Assessing the impact of second screen

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Report by Technologia in association with DTG and i2 media research

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Contents

Executive summary .....................................................................................................................................................................7

1 Introduction ...........................................................................................................................................................................17

2 Definitions and scope ..........................................................................................................................................................18
  2.1 Terminology ....................................................................................................................................................................18
  2.2 Existing definitions of ‘second screen’ ..........................................................................................................................18
  2.3 The ‘second screen phenomenon’ ..............................................................................................................................20
  2.4 Key dimensions ............................................................................................................................................................23
  2.5 Related trends ..............................................................................................................................................................25

3 Typologies of second screen functionalities and apps ......................................................................................................26
  3.1 Introduction ....................................................................................................................................................................26
  3.2 Top-level functionalities ................................................................................................................................................26
  3.3 Component functionalities .............................................................................................................................................27
  3.4 Clustering second screen apps by their component functionalities ............................................................................29

4 The uptake of second screen apps ......................................................................................................................................33
  4.1 Methodology .................................................................................................................................................................33
  4.2 Downloads by type of app ..............................................................................................................................................33
  4.3 Demographics and network effects ...............................................................................................................................36
  4.4 Uptake by operating system ..........................................................................................................................................37
  4.5 A note on data availability .............................................................................................................................................37

5 Human aspects of second screen ......................................................................................................................................38
  5.1 Introduction .................................................................................................................................................................38
  5.2 Increases in access to connected devices and the tendency to ‘multi-task’ ..................................................................38
  5.3 Fundamental limitations imposed by human attention .................................................................................................40

6 The equipment of second screen ......................................................................................................................................42
  6.1 Overview of equipment requirements ...........................................................................................................................42
  6.2 Connected first screens ..................................................................................................................................................43
  6.3 Connected second screens ............................................................................................................................................44
  6.4 WiFi in-home connectivity ..............................................................................................................................................46
  6.5 Conclusions .................................................................................................................................................................47

7 The technologies of second screen ...................................................................................................................................48
  7.1 The data flow model .......................................................................................................................................................48
  7.2 Introduction to data link 3/3’ technology stacks ............................................................................................................50
  7.3 Home Network connectivity stacks (Data link 3) ............................................................................................................51
    7.3.1 Universal Plug and Play (UPnP) ...............................................................................................................................52
### Table of Contents

11.1 Introduction .............................................................................................................................................................................. 85
11.2 Issues arising from content, advertising and service delivery over the second screen ................................................................. 85
   11.2.1 Regulations ........................................................................................................................................................................ 85
   11.2.2 Broadcasting Code .......................................................................................................................................................... 89
   11.2.3 Situation where issues could arise ..................................................................................................................................... 89
   11.2.4 The international dimension ............................................................................................................................................... 91
   11.2.5 Convergence ................................................................................................................................................................. 91
   11.2.6 Policy .............................................................................................................................................................................. 91
11.3 PSB prominence in the second screen world .......................................................................................................................... 91
11.4 Technology ........................................................................................................................................................................... 92
11.5 Accessibility ........................................................................................................................................................................... 92
11.6 ‘Technology universality’ ...................................................................................................................................................... 92
11.7 Conclusions ........................................................................................................................................................................... 92

12 Integration and the future of second screen ................................................................................................................................ 93
   12.1 An integration framework ...................................................................................................................................................... 93
   12.2 Themes with the potential to define the future of second screen .............................................................................................. 94
   12.3 Scenarios ............................................................................................................................................................................. 96

13 Conclusions and recommendations ................................................................................................................................................. 99

Appendix A Terms of reference .................................................................................................................................................... 100
Appendix B Listing of interviewees and their organisations ........................................................................................................... 102
Appendix C Listing of the majority of UK second screen apps ...................................................................................................... 104
Appendix D Listing of main non-UK second screen apps ........................................................................................................... 110
Appendix E Download data and population statistics for Chapter 4 ............................................................................................. 111
Appendix F Version features of iOS and Android ....................................................................................................................... 117
   F.1 Android ........................................................................................................................................................................ 117
   F.2 iOS ............................................................................................................................................................................... 118
Appendix G Technology stacks of mobile platforms ..................................................................................................................... 120
Appendix H The data flows of second screen .................................................................................................................................. 122
   H.1 Data link 1 – Broadcaster to/from first screen ................................................................................................................... 127
   H.1.1 Role and importance of this data link ............................................................................................................................ 127
   H.1.2 Technical implementation ................................................................................................................................................ 127
   H.1.3 Technical issues and impact on second screen ............................................................................................................ 128
   H.2 Data link 2 – Service cloud to/from - first screen ............................................................................................................... 128
   H.2.1 Role and importance of this data link ............................................................................................................................ 128
   H.2.2 Technical implementation ................................................................................................................................................ 129
   H.2.3 Technical issues and impact on second screen ............................................................................................................ 129
   H.3 Data link 3 and 3’– First screen to/from second screen (home and cloud based) ................................................................ 129
   H.3.1 Role and importance of this data link ............................................................................................................................ 129
   H.3.2 Technical Implementations ............................................................................................................................................ 130
K.8 (COMP) Comprehensive third party apps........................................................................................................................................................ 173

K.9 (APPR) Apps which have been appropriated to second screen, mainly in the field of social activity around TV content............................................................................................................................................................................................... 177

K.10 (A) Accessibility related functions, either via native capabilities of smart devices (e.g. iOS’s VoiceOver) or as third party apps........................................................................................................................................................ 177
Executive summary

Background
This report was commissioned as an input into Ofcom’s longer-term, strategic thinking on the broadcasting ecosystem, access services, and EPG prominence for licensed Public Service Broadcasters. Essentially we were asked to survey the current landscape of ‘second screen’ in the UK, understand this landscape in terms of the technologies, use cases and commercial arrangements, identify the potential benefits to consumers of innovative second screen applications, and critique the landscape in terms of wider impacts and possible regulatory implications. In addition we were asked to suggest and explore possible future scenarios for second screen in three to five years’ time.

What is ‘second screen’ any why does it matter?
‘Second screen’ broadly denotes the use of handheld devices such as smartphones and tablets in close connection with TV watching. There are around 40 apps available in the UK specifically designed for use in connection with TV and there are some others which have been appropriated for use with TV. Examples of the specially designed apps include apps provided by TV manufacturers (e.g. Sony TV SideView), apps provided by platform operators (e.g. Virgin TV Anywhere), apps provided by broadcasters (e.g. BBC Antiques Roadshow app, ITV’s Britain’s Got Talent app), and apps provided by third parties (e.g. TV Guide and Zeebox). Examples of the appropriated apps include Twitter.

Second screen is a recent phenomenon. So far, second screen apps have not had a large influence on TV though there is no shortage of press comment asserting their impending importance. Notwithstanding the hype in such reports, there could be potentially significant impacts in the future. The broadly positive impacts could be:

- Better and more interactive methods of content selection, improving upon the generally poor usability of first screen EPGs;
- Improved accessibility features (e.g. talking EPGs) which make use of the native accessibility features of smartphones and tablets;
- The publication of programme-specific apps (sometimes called companion apps) which allow viewers to play along with programmes and feel more involved;
- The creation of apps which deliver synchronised supplementary content to the second screen: for example, extra information about the topic in a programme or about the cast or director. Such apps would enrich viewing;
- Ways to enable social engagement with TV via social media;
- Relevant advertising delivered to second screen devices;
- The ability to click through on the second screen and make purchases in response to adverts or editorial content on the first screen.

There could also be broadly negative impacts:

- EPGs could move to the second screen where they are currently not regulated in the way that they are on TVs;
• Accessibility functionalities could move to the second screen where they are not mandated in the way that they are on TVs;

• The ‘technology universality’ of TV could be compromised if not all apps are available for all models and variants of second screen device or if the lifecycles of second screen hardware and software led to second screen functionalities becoming inoperable after the passage of time;

• The technologies and infrastructures of second screen could be used by dominant players to limit competition in a way that harms viewers;

• The regulation of content and advertising on the second screen might be looser than it would be on the first screen at the same time of day, a difference that some consumers might find illogical.

Other impacts cannot be coded as either positive or negative but would undoubtedly affect the TV ‘ecosystem’. For example, if viewers’ attention were to shift markedly from the first screen to the second screen then one would expect advertising revenues to migrate similarly. To the extent that the commercial entities in first and second screen worlds are different, the financial model of TV would surely change if advertising revenues became decoupled from 1st screen content.

The types of second screen apps and their provenance

We have studied around 40 second screen apps currently-available in the UK. Despite the initially bewildering variety on offer we observed that most apps provide one or more of the following three top-level functionalities:

• **Control and access** – using the second screen to control the first screen, provide additional accessibility features, and enhance the electronic interaction between devices;

• **Search and discovery** – using the second screen to help viewers select content and, in some circumstances, control the TV or recorder.

