronised) to video
- Tracking data aggregations and statistics in tabular formats
- Selectable and interactive overlays of individual and aggregated tracking data, putting the consumer in charge of what to show and when and where
- Automatic robotic player cams (using live tracking data)
- Panoramic wrap-around live video “vistas” from sports events to provide the atmosphere of being at a sports event
- Selectable augmented reality “overlays”, combining camera tracking and player tracking to create visualisations such as live offside lines, players name tags, distances and speeds of players and much more

2.4.1 Exploitation of Exemplar Productions

As ChyronHego is especially strongly connected to Sports Broadcasters and wider Sports Rights Holders such as leagues and federations, it is therefore very important for us to be able to refer to the two use-cases of Football in a Pub and MotoGP at Home, to highlight 2 different sports type categories and two venue consumption options. From the results of both of these use cases we can much more easily convince our customers to engage in real projects based upon the underpinning architectures and technology components for any team-based field sport or any racing-based sports.

BT Sport are already a large graphics customer for ChyronHego so would be a natural first customer to exploit the results of the 2-IMMERSE trials through the upgrading of their existing ChyronHego technology. Additionally, Dorna could be another customer that will benefit from the trials with ChyronHego helping them in their transition away from SDI² based workflows through the adoption of next generation ChyronHego products created from the output from 2-IMMERSE .

2.4.2 Exploitation of Production Tools and Workflow Insights

ChyronHego already has a large portfolio of in-house developed production tools. It also has well-established workflows between its own tools and out to technologies from third party suppliers. These tools and workflows have been designed to cater to the existing and long-established world of SDI video feeds and timecodes with the primary delivery end-point being a TV.

² SDI (Serial Digital Interface) is a family of standardized digital interfaces for used for the transmission of uncompressed, unencrypted digital video signals (optionally including embedded audio and time code) within television facilities.

With the production tools and resultant workflows emerging from 2-IMMERSE, we believe that we can leverage and exploit some of the components in full and others partially to ease the transition for us to the new paradigm of IP-based video streams and Object based Broadcasting delivery.

2.4.3 Exploitation of Reference Architectures

Our development teams will be able to use the reference architectures to help expedite the productization process within ChyronHego and to guide best practise in design to ensure learnings from 2-IMMERSE are implemented. It will also help ensure that any eventual technology standards that emerge are able to be easily integrated into next generation products.

2.4.4 Exploitation of Reference Implementations

For ChyronHego to convince its broadcast and media clients to engage in a paradigm shift of how to produce and deliver content to audiences, it is crucial to have proven exemplar productions to demonstrate a working solution. Broadcast customers are particularly wary about trying out any new technologies or workflows until they are proven to have already worked. They are highly risk-averse and have too much at stake in their reputations and revenues to risk deploying systems that are not thoroughly proven to have worked.

2.4.5 Exploitation of Design Specifications and Insights

The knowledge and insight captured from the trials especially will help ChyronHego in making more informed decisions on the best approach to take in its product design specifications.

2.5 Cisco Exploitation Activity and Plans

Cisco designs and sells a broad range of products and services, and delivers integrated solutions to develop and connect networks around the world. Cisco has a significant business unit focused on Service Provider video.

For Cisco, the project proves the application of technology that will enable audiences to engage with visual information, data and entertainment in new ways. We anticipate this will be of most value to Cisco's service provider video unit. However, the technology may also find application in other business units, such as within the enterprise.

A significant area of activity for Cisco is enabling the transition of live media production workflows from SDI connected appliances to all IP data centres. The 2-IMMERSE architecture and an object-based workflow is well aligned with a software defined approach to live media workflow orchestration, and there is an opportunity to see how these can be brought together.

Once the first trial completes we will disseminate the architecture, user experience and trial results with key internal stake holders. An internal knowledge share call is scheduled in early June through the Chief Technology and Architecture Office to key influencers and stakeholders.

Cisco has a strong presence at all of the major industry trade shows (such as IBC, NAB). We have already referenced the work conducted in 2-IMMERSE with customers from around the world and expect to build this activity as there are more demonstrable outcomes of the project.

2.5.1 Exploitation of Exemplar Productions

Whilst Cisco is not involved directly in media production other than as a technology supplier, credible and innovative exemplar productions provide credibility and help prove the reference architecture and implementations that are being developed in the project.

2.5.2 Exploitation of Production Tools and Workflow Insights

Cisco is a technology provider to the production industry, and as noted we are active in enabling the industry transition of live media production workflows from SDI connected appliances to all IP data centres. Insights into the evolution of 2-IMMERSE workflows to support object based production will help inform this transition.

2.5.3 Exploitation of Reference Architectures

The Reference implementations give us a practical validation of end-to-end architectures including layout, timing and synchronisation, based on a cloud and micro-service platform. It has potential for exploitation within Cisco's media distribution suite and across other domains within Cisco, for example within the enterprise.

The reference architecture and implementation in 2-IMMERSE is being shared internally within Cisco. We have also recently held a knowledge call with the BT TV platform team to help them understand and assess the capabilities of a micro service based TV platform.