• **Contextualised enhancement** – providing additional material or interactivity related to the content of the programme on the main screen.

Through a detailed analysis of the apps, and of the organisations publishing each one, we have discovered a rationale to the second screen landscape:

• **Broadcasters** specialise in apps that enrich programmes. They are in a privileged position of knowing programme content in advance of transmission and can create bespoke apps that work synchronously with particular programmes. To enable such interaction they are also able to insert watermarks into programme content, which is one way to enable high levels of synchronisation between first and second screens. To date, there have been only few broadcaster apps in the UK and those that have been created are mainly ‘playalong apps’ for live mass market shows, games shows and those which involve an element of contest.

• **Platform operators** (Sky, Virgin, etc.) provide both search & discovery and control & access. The former functionality is made possible by their knowledge of users’ past viewing choices; the latter functionality is made possible by their direct access to the set top boxes and their protocols. In addition, and this is not defined as ‘second screen’ in our study, some platform operators are in a position to stream broadcast content to the second screen via a set top box and home network.

• **Consumer Electronics (CE) companies** are well placed to provide apps in the control and access area because they control the technology stacks in their products. Their efforts had initially focused on (i) second screen as an extension and enhancement of the remote control, and (ii) exchanging content between the screens, though there is now a move towards providing social media and additional content as well.
Third parties have no guaranteed access to the technology stacks, nor to inbuilt synchronisation possibilities. Accordingly they have often started where barriers to entry are low, specifically combining EPGs and social media feeds, where data is available and relatively cheap. In other cases they have made use of existing infrastructures to enhance viewer experience of TV: for example, real time betting/gaming. Third parties have to date tended to avoid applications that require technically challenging elements (e.g. synchronisation) or standards for interoperability – the latter because open standards do not prevail. But a few third parties have developed technology – notably in the fingerprinting and content recognition area.

The landscape is mapped in the following Venn diagram.

The uptake of second screen

There is publicly available data on the downloads of many apps but not on their usage. The level of personal downloads of platform apps and manufacturer apps can reach up to 25% of the applicable first screen receivers. The EPG apps can reach around 2 million downloads. By contrast, even the most popular broadcaster apps are downloaded by under five percent of viewers.

Demographics are known to affect the uptake of phones and tablets, the use of apps in general, and the propensity to use second screen apps in particular. Second screen usage is more age-sensitive than most other technologies: it requires both the ownership of second screen devices and a propensity to divide attention between screens. Both device ownership and shifting attentions are more prevalent among younger viewers.
The technologies of second screen

To analyse the technologies involved we formulated a reference model showing the data flows involved in supporting various second screen apps.

- Data link 1 is the ‘traditional’ link from broadcaster to a TV receiver, and is typically used for linear ‘broadcast’ content. It pre-dates second screen applications. On this link, content is multiplexed with metadata which describes the delivery system, content and scheduling of broadcast data streams.

- Data link 2 is a direct two-way Internet Protocol (IP) link between the service cloud and the first screen. It provides an alternative way for the first screen to receive content but is mainly used for catch-up or on-demand content.

- Data links 3 and 3’ are two-way Internet Protocol (IP) links between the first screen and the second screen, used in any application where the second screen interacts with, or responds to, the first screen. There are two ways in which this link can be implemented: directly (link 3) through a home network and indirectly (link 3’) via a remote server. In the latter case, the first and second screens do not need to be on the same network.

- Data link 4 is a two-way Internet Protocol (IP) link between the service cloud and the second screen and is the backbone for second screen applications.

- Data link 5 is a two-way Internet Protocol (IP) link between broadcasters and the ‘service cloud’. It carries scheduling information, metadata and viewer analytics.

- Data link 6 is a two-way Internet Protocol (IP) link between the broadcaster and the second screen. Built from data links 4 and 5, it allows broadcasters to interact with second screens. The link applies to integrated platforms where a broadcaster or platform operator has control of the delivery chain including the second screen application itself.
Through our analysis we found that the technologies involved in second screen are substantially closed:

- Virgin, Sky and YouView employ proprietary platform APIs
- TVs and set top boxes employ proprietary APIs
- Where watermarking is used, the techniques are proprietary
- Where fingerprinting is used, the techniques and databases are proprietary.

The majority of entry barriers occur around the link between first and second screens; these are:

- Content identification and synchronisation
- Home network connectivity and control
- Cloud connectivity and control.

While the BBC has created an open API, illustrated its use for improving accessibility, and promoted it through standards bodies, we have not found great enthusiasm for the BBC’s approach. This is partly because TV manufacturers are assumed to want to keep control of the look and feel of their products, and partly because closed APIs are not widely seen as a major barrier.

When looking at open and closed standards a key question is whether innovation is promoted or discouraged. We have found that innovation is occurring widely throughout the ecosystem:

- The vertical platforms have created apps that control their set top boxes and introduce remote recording and additional streaming to the second screen;
- Manufacturers are innovating in the use of both screens to access distributed content;
- Third parties such as Shazam and Zeebox are investing in innovative techniques for content recognition and synchronisation. They also innovate in their use of open metadata and social network concepts;
- Where necessary, closed protocols are being reverse engineered, a possibility which is made easier by the tendency to build the closed APIs on top of standard open technology stacks such as DLNA and UPnP.

Taking the above into account, we conclude that the predominantly closed technologies of second screen are not working against the interest of consumers.

**Commercial analysis**

The most fundamental commercial driver behind second screen is the battle for viewers’ attention – sometimes called the ‘battle for eyeballs’. Crucially, the battle is not just between different players, it is between completely different types of player.

The second screen space is partly defined by the types of app and partly by the type of player. Effectively, each type of commercial entity has different core motivations and is using apps in different ways.
Assessing the impact of second screen

<table>
<thead>
<tr>
<th>Motivation</th>
<th>Achieved via</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broadcasters</td>
<td>To maintain viewer attention and to monetise it</td>
</tr>
<tr>
<td>Platforms</td>
<td>To monetise viewer attention</td>
</tr>
<tr>
<td>CE manufacturers</td>
<td>To differentiate their products from the competition</td>
</tr>
<tr>
<td>Third parties</td>
<td>To win viewer attention to monetise it</td>
</tr>
</tbody>
</table>

In this context, the interests and motivations of content and platform companies are in competition with those of third parties. Understanding this conflict demonstrates the strong rationale for content and platform companies (e.g. Sky), investing in first to market third parties who are willing to co-operate with a platform (e.g. Zeebox).

Despite the hype, the available data do not support the view that the ‘battle for eyeballs’ is yet particularly intense. If X-Factor has an audience of 11 million and its app has around 550,000 downloads, then 95% of eyeballs are still on the first screen.

Electronic Programme Guides (EPGs)

First screen EPGs are a relatively unsophisticated tool for helping viewers discover the content they might want to watch. There are already alternatives which use viewer profiling, content search mechanisms and social-networks to produce far more individualised recommendations.

Second screen electronic programme guides are currently available either as third party apps or as apps produced by equipment or platform providers. Many interviewees considered that second screen EPGs are preferable, citing such factors as the better user interface, the possibilities for personalisation, the integration of social media, and the potential for previewing content. Most of these facilities are possible on the first screen but are catalysed by the familiar user interface, processing power and data communication capabilities of second screen devices.

Prominence in the second screen context

If EPG functionality migrates to the second screen as suggested above, grids and lists will tend to be supplemented or replaced by richer alternatives. It follows that the linear position (LCN) of a channel will have less effect on its effective prominence than hitherto.

The experience so far is that second screen apps do not adhere to just one principle vis-à-vis prominence. Thus an individual app typically allows users the opportunity to display content according to popularity, ‘buzz’, tweets per minute, friends’ activity and recommendations as well as linear position on a grid-based guide.

Accordingly, prominence as a concept will persist even if linear position is less salient. It is possible to see how, say, BBC1 could continue to receive prominence based on social recommendation, viewing figures, ‘buzz’, past viewing patterns or stated preferences. So the ‘static prominence’ determined by LCN could become replaced by a form of ‘dynamic prominence’.
Accessibility through the second screen

Second screen devices should in principle have a role in improving the accessibility of TV. Second screen devices typically have native accessibility features such as a screen reader, a zoom function to make touch navigation easier, and swipe gesture control. TV apps such as EPGs can piggy back on these accessibility features, thereby creating accessible TV apps.

One of the barriers to improved accessibility has been the cost of building such features into TV equipment. It is often argued that the cost cannot be justified in the case where only a small number of TVs or STBs would benefit from any one development programme. Second screen apps have the potential to be used across multiple brands and models of first screen, thereby serving a wider constituency and potentially being more able to recoup costs. The transformed economics should in principle enable more forms of accessibility impairment to be addressed.