2.5.4 Exploitation of Reference Implementations

We will review the reference implementation with stakeholders for potential exploitation within media distribution suite and across other domains within Cisco, for example within the enterprise.

We have recently engaged with an internal innovation team developing an immersive lab environment which has application in areas such as 'smart cities'. This engagement is exploring the use of the 2-IMMERSE layout service to manage presentation of multi-element experiences on large immersive displays - see <http://pirl.tech/>

2.5.5 Exploitation of Design Specifications and Insights

Validation of the user experience with the end consumers of content is critical to prove design paradigms that can inform both future customer products and user experience design.

These specifications and insights will likely have value to our UX design teams, who work on a range of UX activities including TV and multi-screen, and we plan to share the specifications and insights with them.

2.6 Illuminations Exploitation Activity and Purpose

Illuminations is a SME that makes and distributes films about the arts and performance for broadcast television, cinema screening and online dissemination. We also produce media about religion, history and ideas. Our recording of performances act as both an archival record of a transient event but should also be a creative artefact in their own right whose purpose should be to engage a diverse audience. We seek to use the findings of 2-IMMERSE to enable us to create multi-screen experiences that enable audiences to engage more effectively with our performance content as well as potentially our programming about the arts, religion, history and ideas.

Over the past two decades Illuminations and lead producer John Wyver have created more than 30 full-length screen versions of stage performances. These have been developed in partnerships with major cultural organisations in Britain including the Royal Shakespeare Company (RSC), the Almeida Theatre, Chichester Festival Theatre, the Donmar Warehouse, Sadler's Wells, Matthew Bourne's dance company New Adventures, the London Symphony Orchestra and the commercial theatre producers ATG. Current projects and those planned for 2018 include new collaborations with Studio Wayne MacGregor and the Hofesh Schechter Company, as well as further projects with the RSC and New Adventures. This work positions Illuminations as the leading independent producer of screen performance in Britain.

The market for screen performance in Britain is currently very healthy, as it is to a perhaps lesser degree across much of the rest of Europe. Cinema screenings of plays, opera and dance have been established as an entirely new hybrid form in the past decade and have proven their popularity. Broadcasters have taken notice of this interest, and both the BBC and the digital channel Sky Arts have once again embraced this form of programming. And the Arts Council/BBC funding initiative known as The Space is offering significant support to the creation and dissemination online of performance. The opportunities as a viewer to watch screen performance, as well as the possibilities for producers and cultural organisations to create this, have almost certainly never been more extensive or more varied.

2.6.1 Exploitation of Exemplar Productions

Whilst the recent history of distribution of screen performance is encouraging, for producers and distributors of screen performance the market still feels volatile and uncertain. There is concern that the cinema audience for such work is suffering because of possible market saturation and an over-supply of product. While broadcasters currently fund such work, they do so largely for returns in the form of cultural prestige and fulfilment of cultural public service obligations, and not because screen performances attract large audiences. And the economics of online distribution are highly uncertain, and have a high degree of dependence on public funding.

Producers, cultural organisations, distributors and funders are, as a consequence, eager to identify ways in which screen performance can be developed in innovative ways and can be extended so as to provide richer experiences for audiences. Audience satisfaction is clearly a long-term goal here, as is the establishment of sustainable structures for monetisation of products and services, but for collaborators and funders, short-term aims include the wish to be associated with projects that are seen to be exploring potential new forms in this space.

We are convinced, therefore, that there is considerable potential for extending the 2-IMMERSE prototypes for Watching Theatre at Home and Watching Theatre in School with further collaborations with cultural organisations, as well as of course with the RSC itself. And we are optimistic also that cultural funding will be available to develop this work as a next step before fully realised products can be taken to market. Potential partners here include Arts Council England and The Space as well as cultural organisations themselves.

Essential to the engagement of both the RSC at the next stages of the project, and also for future collaborators, is the operation of a functional prototype for a multi-screen presentation of the RSC's Hamlet, which is intuitive for the user and offers an enhanced experience when compared to linear viewing of the screen performance in a domestic context. The current version of the prototype suggests how this can be achieved, but is not yet as fully realised as we would wish. We recognise that, although second-screen media has been a well-established focus for the technology and user experience worlds for a decade or more, awareness of its potential in the cultural field is minimal. Hence the importance of being able to demonstrate its excitement and potential with an elegant and stable prototype.

With such a multi-screen presentation of the RSC performance of Hamlet, we believe that Illuminations will be able to interest and engage other performance companies to develop the principles that the prototype demonstrates in further productions. In relation to the RSC our target is to engage the company in a project to develop multi-screen experiences for the full catalogue of plays recorded live from the RSC under the stewardship of Artistic Director Gregory Doran. The company intends that by 2021 it will have a recording of a live performance of each of the 36 plays by William Shakespeare included in the 1623 "First Folio". This collection will be only the second time that such a catalogue has been created by the single production entity, the first being The BBC Television Shakespeare produced between 1978 and 1985. The BBC's Shakespeare series continues to sell to individual buyers and is extensively used in education around the world – and this despite the

productions themselves looking exceptionally old-fashioned. The RSC series is intended to achieve a comparable position in the twenty-first century, and Illuminations hopes to see each of those productions accompanied by a multi-screen complement.