The current use of second screen to improve accessibility is limited. The main current application of second screen for blind and partially sighted people is in the control of TVs and STBs. Here a standard TV control app such as Sky+ or Virgin TV Anywhere is used in conjunction with a native screen reader and, in some cases, gesture control. This approach works quite well, although we were told by several interviewees that iOS implementations generally give fewer problems than Android. The problems have been mainly practical rather than matters of principle; we might therefore expect accessibility features to improve over time as the problems gradually get solved.

There are fewer applications of second screen for deaf people. It might be feasible to stream subtitles to a second screen device but there would be few situations in which this was preferable to having subtitles on screen. If subtitles were presented on a second screen while content is presented on the first, then the viewer’s gaze would need to keep shifting between the screens.

While second screen is not a ‘golden bullet’ solution to the challenge of accessibility, it is probable that in many instances, second screens will become the preferred interface for the control of basic first screen functions such as channel, volume, and on/off. There is some scope for the personalised processing of video and audio in order to achieve optimally accessible content. Specialised second screen apps for low prevalence accessibility issues could also be provided on second screens, but this is more speculative. For example, dynamic Braille through a future second screen device would be possible if subtitle and audio description text were transmitted in real time on the internet.

TVs are regulated for their accessibility features whereas second screen is not. The disabled community has won important battles with respect to the provision of accessibility via TV, namely the inclusion of subtitles and audio description. So it is possible to see the potential migration of accessibility functionalities to the second screen as a threat to hard won gains.

Trends and future scenarios

The role of second screen in programme search and discovery and the related channel change seems certain. However there is uncertainty in how much second screen will capture viewers’ attention – the ‘battle for eyeballs’. The two key dimensions are the extent to which 2nd screen will be adopted and exploited for commercial means (advertising and retail), and the extent to which they will be adopted and exploited to enrich editorial content in programmes across a wide range of genres as opposed to the live entertainment, games shows and contests where they have predominated. Using these two dimensions we have developed four scenarios ranging from the minimal ‘search and chat’ where second screen use is concentrated on EPGs and social media through to ‘just for you’ where two-screen viewing has become the norm for both programmes and advertising. For two-screen viewing to be the norm the costs and barriers to second screen apps would need to be reduced: there would have to be a synchronisation infrastructure and open standards.
Public policy issues

We have identified five main areas of public policy impact:

1. Issues arising from content, advertising and service delivery over the second screen. Second screen content is regulated more lightly than first screen content. However the regulators ATVOD and the ASA told us that there have not been any complaints so far. While some types of consumer harm can be imagined, there is no evidence that there is yet anything untoward about the use of second screen given its state of development.

2. PSB prominence in the second screen world. The dynamic form that prominence could take on second screens will render regulation somewhat more difficult to specify and enforce than hitherto on first screens.

3. Technology and competition. Second screen infrastructures, technologies and standards are largely closed and proprietary. While there are certainly entry barriers as a result, the level of innovation has not noticeably suffered, nor is there great support for more open access to second screen technologies.

4. Accessibility. Accessibility features can be provided on second screen devices, though at present the main use has been to enable talking EPGs for blind people. Second screen devices have the potential to offer more accessibility features but they are currently not required to do so under regulations which
apply to the first screen. The fragmentation of hardware and software in second screen means that second screen accessibility cannot be guaranteed in the way that first screen accessibility can.

5. ‘Technology universality’. The hardware and software in second screen is fragmented. The two main operating systems in use are iOS and Android but there are many different versions of Android, and the available features are dependent on the processor chipset. The accessibility capabilities differ between versions of Android too. Smartphones and tablets are developing much faster than TVs and are being replaced more frequently (typically 1 to 2 years). This, too, can have impacts because previously supported features can be dropped (as happened recently with Flash on Android). These characteristics of second screen devices are not problematic in themselves but collectively they mean that second screen services will not be as stable as TV and cannot offer the ‘technology universality’ that is normally expected of TV.

Conclusions and recommendations

1. The second screen space is only a few years old. As a result, many aspects are still in a state of flux, including: the definition of second screen as a category, the functions and features offered, the technologies and infrastructures involved, and the business models of the players in second screen. Consequently any conclusions are necessarily based on a snapshot of this immature market.

2. Nevertheless the field is developing fast, so Ofcom should consider acting to give itself maximum flexibility in whether and when to update regulation in recognition of the wider use of second screen, or where some other intervention might be warranted. We have highlighted such areas for Ofcom’s consideration according to the three main functionalities identified in our survey.

3. In the functional area of ‘accessibility and control’, the technologies are still largely proprietary. The BBC has proposed an open standard (the Universal Control API) but this shows little sign of becoming adopted. In the area of synchronisation there are no standards. The lack of standards for both control and synchronisation raises entry barriers and therefore could discourage the development of new apps. There is no sign that the lack of open standards is currently harming innovation but the situation may change and Ofcom should keep the issue under review.

4. In relation to ‘accessibility’, despite the fact that second screen is not at this point a priority for organisations such as the RNIB, Ofcom should consider how the requirement for, or the promotion of, accessibility on the first screen might evolve to encompass the second screen. In the longer term, ideas such as dynamic Braille would be accelerated if enabling data including real time subtitles and audio description text were made available on the internet.

5. In the functional area of ‘contextual enhancement’, there is a potential loophole in that content being called up on a second screen but without using watermarking of first screen content (e.g., via a synchronised time stamp) is not currently subject to broadcast regulation. Current regulations enable all content on the first screen – including web addresses and embedded data – to be regarded as ‘content’ and regulated accordingly. If an audio watermark transmitted in a broadcast signal elicited inappropriate content to appear on a second screen then the broadcaster would be accountable for the watermark. However, some second screen synchronisation methods do not involve the insertion of content in the broadcast signal. Thus a second screen app could potentially offer synchronous, related, content to the first screen, behaving in effect as ‘push’ content but not necessarily being capable of being regulated as broadcast content. This loophole will need to be addressed; consideration should be given to the circumstances when second screen content would legitimately be seen as part of first screen content and need to be regulated as such.
6. To inform future policy on second screen Ofcom should consider adding questions to its surveys to try to track the level and type of usage of second screen apps, perhaps referencing the main functionalities established through the our survey.
1 Introduction

This project was commissioned as an input into Ofcom’s longer-term, strategic thinking on the broadcasting ecosystem, access services, and EPG prominence for licensed Public Service Broadcasters. The terms of reference are included in Appendix A. Essentially we were asked to survey the current landscape of ‘second screen’ in the UK, understand this landscape in terms of the technologies, use cases and commercial arrangements, identify the potential benefits to consumers of innovative second screen applications, and critique the landscape in terms of wider impacts and possible regulatory implications. In addition we were asked to suggest and explore possible future scenarios for second screen in three to five years’ time.

The study was started in early February 2013 and lasted until the end of April 2013. It was undertaken by a team from three organisations under the overall leadership of Technologia:

- Technologia – a technology and policy consultancy and a member of Ofcom’s consultancy panel;
- The Digital Television Group (DTG) - the UK’s not-for-profit digital television trade association formed in 1995 and bringing together the value chain in digital television to discuss and agree technical standards;
- i2 media research - a consumer and media psychology consultancy attached to Goldsmiths University which has extensive experience of concentrating on consumer-facing issues around the consumption of and engagement with digital TV and related media products and services.

The study was undertaken through desk research, workshops and interviews. We would like to thank the individuals and organisations that have kindly contributed to this work by being interviewed or sending us written responses to our questions. A list of participants is included in Appendix B.
2 Definitions and scope

2.1 Terminology
As well as ‘second screen’, several other terms are in use in the industry including ‘dual screen’ and phrases based on the word ‘companion’ such as ‘companion screen’ and ‘companion apps’. In this report we shall use the term ‘second screen’ as the generic term.

It is sometimes helpful to recognise:

- ‘Second screen apps’ – software loaded onto a device (the term ‘companion app’ is sometimes used by others)
- ‘Second screen services’ – websites that deliver content and the servers that deliver services to second screen devices
- ‘Second screen devices’ – devices (mainly smartphones and tablets, but also including laptops and PCs) that provide the second screen and associated processor.

For brevity, unless the context requires otherwise, we shall use the term ‘app’ to cover both the software on a device and the connected services that support it. Thus, for the purposes of this report, an ‘app’ can include websites.

2.2 Existing definitions of ‘second screen’
There is no single accepted definition of ‘second screen’; consequently there are situations where there is ambiguity as to whether a particular application is ‘second screen’ or not. For example, Twitter is currently becoming an important adjunct to TV watching for some people but is a generic service that was not designed with TV in mind. In interviews we have found that some observers would include Twitter as a second screen app whereas others would not.

Our starting point was Ofcom’s definition which reportedly is a modified version of the DVB’s definition¹:

Second screen are a class of connected devices or applications that are designed to be complementary to TV watching or radio listening by presenting content that is contextual and/or synchronised to what is showing on the primary screen whether that is live or on-demand. The second screen may be completely integrated with the TV content and/or with the television set.

A 2010 BBC R&D project² adopted a similar working definition of a second screen:

Second screens are a class of applications (or devices) that are designed to be complementary to TV watching or radio listening by displaying content that is contextual and synchronised to what is showing on the primary screen whether that is live or on-demand. The second screen may be completely passive or it may allow interaction with itself, the primary screen, other people in the

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¹ See Appendix A

same room or even wider social interactions. Ultimately second screens could communicate with other second screens in the same domestic environment.

In our interview with BBC R&D, they stated their view that varying degrees of automatic or ‘intelligent’ awareness between the two screens is required, depending upon the kind of experience to be offered by the second screen application. In this definition, tweeting in response to a call to action from a BBC presenter would not count as ‘second screen’. The BBC refers to the second screen as ‘companion screen’ and services based on this intelligent awareness as ‘companion screen services’. For the BBC, intelligent awareness allows the companion device to automatically offer services related to content on the TV screen, ranging from those based on simple awareness of what the TV programme is, including accessible EPGs and web information surfaced about the TV programme, through to experiences editorially related and accurately synchronised to points in the TV programme, and up to frame-accurately synchronized experiences offering complementary video/audio on the companion device.

Arqiva told us that ‘second screen’ refers to the use of a personal device (tablet, smartphone etc.) to provide content that is supplementary and/or related to that being presented simultaneously as linear broadcast on a ‘conventional’ TV.

However, these definitions emphasise the purposeful use of second screens by broadcasters. Other stakeholders in different parts of the value chain take a wider view and include types of usage that have a lesser degree of linkage to content. Recognising the gradation, Decipher and Red Bee Media have suggested three definitions, ranging from ‘dual screening’ which covers any activity using a second device undertaken while watching TV, ‘synchronous activity’ which is any second screen activity prompted by the TV regardless of the level of integration, and ‘companion experiences’ which refers to activity on a second device specifically created by the maker of the service/content being watched. Their definitions are illustrated in Figure 1.

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3 Arqiva email

Unfortunately, while the gradation is well observed, there is no standardisation as regards terminology. BT told us:

“We don’t believe there is common industry view of the terms ‘dual screen’, ‘companion screen’ and ‘second screen’. Some people here refer to ‘companion apps’ when talking about EPG-type applications and ‘dual screen’ when describing tightly-coupled usages.”

Such a schema would align with the insights of Figure 1 but using the opposite terminology. In summary, while many participants have observed the different varieties of second screen experience currently available and have sought to give them names, a common terminology has yet to evolve.

2.3 The ‘second screen phenomenon’

Taking into account the lack of accepted definitions we first note the existence of a ‘second screen phenomenon’ – i.e. the tendency for people to either watch TV through second screen devices or to use these devices as part of their TV watching experience. No doubt was expressed in interviews that a second screen phenomenon exists and is growing as the ownership of second screen devices spreads and their integration into daily life continues. The second screen phenomenon is itself part of a wider cultural trend for audiences in live sports events, concerts and lectures to use a second screen device simultaneously with

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5 BT Research interview
the main action, entertainment or lecture happening live. Second screen apps are even being developed for cinemas⁶.

TV watching has never required nor achieved 100% of people’s attention. Three in ten Americans say they do something else while watching TV (30%) and only 14% say they do not do any other activity while they watch TV⁷. To an extent, second screen apps represent a new opportunity to make sure this ‘something else’ is connected to TV. According to Rovi Corporation, 85% of people who own a second screen device use their devices while the TV is playing⁸.

The second screen phenomenon is enabled by the level of ownership of relevant devices. According to 2012 Ofcom figures, 58% of consumers own a smartphone and 19% own a tablet⁹. With this level of penetration, it is likely that around two thirds of TV viewers would already have the ability to sit down to watch television with a tablet or smartphone in hand. It is almost certain that the vast majority would also have access to broadband as 77% of households have a broadband connection¹⁰. Tablet ownership is probably now higher than these figures suggest because 4.1m tablets were sold in the UK in the last three months of 2012¹¹ and these are not included in the Ofcom figures.

According to Ofcom data, only 5% of households have a connected TV¹². However, the Sky+ and Virgin TiVo set top boxes can also connect to a home network, as can games consoles. Ofcom found in Q1 2012 that 41% of households had internet enabled set top boxes (STB)¹³ such as these. It is likely therefore that around half of households now have a connected TV or STB.

Smartphones and tablets are widely used. 12% of UK internet users claim to access the internet the most through their connected devices; indeed, 16.4% of internet traffic is generated from these devices¹⁴. Using a smartphone for social networking is particularly popular among 18 to 24 year-old mobile phone owners in the UK (62%)¹⁵.

Smartphones and tablets are increasingly used as media consumption devices. According to BBC statistics, tablets’ share of total iPlayer requests grew from 6% in January 2012 to 10% in November and 15% in February 2013. Smartphone requests have seen similar growth from 6% of the total a year ago to 16% in January 2013¹⁶. Virgin told us that the uptake of the Virgin TV Anywhere app (which enables streamed

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⁷ http://www.harrisinteractive.com/NewsRoom/HarrisPolls/tabid/447/mid/1508/articleId/818/ctl/ReadCustom%20Default/Default.aspx
⁹ http://stakeholders.ofcom.org.uk/binaries/research/cmr/cm12/icmr/ICMR-2012.pdf, p22
¹⁰ http://stakeholders.ofcom.org.uk/binaries/research/cmr/cm12/icmr/ICMR-2012.pdf, p23
¹¹ http://www.guardian.co.uk/media/2013/mar/04/bbc-iplayer-tablet-viewing?CMP=twt_fd
¹² http://stakeholders.ofcom.org.uk/binaries/research/cmr/cm12/CMR_UK_2012.pdf, p116
¹³ http://stakeholders.ofcom.org.uk/binaries/research/cmr/cm12/CMR_UK_2012.pdf, p238
¹⁴ http://stakeholders.ofcom.org.uk/binaries/research/cmr/cm12/icmr/ICMR-2012.pdf, p8
¹⁵ http://stakeholders.ofcom.org.uk/binaries/research/cmr/cm12/icmr/ICMR-2012.pdf, p206
¹⁶ http://www.guardian.co.uk/media/2013/mar/04/bbc-iplayer-tablet-viewing?CMP=twt_fd
content on an iPad or iPhone) has been “significant” since it was launched in November 2012. Sky told us that both its Sky+ app and its Sky Go app (which enables media playback through smartphones and tablets) had been popular.

In principle, therefore, device ownership suggests that the proportion of users who are able to access second screen experiences is between a half and two-thirds. This is consistent with reports on second screen usage. The proportion of people reporting that their TV watching is now complemented by smartphones, laptops and tablets varies across research studies. Reports of second screen use range from 24%\(^ {17}\) to 63%\(^ {18}\) and as much as 67%\(^ {19}\). But, according to Rovi, only 14% of activities on a second screen device are related to what is playing on the TV, a filter which is closer to how this study defines second screen activity’\(^ {20}\).

In another study\(^ {21}\) 34% reported regularly multi-screening whilst watching TV and only 14% of UK consumers of TV and internet services reported never having multi-screened. Using a second screen device simultaneously with TV viewing is recognised as being particularly prevalent among the “younger demographic”, variously defined as 19 to 24 or 18 to 34 year olds\(^ {22}\). To quote a report by Rovi:

“To meet the needs of technology influencers, it’s more important for us to address the pain points of the 22-year-old versus the 52-year-old. In the younger demographic, highly curated experiences are desirable, requiring new attitudes toward guidance and recommendations. Providing relevant, accessible discovery and entertainment options that are easy to share via social media is key to success’\(^ {23}\)

In summary, the level of ownership of devices potentially capable of second screen use, coupled with emerging patterns of behaviour, all contribute to the growth of the second screen phenomenon. But younger viewers are far more likely to use second screen apps than older viewers, emphasising that these apps are part of a wider trend. Quoting again from Rovi:

‘Watching television with a smartphone or tablet device is quite simply one of the most popular leisure activities of the mobile era’\(^ {24}\)

\(^{17}\) GfK NOP Media, for Deloitte (Aug, 2012). The rise and rise of ‘second screening’. (http://www.deloitte.com/view/en_GB/uk/industries/tmt/f0f3f07a77349310VgnVCM3000001c56f00aRCRD.htm)

\(^{18}\) Ipsos MediaCT for IAB (May 2012). Smart phones are first choice for second screen. (http://www.mediapost.com/publications/article/174919/smartphones-are-first-choice-for-second-screen.html#axzz2M7Y9e03a)


\(^{21}\) COG research for Thinkbox (June 2012). Screen Life: the view from the sofa. http://www.thinkbox.tv/multi-screening-encourages-more-tv-and-ad-viewing and http://www.thinkbox.tv/server/show/ps2165 (n=23 TV HHs (with more than 60 participants), ethnographic research with psycho-physiological analysis over a 1 week period, and online research with n=2000 users of TV and internet – though note, in the second reference it cites n=1000)

\(^{22}\) Rovi interview


Assessing the impact of second screen

The phenomenon itself has generated quotes such as the one above, and many column inches. There is less written which seeks to separate the hype from the reality, and show what consumers are actually using their second screens for, what they engage with, and for how long.