In addition to being essential for the next stages of this vision, the Watching Theatre at Home prototype is similarly important as a focus for the continuing discussions with the Education department of the RSC to develop, test and evaluate in close collaboration with them the Watching Theatre in Schools prototype. RSC Education's interest is in extending the currently exceptionally successful online presentation of screen performances of RSC productions in primary and secondary schools in the UK, as well as in limited, commercial contexts in the United States and China.

The UK schools presentations are seen as a core offering by the RSC to fulfil stakeholder expectations of public funding, and they also benefit from a degree of commercial sponsorship. The hope is that a successful multi-screen prototype for these showings could strengthen both of these forms of support. In a different context, the currently modest initiatives in developing commercial educational offerings for foreign markets may also offer an exciting route for the exploitation of the prototypes and related production tools.

Crucial to all of this will be the successful implementation of the 2-IMMERSE production tools so that we can demonstrate convincingly how achieving further, multiple experiences linked to a wide range of performance is not dependent on authoring tailored applications, but rather can be created easily and cost effectively with the suite of production tools.

2.6.2 Exploitation of Production Tools and Workflow Insights

Having good exemplar productions is critical but so is having the tools to repeat the experience cost effectively. We hope to gain insights into the workflows required to create multi-screen productions; at least for example, gaining a clear understanding of the types of assets that need to be created and understanding something of the best ways they need to be treated and presented. Crucial to all of this will be the successful implementation of the 2-IMMERSE production tools so that we can demonstrate convincingly how achieving further, multiple experiences linked to a wide range of performance is not dependent on authoring tailored applications, but rather can be created easily and cost effectively with the suite of production tools. One example tool is the tool developed by IRT and used within Hamlet, to enable the development of the timed script. This took several hours of effort but compared to the transcription service usually used offered considerable cost advantages.

2.6.3 Exploitation reference Architectures

Illuminations' interest is focused quite tightly on the production part of the value chain. We do not see our work as involving directly the exploitation of the architectures developed within 2-IMMERSE, although we would expect future commissions to use the platforms developed within the project.

2.6.4 Exploitation of Reference Implementations

As for the comment to reference Architectures, Illuminations' interest is focused quite tightly on the production part of the value chain. We do not see our work as involving directly the exploitation of the architectures developed within 2-IMMERSE, although we would expect future commissions to use the platforms developed within the project.

2.6.5 Exploitation of Design Specifications and Insights

There are insights that we are gaining – often focused on a key awareness gained from trials, of the user experiences that are not yet optimal. In particular we'd like to improve the way timed text appears and know that the formatting of the additional content is not as good as it could be. User feedback has also led us to consider the extent to which the additional content presentation and structuring should mirror that found in a theatre programme. Working within 2-IMMERSE has

enabled us to ask sensible questions; without the prototype implementations it is difficult to know what works and what does not so 2-IMMERSE has given us a head-start in developing a design language that works for multi-screen representation of filmed performances though considerable more work will be required before we can write a house-style guide.

2.7 CWI Exploitation Activity and Plans

The mission of CWI is to discover and develop new ideas, and the transfer of theoretical and fundamental knowledge to academia and to European industry. The group involved in 2IMMERSE, the Distributed and Interactive systems group (DIS), focusses on facilitating and improving the way people access media and communicate with others and with the environment. We address key problems for society and science, resulting from the dense connectivity of content, people, and devices. We use recognized scientific methods, following a full-stack, experimental, and human-centred approach. The group transfers knowledge through scientific publications, standards bodies, open-source implementations and consultancy. We pride ourselves on pushing boundaries, leading the way for others to follow.

In 2-IMMERSE DIS seeks to explore new models and workflows (and roles within the production chain) to support broadcasters and producers to create and curate novel multi-screen interactive experiences. With this purpose in mind, within the project we aim at the development and evaluation, in large trials, of production tools and the delivery platform. In addition, we participate in the development process of the platform, with particular interest on the timeline service.

2.7.1 Exploitation of Exemplar Productions

The exemplars multi-screen interactive productions are essential assets for CWI to showcase the potential of the platform and of the production tools. Moreover, our group has been particularly active in the creation of the experience, as a primary mechanism to gather requirements for the development of the production tools. Exploitation of these productions happens through dissemination at large academic (particularly ACM Multimedia, ACM CHI, and ACM TVX), European Commission focused (NEM Summit), and commercial (IBC) events. The primarily expected exploitation mechanisms include:

- Invitation to other projects (European or National projects) in the area of multi-screen and immersive media creation, delivery, and consumption. As a research institution, this is a major source of income, which allows us to continue doing ground-breaking research.

2.7.2 Exploitation of Production Tools and Workflow Insights

One major interest of the group is on new workflows and models for the production of novel multi-screen interactive productions. The research group has a long tradition in developing authoring tools for rich media experiences (e.g., Ambulant player³) and support infrastructures for these. In particular, we have lead the task following a user-centred approach, involving the end-users since the beginning. Based on the experiences of creating these new types of experiences from scratch, we have run a number of focus groups and interviews to identify the requirements. The development of paper prototypes allowed us to test different alternatives and ideas, concluding a novel design for the production tools currently under development. This user-centred process has as well resulted in the

³ The AMBULANT Open SMIL Player is an open-source media player with support for SMIL 3.0. The current AMBULANT release provides namespace-based support for the SMIL Language, Unified Mobile and SMIL Tiny profiles. The current release also provides full backward compatibility with SMIL 2.0.
aaa.ambulantplayer.org

identification of a new role that needs to be fulfilled by the production team (multi-screen director), as reported in our recently accepted paper to ACM TVX. When the first version of the tools is ready, we will proceed to evaluate them based on realistic scenarios and with potential users, requiring coordination with BBC, BT, and Illuminations.

We believe that these novel production tools will be extremely valuable assets, enabling producers to create novel and innovative productions, which are customizable, multi-screen, object-based and interactive. Our group is considering two ways of exploiting such tools, which will be decided once they are more mature:

- Open source tools, as software exemplars
- Licensing per-use, fee-based

Initial discussions with the valorisation team within CWI have already started in order to better define the strategy, the expectations, and the path to follow.

2.7.3 Exploitation of Reference Architectures

While CWI has actively participated in the definition of the architecture, there are no specific plans at the moment for its exploitation.

2.7.4 Exploitation of Reference Implementations

While CWI has actively participated in the implementation of the platform (particularly in the timeline service), there are no specific plans at the moment for its exploitation. Initially, the team had the intention of contributing to standardisation activities in W3C, but more recent evaluation of the alternatives and possibilities discourages us from doing so. Nevertheless, we will keep the option open, in an opportunistic manner, in case better opportunities present in the coming months.

2.7.5 Exploitation of Design Specifications and Insights

The project offers a unique opportunity to get know-how regarding production, delivery, and consumption of novel multi-screen immersive media experiences, a core research area within the DIS group. We intend to exploit such valuable knowledge acquire during the project using a number of mechanisms:

- Training: CWI will update its curricula and knowledge based and start disseminating in different for a: keynotes at conference and courses.
- Consultancy: we will be equipped with knowledge and insights about new media experiences, allowing us to create public-partner partnerships with interested commercial partners

The knowledge will come for the architecting, designing, and development of the platform, infrastructure, and production tools. Moreover, evaluation (though trials and experiments) will be fundamental for consolidating such knowledge. These activities will lead us to research sustainability, with the acquisition of more projects in this area of research.

2.8 IRT Exploitation Activity and Plans

As a pioneer in digital media technology, IRT investigates and develops technologies for augmenting TV content with interactive audio-visual broadband content. In doing so, we support our shareholders, the public-service broadcasters of Austria, Germany and Switzerland, in making their services more attractive for their audiences. IRT promotes HbbTV 2.0 as a cost effective solution with broad market reach.

2.8.1 Exploitation of Exemplar Productions

Content of the 2-IMMERSE productions will be used to demonstrate exploitable assets to our shareholders and potential customers of IRT. IRT's strategic and commercial interest is to cooperate with German broadcasters including all major broadcast groups to enhance their offerings with HbbTV 2 features by implementing showcases jointly, but also supporting integration of those into actual products.

Test applications and HbbTV reference implementations that show the use of these features in attractive programming contexts is useful in this regard.

IRT demonstrates relevant and innovative applications on emerging TV prototypes and retail TVs from various manufacturers. For example, IRT has shown a first prototype implementation of DVB CSS at IBC 2016 that synchronised audio tracks on a tablet PC with video clips running on a Samsung TV.

This showcase attracted other TV manufacturers and helped extending our network of manufacturers we collaborate with. This helps improving the existing assets with regard to the set of supported features and interoperability across end-devices from different manufacturers.

2.8.2 Exploitation of Production Tools and Workflow Insights

None planned to date.

2.8.3 Exploitation reference Architectures

None planned to date.

2.8.4 Exploitation of Reference Implementations

IRT's main assets in this category are libraries for multi-screen applications based features from the HbbTV 2.0 specification. These features include:

- Automatic discovery of HbbTV devices by an application running on a mobile device
- Application launch on an HbbTV device triggered by an application on a mobile device
- Tight synchronisation of content presentations on an HbbTV and mobile device based on the DVB-CSS protocols.

These libraries are currently used in 2-IMMERSE pilots make the HbbTV 2.0 multi-screen features available in Android-based mobile applications.

Open source publication of software libraries will be assessed in the course of the project.

IRT develops Test cases for HbbTV 2.0 features relevant to 2-IMMERSE makes them accessible to interested parties. This includes major TV manufacturers and other HbbTV terminal-stack developers. IRT hosts interoperability events (IOT) on behalf of the HbbTV consortium. During these events, tests are performed on a broad set of TV devices (prototypes and latest retail devices) of different TV manufacturers. Currently IRT hosts 3 IOTs per year, usually in early spring (March), early summer (June/July) and late autumn (November).