2.4 Key dimensions

Within the second screen phenomenon we have identified two key dimensions against which we can map second screen activity:

- **The intentions of the application developer:**
  - Products which have been specifically created for use as a second screen in connection with TV viewing; versus
  - Generic products which have been ‘appropriated’ for use as a second screen in connection with TV viewing.

- **Dependence on real-time interaction/communications:**
  - Dependent; versus
  - Not dependent.

Combining these two factors in Table 1 provides four categories against which apps can be mapped. Each quadrant lists examples of apps in that category.
### Table 1: Initial classification of apps in second screen space

<table>
<thead>
<tr>
<th>Made...</th>
<th>Dependent on real-time interaction/communications</th>
<th>Not dependent on real time interaction/communications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>... with a deliberate focus on TV</strong></td>
<td><strong>Intentionally second screen apps</strong></td>
<td><strong>TV magazine apps</strong></td>
</tr>
<tr>
<td>Products which have been specifically created for use as a second screen apps in connection with TV viewing</td>
<td>Apple TV Remote</td>
<td>BBC Top Gear</td>
</tr>
<tr>
<td></td>
<td>BBC Antiques Roadshow app</td>
<td><strong>London 2012</strong></td>
</tr>
<tr>
<td></td>
<td>Britain’s Got Talent app</td>
<td></td>
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<tr>
<td></td>
<td>Fanatix</td>
<td></td>
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<tr>
<td></td>
<td>LG Magic</td>
<td></td>
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<tr>
<td></td>
<td>Panasonic Viera remote</td>
<td></td>
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<td></td>
<td>Roku</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Samsung AllShare remote</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Shazam for TV</td>
<td></td>
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<tr>
<td></td>
<td>Sky+ app</td>
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<td></td>
<td>Sony TV SideView</td>
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<td>TV Check</td>
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<td>TV Guide</td>
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<td></td>
<td>TV24</td>
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<td></td>
<td>Virgin TV Anywhere</td>
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<td></td>
<td>YouView app</td>
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<tr>
<td></td>
<td>Zeebox app</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&lt;3 million downloads in the UK</td>
<td></td>
</tr>
<tr>
<td><strong>... with a generic focus</strong></td>
<td>** Appropriated apps**</td>
<td><strong>Incidental apps</strong></td>
</tr>
<tr>
<td>Products and services that have a looser relationship with TV</td>
<td>Facebook</td>
<td>Wikipedia</td>
</tr>
<tr>
<td></td>
<td>Google Plus</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Twitter (user generated)</td>
<td>Pinterest</td>
</tr>
<tr>
<td></td>
<td>Twitter (broadcaster initiated, e.g. #BBCQT)</td>
<td>Email</td>
</tr>
<tr>
<td></td>
<td>William Hill</td>
<td>SoundCloud</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Texting/WhatsApp</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&lt;60 million downloads in the UK</td>
</tr>
<tr>
<td></td>
<td>&lt;15 million downloads in the UK</td>
<td></td>
</tr>
</tbody>
</table>

Within this project we are concentrating on the apps and services in the left hand column of the table; in effect those that enable or depend on real-time interaction/communications. The upper left quadrant is labelled ‘Intentionally second screen apps’, and the bottom left quadrant is labelled ‘appropriated second screen apps’. According to this table, we exclude some applications that we know to be used while watching TV - such as email - because there is no explicit connection to the TV-watching experience.

We think that this categorisation leads to a sufficiently narrow definition to be useful in policy terms. However in case there are still ambiguities we have specified three further criteria for inclusion as a second screen application or service within this report:

1. **Must relate to linear TV**
   - The second screen must strongly relate to a linear TV channel, i.e. programmes that will be, are being, or have been broadcast, and are capable of being viewed on a main TV set (whether or not they are actually being watched on a TV set or not). Note that we therefore include streamed TV services on the first screen but exclude situations where the first screen is displaying video on demand material unrelated to a linear TV channel.

2. **Must use a second, independent, device**
   - The usage must also employ a second screen device such as a smartphone, tablet, PC or laptop. This excludes situations where the main screen is partitioned between broadcast and another application. It also excludes situations where the second screen is the only TV viewing device such as where linear TV content is being streamed to the second screen in a manner that is independent of the content being displayed on the first screen.
3. **Must involve synchronisation, interoperability or some other intentional linkage between the two screens**

   There must be an intention to ‘link’ the contents of the two screens. The intentionality can be on the part of the platform operator, broadcaster, content provider, or in some cases the viewer. It may involve a technological linkage such as a synchronisation technology such as audio watermarking, equipment interoperability, or a soft linkage such as a ‘call for action’ to the viewer. Using a second screen for streamed content that is unrelated to the main screen is excluded.

Standing back from the detail it appears that ‘second screen’ is still a concept that has not yet been fully shaped by usage. Different players are pulling the technologies in their direction but overall ‘second screen’ has no inherent character at present. Some see second screen as a *revolution* that is disrupting traditional TV whilst others see it as an *evolution* of existing technologies and behaviours.

### 2.5 Related trends

The development of second screen applications is also taking place against a backdrop of change. The set-top box (STB) is slowly turning into a ‘media gateway’; this is indicative of a decline in the relative importance of the main set/screen as a single, integrated device. It is also indicative of the slow replacement cycle of main sets, which are expensive and replaced much less frequently than set top boxes. Set top boxes are cheaper and can provide additional functionality, such as connection to the internet.

During the project we have observed other ‘parallel’ trends occurring which may involve the same devices or be related in some way. These include:

- Internet connected TV and streamed IPTV. These make some second screen functions implementable, or easier to implement;
- Watching TV content on mobiles and tablets instead of main TVs (It is notable that the vertical platform apps Virgin TV Anywhere, Sky Go and YouView all include this streaming functionality);
- New human interface technologies which could change the way that both first screen and second screen devices interact with people. For example, during the course of the project Samsung launched a smartphone which allows users to control its screen using only their eyes.\(^{25}\)

These are not ‘second screen’ trends as we have defined the term, though they undoubtedly affect the growth of the second screen phenomenon.

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3 Typologies of second screen functionalities and apps

3.1 Introduction
This chapter is based on a review of around 40 currently available second screen apps together with an illustration of their functionalities. We have sought to ‘make sense’ of the initially bewildering range of apps available by constructing typologies.

To help make explicit the sorts of applications that are included in our definition we have compiled a list of apps that meet our three criteria (section 2.4). We have included:

- The majority of the second screen apps available in the UK according to the criteria of section 2.4;
- A small number of apps that are just outside our criteria but we think could migrate to satisfy our criteria;
- Examples from outside the UK which represent a use case not currently available in the UK but could potentially become available in the UK. If the leading variant of a particular app is not currently available in the UK, we assume that it will eventually be sold here. For example, while Shazam for TV is not yet in the UK, Shazam is, and the company has indicated its intention to become more TV-focused in its UK activities.

A full listing of the applications we have considered is included in Appendix C.

We then conducted an iterative process to develop classifications of apps and the functionalities they offer. The process is explained below.

3.2 Top-level functionalities
Despite the heterogeneity of second screen apps we observed that most apps provide one or more of the following three top-level functionalities:

- **Control and access** – using the second screen to control the first screen, provide additional accessibility features, and enhance the electronic interaction between devices, for instance by enabling the sharing of content between screens and other networked devices;

  The rationale for using a second screen for control and access is that it can provide an additional easy-to-use remote control, the capacity to control the first screen from a different room in the house (e.g. controlling children’s viewing), and the capacity to control the first screen remotely when not on the home network.

- **Search and discovery** – using the second screen to help viewers search or discover channels and/or content by selection from an EPG, programmable alerts for shows, recommendation related to previous viewing choices or inferred preferences, or by reference to social networks. Second screens allow:
  - A more visually appealing menu to be displayed
  - The ability to search for content without compromising the viewing on the first screen
  - More convenient and richer forms of interaction like touchscreen and QWERTY keyboards
  - Curation, such as concentrating on sport
  - Customisation and personalisation
Assessing the impact of second screen

- Additional information feeds, including background information and a social dimension powered by such services as Twitter
- In some circumstances, remote or nomadic control of recorders.

The technical requirements associated with search and discovery are generally not onerous. Even where the TV is not controlled directly from the second screen device, it is still apparent that second screen applications have the capability to help users decide what to watch.

- **Contextual enhancement** – providing additional material or interactivity related to the content of the material playing on the main screen.

We tested this typology in our interviews and found that all agreed with it as a reasonable representation of the apps and services available. It was also observed by some that the three functionalities are currently at different levels of maturity and uptake:

- **Control** is a straightforward offering with a clear utility to viewers. Some new functionalities are provided, such as ‘time and place’ shifting for remote recording, but for the most part it is a variant of the handheld remote control. This class of apps makes almost no new demands on viewers, nor does it generally involve new business models;

- **Search and discovery** is slightly more speculative as it involves viewers searching for content on a second device instead of the main screen, and often using different methods of selection;

- **Contextual enhancement** is more experimental and less clearly accepted by viewers. It involves ‘new behaviours’ and, sometimes, new business models. The interactive nature of these offerings can act to reinforce linear TV and therefore the value of the first screen to advertisers.

Aligned to these observations is the idea, put forward by one interviewee, that the different functionalities had different levels of utility - with the control and access functions providing more durable value to consumers than content related apps. During our interviews we found that most interviewees believed that the simpler an app, the more utility, relevance and success it will have.

### 3.3 Component functionalities

We then broke-down the top level functionalities into a finer classification. We identified ten such lower level functionalities which we have called ‘component functionalities’ to show that they are related to the three top level functionalities described above, but the term ‘use case’ is an equivalent concept. Table 2 lists these functionalities; they can all be described in terms of the use that is made of the second screen. For simplicity we have also given each of these ten component functionalities a short form title. So in Table 2 the first component functionality is “I use the second screen for controlling the first screen channel selection while on the same home network” and it is also described simply as ‘channel change’.
Table 2: List of component functionalities

<table>
<thead>
<tr>
<th>Using the second screen for ...</th>
<th>Short form title</th>
<th>Top level functionality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controlling the first screen channel selection whilst on the same home network</td>
<td>Channel change</td>
<td></td>
</tr>
<tr>
<td>Fully controlling the first screen on the same home network</td>
<td>Full remote control</td>
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<tr>
<td>Managing schedule of recordings and/or DVR hard drive from anywhere</td>
<td>Nomadic control</td>
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<tr>
<td>Flipping content between first and second screens, and other additional features, mainly on same manufacturer devices</td>
<td>Content sharing</td>
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<tr>
<td>Additional accessibility services e.g. talking EPG</td>
<td>Enhanced accessibility</td>
<td></td>
</tr>
<tr>
<td>Accessing an EPG enhanced with rich content (additional information, remote control, preview, personalisation)</td>
<td>Rich EPG 26</td>
<td></td>
</tr>
<tr>
<td>Seeing other people’s tweets and comments about a programme, and seeing metrics on viewing and social media activity ('Buzz')</td>
<td>Socially enhanced EPG</td>
<td></td>
</tr>
<tr>
<td>Registering my viewing of a programme and sharing comments with other viewers</td>
<td>Social viewing</td>
<td></td>
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<tr>
<td>Interacting with the programme in additional ways or getting extra content</td>
<td>Programme enrichment</td>
<td></td>
</tr>
<tr>
<td>Interacting with related content and services</td>
<td>Related content and services</td>
<td></td>
</tr>
</tbody>
</table>

26 The term ‘EPG’ is not intended to imply an EPG as defined in the Communications Act 2003 – see Section 9.2
### 3.4 Clustering second screen apps by their component functionalities

We then researched the apps in Appendix C to identify which component functionalities are offered in each app. We produced a table which was then sorted so as to identify clusters of related apps, i.e. apps which largely have the same combination of component functionalities or are otherwise similar by virtue of their salient characteristics. The sorted clusters are shown in Table 3.

<table>
<thead>
<tr>
<th>Table 3: Clustering of apps</th>
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</table>
### Assessing the impact of second screen

<table>
<thead>
<tr>
<th></th>
<th>Control and access</th>
<th>Search and discovery</th>
<th>Contextual enhancement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Channel change</td>
<td></td>
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<tr>
<td></td>
<td>Full Remote control</td>
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<td></td>
<td>Nomadic control</td>
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<td></td>
<td>Content sharing</td>
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<td></td>
<td>Enhanced accessibility</td>
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<td></td>
<td>Rich EPG</td>
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<td></td>
<td>Socially enhanced EPG</td>
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<td></td>
<td>Social viewing</td>
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<td></td>
<td>Programme enrichment</td>
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<td></td>
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<tr>
<td></td>
<td>Related content and services</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>R-EPG</strong></th>
<th>TV24.co.uk</th>
<th>Livesport.co.uk</th>
<th>Sidereel</th>
<th>✓</th>
<th>✓</th>
<th>✓</th>
<th>✓</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S-EPG</strong></td>
<td>Fanatix</td>
<td>On Air</td>
<td>TV Guide</td>
<td>✓*</td>
<td>✓*</td>
<td>✓</td>
<td>✓</td>
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<td></td>
<td></td>
<td></td>
<td>TV Check</td>
<td>✓</td>
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<td>✓</td>
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<td><strong>COMP</strong></td>
<td>Zeebox app</td>
<td>✓</td>
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<td></td>
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<td><strong>APPR</strong></td>
<td>Google Plus</td>
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<td></td>
<td>Twitter</td>
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<td>Foursquare</td>
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<td>YouTube clips</td>
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<td>Pinterest</td>
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<td>✓</td>
<td>✓</td>
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<tr>
<td><strong>A</strong></td>
<td>EPG plus screen reader</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
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<tr>
<td><strong>MISC</strong></td>
<td>dijit</td>
<td>✓*</td>
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</tbody>
</table>

**Notes to Table 3**

(a) Full remote control of set top box, only
(b) Requires an additional IR controller, the Griffin beacon
(c) First screen content delivered via IP
(d) Shazam for TV is currently available in the USA
(e) Can be used for Samsung Smart TVs and Virgin TiVo on iPad
As can be seen from the table, there are effectively ten ‘clusters’ of second screen app offering different combinations of component functionalities. We found that the provenance of an app was important in influencing its functionalities. In some cases there were apps that provided more or less functionality than was typical for the cluster. Following the nomenclature in the left hand column in Table 3, the clusters are:

(M) Consumer Electronics (CE) manufacturer produced remote control apps
(P) Platform-produced apps to provide access to EPG (rich, socially enhanced, or regular schedule) and control the set-top box or connected TV box or service e.g. Apple, Roku, YouTube
(B) Broadcaster produced apps to enrich viewer experience of TV content
(3RD) Third party produced apps to provide access to contextually enhanced experience (social activity, betting, shopping)
(R-EPG) Third party produced apps to provide access to rich EPG, both with and without capacity to change channel
(S-EPG) Third party produced apps to provide access to socially enhanced EPGs, both with and without capacity to change channel
(COMP) Apps with comprehensive features including rich EPG, social EPG and programme-related information and services
(APPR) Apps which have been appropriated to second screen, mainly in the field of social activity around TV content
(A) Accessibility related functions, either via native capabilities of smart devices (e.g. iOS’s VoiceOver) or as third party apps
(MISC) Miscellaneous.

These clusters of second screen app can be represented on a Venn diagram, Figure 2, which shows which of the top-level functionalities they are related to. As recognised above, there were apps that provided more or less functionality than was typical for a cluster so the Venn diagram is indicative rather than exhaustive.
Assessing the impact of second screen

Figure 2: Venn diagram of second screen apps, mapped across top level functionalities. Note that the colour coding will be discussed later in the report

The different clusters of app are described in detail in Appendix K. The next chapter explains the equipment requirements for second screen experiences.
4 The uptake of second screen apps

4.1 Methodology
As a check on the hype about second screen we have reviewed statistics on downloads obtained from the app statistics site XYO. This site gives the number of downloads but unfortunately not the number of active users. The source data is reproduced in Appendix E together with other population statistics used in this chapter.

In interpreting these figures it is necessary to recognise that there is a difference between downloads and users. We have divided the figures by two population factors (TV households and UK population 15+) in order to give an idea of scale. Traditionally, TVs are scaled by numbers of households but personal devices such as mobile phones are scaled by numbers of people. Second screen apps could in principle be scaled by either, so here we have mainly used both UK households and UK population aged 15 years+. Arguably primary data would need to be collected to help understand the use of second screen apps in the UK, referenced both to household and to user. In some cases we have used other, more specific, population factors to generate more relevant denominators.