Software libraries developed in 2-IMMERSE are reused by broadcasters to implement own showcase with support by IRT.

Through collaboration and technical experiments within the framework of 2-IMMERSE, we build up knowledge, which we can exploit through training courses which we offer as a commercial service to different companies in the HbbTV value chain, i.e. mainly broadcasters and operators but also TV manufacturers.

Training sessions – called Intensive HbbTV Seminar. The first HbbTV seminar including HbbTV 2 topics took place in March 2017. It included a section on multi-screen applications and media synchronisation in-cooperating application scenarios, technical insights and demos stemming from 2-IMMERSE.

Another HbbTV 2 seminar is planned to take place end of 2017.

2.8.5 Exploitation of Design Specifications and Insights

No exploitation planned to date.

2.9 IPR Management

The assignment of intellectual property amongst the partners has been covered in section 8 of the completed and signed Consortium Agreement.

Ownership of intellectual property shall be shared where there is joint invention and where the IPR cannot be broken down into subcomponents for the purpose of applying for, obtaining and maintaining protection.

IPR will be an agenda item for each Project Management Committee meeting and discussed during the weekly conference calls when appropriate, e.g. if a new opportunity to file is identified.

2.10 Business models

Previous sections identify exploitation assets and individual plans by 2-IMMERSE partners. For the final version of this deliverable, D6.3, we will document a selection of business models for these assets which include the 2-IMMERSE platform as well as individual platform components. We approach the development of business models by following milestones:

- **Kick off** (next PMC in September 2017):
 - Select a methodology. Candidates include the Business Model Canvas by Osterwalder as described in “Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers” and <https://hbr.org/2013/05/a-better-way-to-think-about-yo>
 - Initial brainstorming
 - Assign tasks to individual partners to get initial model descriptions
- **Workshop** (end of first quarter of 2018)
 - Discuss partners initial contribution
 - Identify potential gaps and harmonise business models
- **Documentation** (end of project)

3 Dissemination

The section revisits 2-IMMERSE dissemination plans and activity to date. In the proposal we listed the target audiences for our dissemination as:

- **General Public** – who require information described in easy to understand language.
- **Academics** – who require rigorous presentation of scientific results.
- **Programme makers and commissioners** – who require exemplars of production practice and object-based experience design and production workflows and tools with which to explore these.
- **Production engineers and suppliers** – who require concise and convincing presentation of exploitation opportunities and potential business models (from ITC suppliers, broadcasters, production houses and public venues).

At this stage of the project we can be more specific about the stakeholders and the broader communities for whom the project will be critical for some and of interest to others. In the broadcast and project value chains implicated by the pilot services are:

1. **Commissioners:** who need to be convinced of the value of experiences to their audiences;
2. **Content Producers** who need to be convinced of the value to and consequence for their art and their craft;
3. **Broadcasters** who need to understand the business value against the challenges of delivering broadcast quality content in new interactive formats;
4. **Venue owners** (such as hospitality chains who own pubs and restaurants) who need to understand the business benefits to their establishments;
5. **Audiences** who need to know why they should try new experiences;
6. **Project partner organisations and the EU Commission** who need to know whether the project's targeted and achieved contributions are worth the resource investment;
7. **Software developers and hardware manufacturers** who need to be able to build on and extend the platform and conform to its specifications to deliver the targetted experiences;
8. **Standards bodies and regulators** who need to monitor the performance of standards specifications and the evolution of new ones to enable industries to thrive;
9. **Academics:** who need to have an understanding of the social and technical science behind the contributions made;

In order to deliver the four service pilots in sport and theatre we will engage with practitioners in categories 2-7. Individuals and companies will be consulted and contribute in the process of designing and delivering the trials but we hope to reach broader audiences within these. We will deliver presentations and workshops at practitioner and industry-driven events such as IBC, ACM TVX, ACM CHI, NEM with the intention of testing our contributions and building a Community of Practice to further explore and experiment with our object-based, multi-screen experience delivery platform beyond the lifetime of the project. By building an extensible platform to support the four service pilots we will test the appropriateness and completeness of standards to support the requirements for delivery.

Only through the delivery of content experiences and audience feedback will commissioners (cat.1) take note. Along the way as results come in we have academics on the project who will generate peer reviewed publications at conferences and journal articles (the latter more likely

towards the end of the project) (cat. 9). Attending top conferences since the beginning of the project is thus important, as it provides a good dissemination outlet and good networking opportunities. Highly recognized conferences gather academics, practitioners, and commercial partners: producers, broadcasters, and academics. In particular, the project targets the following academic international conferences, independently of the continent in which they are hosted each year:

- ACM CHI, which it is the premier international technical and UX conference for computer interaction. The conference attracts yearly over 3000 participants from all over the world, including representatives from industry. For example, the course that was run by CWI in 2016 was attended by people working at YouTube, Facebook, and many other relevant companies and universities.
- ACM TVX, which it is the premier international conference on interactive experiences for online video and television. The conference attracts yearly over 100 participants from all over the world, particularly attracting representatives from the broadcast and online video world: Samsung, YouTube, Facebook, Nokia... For example, during TVX2016 CWI attended the TVX in Asia Forum, networking with companies such as NHK, NTT, and Samsung. Moreover, CWI is steering committee member of the conference.