4.2 Downloads by type of app
By comparing the number of downloads per app relative to the number of TV households, it is possible to ascertain a relative measure of their impact. The results are shown in Table 4. We would caution that the percentages presented here cannot be interpreted as ‘market penetration’ as they do not take account of the number of smart devices owned by each smart device owner, nor how many devices smart device owners once owned and no longer use (having replaced them).

Table 4: Downloads by class of app and as a percentage of households

<table>
<thead>
<tr>
<th>App</th>
<th>Total Number of Downloads</th>
<th>As a % of TV Households (26.8 million)</th>
<th>As % of UK popn aged 15+ (52 million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE Manufacturer apps</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Panasonic Viera remote</td>
<td>124,600</td>
<td>0.5% (~25% of Panasonic households)</td>
<td>0.2%</td>
</tr>
<tr>
<td>Platform apps</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sky+</td>
<td>2,604,000</td>
<td>9.7% (27.7% of Sky TV Households)</td>
<td>0.5%</td>
</tr>
</tbody>
</table>

27 http://xyo.net/
### Assessing the impact of second screen

<table>
<thead>
<tr>
<th>App</th>
<th>Total Number of Downloads</th>
<th>As a % of TV Households (26.8 million)</th>
<th>As % of UK popn aged 15+ (52 million&lt;sup&gt;18&lt;/sup&gt;)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virgin TV Anywhere</td>
<td>269,000</td>
<td>1.0% (7.1% of Virgin TV Households)</td>
<td>0.52%</td>
</tr>
<tr>
<td>YouTube Remote</td>
<td>246,000</td>
<td>0.9%</td>
<td>0.47</td>
</tr>
<tr>
<td>YouView app</td>
<td>27,000</td>
<td>0.1% (11.74% of YouView Households)</td>
<td>0.05%</td>
</tr>
<tr>
<td>Roku</td>
<td>11,000</td>
<td>0.041%</td>
<td>0.02%</td>
</tr>
<tr>
<td><strong>Broadcaster apps</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BBC Antiques Roadshow app</td>
<td>28,500</td>
<td>0.1%</td>
<td>0.05%</td>
</tr>
<tr>
<td>Britain’s Got Talent</td>
<td>174,000</td>
<td>0.6%</td>
<td>0.3% (1.5% BGT viewers)</td>
</tr>
<tr>
<td>X-Factor</td>
<td>547,500</td>
<td>2.0%</td>
<td>1.05% (5% X-Factor viewers)</td>
</tr>
<tr>
<td><strong>3&lt;sup&gt;rd&lt;/sup&gt; party</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shazam</td>
<td>7,125,600</td>
<td>26.6%</td>
<td>13.07%</td>
</tr>
<tr>
<td>William Hill</td>
<td>584,000</td>
<td>2.2%</td>
<td>1.12%</td>
</tr>
<tr>
<td><strong>Rich EPG</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TV24</td>
<td>1,259,000</td>
<td>4.7%</td>
<td>2.42%</td>
</tr>
<tr>
<td><strong>Social EPG</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TV Guide</td>
<td>2,706,300</td>
<td>10.1%</td>
<td>5.02%</td>
</tr>
<tr>
<td>Fanatix</td>
<td>18,000</td>
<td>0.1%</td>
<td>0.03%</td>
</tr>
<tr>
<td><strong>Comprehensive</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zeebox</td>
<td>219,000</td>
<td>0.8%</td>
<td>0.42%</td>
</tr>
<tr>
<td><strong>Appropriated and other comparators</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 4 shows that the most popular apps are in the appropriated category, i.e. related to social media (Facebook, Google+ and Twitter) and show downloads much more akin to the UK population of 62.6m than they do TV households.

The second most popular app is Shazam, which indicates the high perceived value of its core functionality in music, more than in television.

The third most popular genre of app is the platform specific variety such as Sky+, YouView and Virgin TV Anywhere. We have shown the percentages based on the numbers of users of the respective platforms. The Virgin figure is artificially deflated because not all Virgin households have the TiVo box which is necessary in order to use TV Anywhere as a second screen app. The uptake in this area reflects the perceived utility of these apps, a finding that was confirmed in interviews. We have not been able to scale any of these figures to the proportion of customers on a vertically integrated platform that own a smartphone or tablet.

Fourthly, EPG apps are averaging between 5 – 10% of the TV population which is probably indicative of the number of apps in this space, as well as the fact that similar functionalities are provided by a number of platform specific apps, websites and even the TV itself. Looking at the data in Appendix E, EPG apps appear to be more popular on mobiles, which may suggest that the inherent mobility and convenience of mobile phones is a factor in their success. Tablets may compete more directly with infra-red remotes.

Any one manufacturer’s specific remote control has a low numbers of downloads which is a consequence of the small proportion of households owning a compatible model of any one manufacturer’s TV. However, for the one app that we have statistics for, Panasonic Viera Remote, it would seem that the uptake is 25% relative to Panasonic Viera households.

The least ‘popular’ apps as a percentage of TV viewers are apps that provide contextual enhancement such as X-Factor, Britain’s Got Talent and the Antiques Roadshow. Such apps are variable in their uptake, presumably depending more on the popularity of the shows themselves, the perceived value of the app, the digital literacy of its viewers, their willingness to engage with the content and whether or not they have the requisite technology. Additionally, different programmes have different demographics. However, ITV told us that the number of downloads of the Britain’s Got Talent app has doubled over the last year.
In conclusion it would appear that while the appropriated apps are far more popular than second screen apps, the level of personal downloads of platform apps and manufacturer apps can reach up to 25% of first screen receivers.

### 4.3 Demographics and network effects

Demographics are known to affect the uptake of phones and tablets, the use of apps in general, and the propensity to use second screen apps in particular. Data from Rovi suggests that second screen usage is more age-sensitive than most other technologies\(^{29}\). This can be attributed to the need for viewers to adopt new TV watching behaviours in some instances which is much more likely among younger viewers. The ownership of devices is already skewed towards younger consumers.

As is evident by the growth of certain social media apps, there are might be network effects involved with some types of app. In Table 5 we note the types of app that could exhibit network effects.

<table>
<thead>
<tr>
<th>Type of app</th>
<th>Possible network effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>(M) Consumer Electronics (CE) manufacturer produced remote control apps</td>
<td>Unlikely</td>
</tr>
<tr>
<td>(P) Platform-produced apps to provide access to EPG (rich, socially enhanced, or regular schedule) and control the set-top box or connected TV box or service e.g. Apple, Roku, YouTube</td>
<td>Unlikely</td>
</tr>
<tr>
<td>(B) Broadcaster produced apps to enrich viewer experience of TV content</td>
<td>Possible network effects from audience participation in games and contests</td>
</tr>
<tr>
<td>(3RD) Third party produced apps to provide access to contextually enhanced experience (social activity, betting, shopping)</td>
<td>Possible network effects</td>
</tr>
<tr>
<td>(R-EPG) Third party produced apps to provide access to rich EPG, both with and without capacity to change channel</td>
<td>Unlikely</td>
</tr>
<tr>
<td>(S-EPG) Third party produced apps to provide access to socially enhanced EPGs, both with and without capacity to change channel</td>
<td>Generic social media network effects and network effects from app-specific social media</td>
</tr>
<tr>
<td>(APPR) Apps which have been appropriated to second screen, mainly in the field of social activity around TV content</td>
<td>Generic social media network effects and network effects from app-specific social media</td>
</tr>
</tbody>
</table>

Most of the social media apps are based on Twitter so any network effects are generic and not limited to an individual app. The broadcaster apps would probably exhibit more network effects from their overall popularity than the use of an app. The third party apps which use their own user data are the most likely to involve network effects. For example, Zeebox shows one’s friends’ TV activity only if they are also Zeebox users.

4.4 Uptake by operating system

An analysis of app downloads relative to operating systems in Appendix E has yielded a number of observations:

- Android typically has a quicker replacement cycle than iOS devices due to the greater support for older devices that Apple provides; the total number of Android downloads therefore may be further inflated relative to the numbers of active users.

- Apps such as YouTube appear to have surprisingly low downloads on Apple devices; this is probably due to the fact that it comes installed as a ‘native’ application on iOS, reducing the need to download it manually from the iTunes app store.

- Differences in downloads of various apps between operating platforms may indicate differences in prominence in the various apps stores.