3.1 Achievements to date

The project web site is available and functional www.2immerse.eu. We know it can be improved and will work on that but we have now ensured it includes all deliverables and is augmented by our Twitter feed. Video would be good but the high value content with which we work and the rights we have to show it make posting video of our work problematic from a rights perspective.

In the first 6 months of the project we communicated our ambitions and ideas for 2-IMMERSE through existing commitments: a tutorial at the prestigious CHI 2016 on Interaction Design for Online Video and TV <https://chi2016.acm.org>; and a book chapter (cat.2,3,6,7,9).

- Cesar, and M. Obrist, "Interaction Design for Online Video and Television," in the ACM CHI Conference on Human Factors in Computing Systems (CHI 2016) [May 10, 2016, San Jose (CA), USA].
- P. Cesar and D. Geerts, "Social Interaction Design for Online Video and Television," in R. Nakatsu, M. Rauterberg, and P. Ciancarini (eds.), Handbook of Digital Games and Entertainment Technologies, Heidelberg, Germany: Springer-Verlag (2016)

Significant dissemination work was also spent during this time successfully consolidating the in-principle interest of key stakeholders to real engagement once the project was funded. Within BT and its partners in the delivery chain this meant revisiting the value and ambition of the project and the commitment requested from rights owner and producers of MotoGP (Dorna) and theatre (Royal Shakespeare Company) through public venue owners (Marstons) for Football and broadcasters within BT's business units (BT Sport).

In February of 2016 Broadcasting Now, an online magazine, covered the 2-IMMERSE Service pilot plans <http://www.broadcastnow.co.uk/news/bt-sport-gears-up-for-motogp-trial/5100158.article>

At IBC 2016, IRT showed a 2nd screen synchronisation based on work in 2-IMMERSE reaching almost all the categories in the list above. Companion screen synchronisation was also demonstrated at Munchener Medientage a month later. <http://www.medientage.de/startseite/>

Also in October 2016 we presented the ideas behind the project in a presentation about theatre rituals followed by workshop in collaboration with ImmersiaTV to an audience of broadcasters, content producers, technology developers and standards creators at the New European Media (NEM) conference in Porto. <http://nem-initiative.org/>

A short film was created by Todd MacDonald from Illuminations to introduce the Theatre in the Home experience. Unfortunately, this short film is not suitable for public use as the project does not have the rights to show publicly the RSC copyright material in this context. The project will generate a new video that uses content to which we do have rights in order to show the user experience of watching theatre at Home that was generated by the project. In February 2017, the film was shown along with three demonstrations including the Theatre in the Home trial experience to the project reviewers and project monitor (cat. 6) at the BBC's Centre House in London. Two members from the BT Sport business unit gave up their time to describe why 2-IMMERSE was important to their business.

Through January to March 2017, producers (cat.2) were consulted in an ethnography of production and a design exercise to inform the construction of the MotoGP production tools. Results to be reported through WP5.

In March 2017 IRT attended a workshop at Samsung in Poland to discuss HbbTV developments presenting the 2-IMMERSE plans and ambition, including the 4 trials and the plan to prepare a test/demo on 'real' HbbTV 2 devices/prototypes. At this workshop it was decided to cooperate on a the 2-IMMERSE showcase on the latest HbbTV 2.0 Samsung TV.

Finally, CWI has recently published an updated article based on the keynote talk at the Congress of Interactive Digital TV

- P. Cesar, "From Secondary Screens to Socially-Aware and Immersive Experiences," in Applications and Usability of Interactive TV, (revised selected papers from CTVDI 2015), 2016, pp. VII – VIII.

3.2 Looking Ahead

Having built the first reference implementation of the 2-IMMERSE platform and completed the first trials of the Theatre Service pilot we have our first peer reviewed papers (long and short) and demonstration appearing at TVX 2017 June 14-16th. (cat. 2,3,6,7,8,9) <https://tvx.acm.org/2017/>

In the same week as TVX we will be demonstrating early prototypes of MotoGP and public venue football experiences at BT's Innovation 2017 event. This is part of a week-long exhibition of the best of BT Research innovations. In attendance, will be industry analysts, BT's partners and executives and significant invited guests from the industries within which BT operates.

A 2-IMMERSE Twitter account has been set up and added to the website <https://2immerse.eu/>

A website review is underway; menu structure changes have been undertaken and content has been added to the site but more work is possible. We will try and identify useful video material that we can post that is not bound by right agreements and whose value warrants the resource implications of production. The project deliverables are posted on the site but they will be organised to target the categories of stakeholders above. Finally, the web site will also continue its blogs reflecting on the challenges, the standards and the results from the trials. Coming soon is a blog from Mark Lomas (BBC) on MPEG MORE and the relevance of MPEG SAND.

IRT will once again attend IBC. The BBC's stand in 2017 will focus on the IP Studio having majored on Object-Based Media last year. 2-IMMERSE will feature in 2018 hopefully with a paper accepted in conference to go with the demonstration in the Future Zone.

The BBC is proposing to co-host TVX at MCUK in 2019 with a focus on Object-Based Media bringing together the Community of Practice and showcasing the legacy 2-IMMERSE platform.

Pablo Cesar (CWI) is co-editing a book on media synchronization, with chapters from IRT (on media synchronisation for television services) and BT (on video delivery and challenges):

- M. Montagud, P. Cesar, J. Jansen, and F. Boronat (eds.), "MediaSync: Handbook on Multimedia Synchronization," Heidelberg, Germany: Springer-Verlag (2017).

2-IMMERSE research team we have been offered space in the BT Sport building to showcase the Football In a Pub scenario. We plan to build a working prototype based on captured material from the 2016 FA Cup. A prototype of the installation will be exhibited at the BT Research Innovation event in June. We hope this showcase can become a key tool for affecting internal decision making within BT and BBC Sport and will help accelerate a move towards Object-Based production techniques the development of a much-improved coverage of football for pubs and clubs and for BT and BBC to develop deeper engagements with home audiences.

As a commissioner of content BBC is the hub of a network of creative companies and through its Creative Studio commissioning and On-line Taster platform has the means to engage and communicate media innovation to broad section of the community.

Workshops and meetings will be held with Creative Industry practitioners and technical developers during the project to create a Community of Practice (CoP). 2-IMMERSE project results, insights and platform ambitions will be included within the BBC's CoP building for Object-Based Media. Existing dates for 2017 are:

- DIS 2017 Edinburgh June 10th
- Bristol Watershed June 22nd
- Tech Open Air Berlin July 11th
- BBC Cardiff Sept 18/19th
- 'Mozfest' Fringe Oct 23rd

As the project progresses, discussions with commissioners and producers will include a broader group from Sports and Drama. Illuminations, as a skilled and experienced media production SME, will help to ensure highest-quality dissemination and communication activities appropriate for a media innovation project, e.g. by preparing short promo clips. Supported by excellent links to the Royal Shakespeare Company, Illuminations will be instrumental in communicating innovations toward the creative industry. Naturally, Illuminations also has a high commercial interest in the project itself and will seek exploitation opportunities also for different customers.

John Wyver, from Illumination, writes a blog under the company web site Illuminations (<http://www.illuminationsmedia.co.uk/blog/>). John is a respected and authoritative figure in the broadcasting of Arts TV in the UK. As and when there is a 2-IMMERSE related story or an experience about which it is relevant to write John will use the blog to mention the outputs of this project.

4 Standardization

4.1 Role of standards and standardization in 2-IMMERSE

As an innovation project 2-IMMERSE expects to utilise and evaluate existing technology and standards as far as it is possible to do so. An obvious use case is with the HbbTV 2.0 association's adoption of specific profiles of the TM-CSS specification from DVB to which HbbTV adds further protocols for device discovery and communication between applications running on multiple devices.

The project will evaluate first implementations (prototypes) of these specifications and assess its suitability for the use cases envisioned. The project expects to discover use-cases that the current specifications and standards do not support. The project will seek to alert the relevant associations and standards bodies to these deficiencies and if appropriate to share with them the methods we have adopted to overcome the shortcoming.

2-IMMERSE partners will follow on-going relevant activities and discuss potential contributions. Currently, there are a number of working groups either forming or progressing in W3C which target TVs and user devices acting as TV companions.

At the time of writing there are no specific contributions planned, this will be reconsidered when first prototype implementation and results from the pilots are available.

Many of the project partners have active roles in a number of standards organisations. Partners can work with their colleagues who are members of the different standards groups to ensure relevant findings of 2-IMMERSE are represented appropriately. A summary of partner's membership in relevant standardization bodies can be found in the table below.

	BBC	BT	CISCO	IRT	CWI
W3C	Member		Member	Member	Member
HbbTV	Member	Member	Member	Founding member	
DASH industry forum			Member		
DVB	Member Chair of DVB TM CSS group amongst others	Member	Active, TM-AVC and TM	Member	
IETF	Member	Member	Active		
DTG	Founding member and working group chairs	Member			
ETSI	Member		Member		
SMPTE	Member	Member	Member	Member	
MPEG	Member	Member	Member		Member

4.2 Relevant standards

4.2.1 HbbTV2/DVB-CSS – companion streams and screens

2-IMMERSE decided to adopt and evaluate the DVB-CSS specification as it is profiled and extended by HbbTV 2. The specification provides the mechanisms for accurate synchronisation of A/V content within the home network, but also the means for device discovery and application communication across the home network.

The requirements derived from the use cases envisioned in 2-IMMERSE are higher as what is supported by a minimum implementation of HbbTV 2. One example is, with HbbTV 2 TVs are only required to support one video decoder. This makes it unlikely to see widely support for a second or even more decoders at least on the HbbTV platform.

2-IMMERSE plans to evaluate HbbTV 2 implementations, if they become available, by a dedicated HbbTV 2 showcase of its platform. As a result of the showcase, a gap analysis will identify the delta between the requirements of a “high-end” 2-IMMERSE TVset and an HbbTV 2 implementation. 2-IMMERSE will look into an opportunity to present these results to standards bodies, ideally to the HbbTV requirements group.

Beside companion screen APIs and media synchronisation, HbbTV 2 brings other improvements that could be of interest by 2-IMMERSE. One example is the updated browser profile, now supporting HTML5 and related APIs. These are required by professional tools like Adobe Animate that can be used to produce on-screen graphics composed with video on the client side rather than in the studio. Tests shall show if the HbbTV 2 profile is sufficient in terms of functionality and performance. If sensible results will be included in the feedback to HbbTV.

4.2.2 MPEG DASH

The DVB profile of MPEG DASH - DVB DASH - which is included in HbbTV 2, was created with substantial contributions from BBC and CISCO. DASH is used as the transport protocol for audio-visual content by the current implementation of the 2-IMMERSE platform.

The streaming community currently looks into low-latency (<http://biblio.telecom-paristech.fr/cgi-bin/download.cgi?id=14719>) and tiled streaming (<http://ieeexplore.ieee.org/document/7888522/?reload=true>) that are two aspects to optimize the DASH protocol in terms of end-to-end delay and bandwidth usage for VR/360 applications. These activities are monitored by the companies of the project, not necessarily by the colleagues working in 2-IMMERSE.

Though, such optimization would make much sense in combination with 2-IMMERSE applications, media streaming technology is not part of the innovation that is planned to be created by the project. Hence it is not planned to make any contributions based on project results to either MPEG-DASH or DVB-DASH groups.

4.2.3 MPEG MORE

MPEG media orchestration is a current work item within the MPEG-B specification suite. Requirements as well as the latest committee draft are available online. The work item came to attention of 2-IMMERSE after defining the initial architecture and starting the work for the first trial.

Recently 2-IMMERSE has analysed the committee draft in its version from end of March 2017. The status of the specification is not mature enough to consider an early adoption of individual aspects for 2-IMMERSE at this stage, except that both 2-IMMERSE and MPEG-MORE use the concepts of DVB CSS for media synchronisation. Nevertheless, there are useful aspects in MPEG MORE that may be considered in 2-IMMERSE once the specification reaches a stable draft.

4.2.4 W3C

Activities around the former Web and TV Interest Group within W3C, which will be re-chartered as the Media and Entertainment IG, will be monitored by 2-IMMERSE partners. There are no contributions related to 2-IMMERSE planned yet. However, partners see potential for contributions, e.g. in improving the community draft of Web Timing objects (<http://webtiming.github.io/timingobject/>) such that it can be integrated with the protocols defined in the DVB CSS specification.

4.3 Year 1 standardization work

The HbbTV consortium has released HbbTV 2 before 2-IMMERSE started but the consortium is still working in this area to provide for instance an official test suite and errata.

BBC and IRT had contributed to the test suite by proposing test cases, technically by writing the assertion of the test case. Within the last year the test cases have been implemented by commercial test material providers. The approval process in HbbTV requires that consortium members review the test case implementation. A review usually happens in cycles of rejections by the reviewer and resubmissions by the contractor until the reviewer is happy with the test case.

Part of this work was performed by 2-IMMERSE partners for the following packages of the HbbTV test suite

- CS: testing companion screen API
- SYNC_API: testing API and performance constraints for media synchronisation

5 Conclusion

This deliverable updates the plans for exploitation, dissemination and standardisation of the project results as they were initially planned in D6.1⁴ It also presents first results in those areas achieved in the first 18 months of the project.

The four envisioned pilots of 2-IMMERSE are a perfect basis for exploitation and dissemination. From the beginning of the project practitioners, e.g. producers, and stakeholders have been included by project partners to present the novel 2-IMMERSE concepts but also importantly to gather their requirements and views on this new kind of object-based multi-screen services, but also to introduce them to the potential of new technology that may change their work in future.

The second half of the project now will focus more on implementation and validation of the service trials. For dissemination activities project partners will be able to use the live system and the video footage taken of such demos (see section 3.1 for video footage taken for the Theatre at Home trial). Learning from rights issues with the Theatre at Home trial, the project will generate films that use content to which the project has sufficient rights in order to show the user experience of watching e.g. the theatre at Home as it was generated by the project. Big presentations at trade fair shows are planned for the end of the project when all the service pilots are finished. In the second year, presentations will be given by individual partners at several occasions and a number of papers will be presented in top conferences.

For exploitation, the next phase will be essential to finish and implement the assets as outlined in the current document. Standardization work in the near future will focus on monitoring activities like MPEG MORE. Contributions will be considered towards the end of the project.

⁴ The first draft of this document, D6.1 can be downloaded from the web site: www.2immerse.eu