4.5 A note on data availability

As we have seen in this chapter there is a lack of widely available data on how individuals and households are using second screen. We suggest that Ofcom might consider including a few questions on second screen usage in the periodic ‘tracker’ surveys that feed into the Communications Market Reports. The questions could include:

- The number of regular viewers of TV with access to a smartphone or tablet
- The TV-related apps that have been downloaded
- The frequency with which TV-related apps are used – from ‘never’ to ‘every day’.
5 Human aspects of second screen

5.1 Introduction
Consider these two press comments:

‘With our attention diverted from the main screen, the traditional TV ecosystem is falling apart.’

‘US consumers are not widely using applications designed by broadcasters on their laptops, smartphones, and other second-screen devices.’

How can it be that there are such different interpretations of second screen? Part of the answer may reside in the human side of the phenomenon. Different types of app make different cognitive demands and it seems that the common belief that people can ‘multi-task’ has tended to overlook known limitations to how humans attend to stimuli, and how we process information carried within media.

This chapter seeks to summarise make observations with regard to what might be successful approaches to the development and deployment of satisfying user experience combining first and second screen functionality.

In summary, this chapter reports:

• that multiple data points show increasing access to connected devices, and substantial proportions of viewers reporting ‘multi-tasking’ whilst watching TV;

• that fundamental limitations of human attention mean that when multi-tasking human attention is not divided, but is instead shifted back and forth between first and second screen;

• that there are therefore appropriate deployments of second screen alongside first screen, both in terms of the timing of a viewer’s focus on the second screen (e.g., during commercial breaks or natural lulls in programme narrative), and in terms of signalling to a viewer that an appropriate second screen experience is available;

5.2 Increases in access to connected devices and the tendency to ‘multi-task’
As evidenced in section 2.3, the ownership and usage of personal devices connected to the internet is increasingly common. A large proportion of the population engages with social media activities and media related activities online. And a high proportion of younger consumers report ‘multi-tasking’, i.e. engaging with multiple activities via different media platforms simultaneously.

Recent data, see Figure 3, show that approximately 20% of UK consumers report engaging in a range of second screen activities whilst watching TV or films.


Available industry and academic research literature has identified a very broad range of psychological and social drivers for viewer engagement with second screen apps around TV. These include:

- user desire/need for shared rather than isolated TV experiences
- a sense of connection with others/community
- social comparisons (validation)
- curiosity in seeking out others’ views
- getting more information
- getting access to content at a convenient time and place
- to influence/interact with content
- sense of acknowledgement from others
- interest in debate/discussion (social inclusion, fun, information).

It is worth noting first that many such drivers predate second screen; many relate directly to the social nature of media consumption.

Taken together, these data sources suggest that the scope and potential impact of second screen is very high. However the realisation of this potential impact is dependent on the development of appropriate second screen applications, namely those whose use is designed to be compatible with first screen media consumption.

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5.3 Fundamental limitations imposed by human attention

The most relevant consideration in relation to what is appropriate is based on an understanding of how humans attend to external stimuli.

A review by Ferrari (2009) noted that human cognitive capacity is limited and attention is selective. This implies that the so-called phenomenon of multi-tasking is based on switching, rather than dividing attention. This switching incurs cognitive ‘costs’ in time and efficiency.

This is to say that at any given point in time, a person’s attention is focused on one stimulus (e.g. the first screen) and that if another stimulus (e.g. the second screen) demands attention or offers a focus for attention then for the time the person attends to content on the second screen s/he does not attend to content on the first screen. This provides a natural limiting factor on adoption and use of some types of second screen applications.

The implication of this insight is interesting. The more involving a TV programme, the less likely it is that a second screen will be able to draw the viewer’s attention away. But the internet is widely assumed to have contributed to decreasing attention spans. In an article titled ‘Second Screen: The Future of TV, or The Latest Sign of Our Shrinking Attention Spans?’ the commentator Zach Wigon concludes:

‘What remains to be seen is how TV -- currently, you could argue, the site of the best storytelling in America -- will be affected by this adaptation toward newer modes of viewer use. Either way, the success or failure of second screen technology will tell us an awful lot about what viewers want their TV-watching experience to be.’

It is obviously too early to pronounce on this topic but we can observe that some types of app can be used when not attending to the TV:

(P) Platform-produced apps to provide access to EPG (rich, socially enhanced, or regular schedule) and control the set-top box or connected TV box or service e.g. Apple, Roku, YouTube

(M) Consumer Electronics (CE) manufacturer produced remote control apps

(R-EPG) Third party produced apps to provide access to rich EPG

(S-EPG) Third party produced apps to provide access to socially enhanced EPGs.

Other types of app are designed to be used during viewing of first screen content. These may be limited to specific types of content (those needing less attention) or to specific times during viewing (e.g. during a lull in viewer engagement, either for a commercial break, or for narrative reasons). Such apps include:

(APPR) Apps which have been appropriated to second screen, mainly in the field of social activity around TV content

(B) Broadcaster produced apps to enrich viewer experience of TV content

(3RD) Third party produced apps to provide access to contextually enhanced experience (social activity, betting, shopping).


34 http://www.indiewire.com/article/television/second-screen-apps?page=1#articleHeaderPanel
The extent to which viewers would wish to engage actively or passively varies across viewers, and this may have implications for target audiences of particular TV programmes. Second screen activities directly related to TV viewing enabled should be appropriate to the target audience and their engagement preferences and tendencies.

The uncertainties in this area are picked up again in Chapter 12.
6 The equipment of second screen

This chapter explains the equipment requirements for the different types of app, and discusses how variations in the equipment available to a consumer affect the types of apps that can be supported. Of particular relevance here are the types of accessibility features included.

6.1 Overview of equipment requirements

By definition, the absolute minimum requirement in terms of equipment is the existence of two screens. But in many cases there are additional requirements. The most important of these are:

- That the first screen is a ‘connected TV’. This can be achieved in four ways:
  - if the TV itself is a smart TV which is connected to the internet;
  - if a ‘new generation’ set top box is used (Virgin TiVo, Sky+, YouView, and some Freeview boxes);
  - if a streaming box is used (Apple TV, Roku, etc);
  - through an up-to-date games console (Xbox 360, Playstation 3, etc.).
- That the second screen is connected to the internet;
- That there is a home network linking the first and second screens via a wired or wireless LAN.

The table below shows the minimum requirements in each case. For example, the third row shows that a broadcaster-produced app would not normally require the first screen to be a connected TV but that the second screen would normally need to be connected to the internet to receive synchronous content. In the case of some apps (notably those which use audio watermarking rather than audio fingerprinting – see section 7.5) full connectivity would only be required in order to download the app but not to run it.
Table 6: Equipment requirements of second screen apps

<table>
<thead>
<tr>
<th>Type of app</th>
<th>Connected first screen</th>
<th>Connected second screen</th>
<th>Home network linking first and second screens</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>Consumer Electronics (CE) manufacturer produced remote control apps</td>
<td>Essential</td>
<td>Essential</td>
</tr>
<tr>
<td>P</td>
<td>Platform-produced apps to provide access to EPG (rich, socially enhanced, or regular schedule) and control the set-top box or connected TV box or service e.g. Apple, Roku, YouTube</td>
<td>Essential</td>
<td>Essential</td>
</tr>
<tr>
<td>B</td>
<td>Broadcaster produced apps to enrich viewer experience of TV content</td>
<td>Normally required</td>
<td></td>
</tr>
<tr>
<td>3&lt;sup&gt;RD&lt;/sup&gt;</td>
<td>Third party produced apps to provide access to contextually enhanced experience (social activity, betting, shopping)</td>
<td>Normally required</td>
<td></td>
</tr>
<tr>
<td>R-EPG</td>
<td>Third party produced apps to provide access to rich EPG, both with and without capacity to change channel</td>
<td>Required for channel change</td>
<td>Essential</td>
</tr>
<tr>
<td>S-EPG</td>
<td>Third party produced apps to provide access to socially enhanced EPGs, both with and without capacity to change channel</td>
<td>Required for channel change</td>
<td>Essential</td>
</tr>
<tr>
<td>COMP</td>
<td>Apps with comprehensive features including rich EPG, social EPG and programme-related information and services</td>
<td>Optional</td>
<td>Essential</td>
</tr>
<tr>
<td>APPR</td>
<td>Apps which have been appropriated to second screen, mainly in the field of social activity around TV content</td>
<td>Sometimes required</td>
<td>Sometimes required</td>
</tr>
<tr>
<td>A</td>
<td>Accessibility related functions, either via native capabilities of smart devices (e.g. iOS’s VoiceOver&lt;sup&gt;35&lt;/sup&gt;) or as third party apps</td>
<td>Normally required</td>
<td></td>
</tr>
</tbody>
</table>

6.2 Connected first screens

Connected first screens are those which connect to the internet, typically but not necessarily via a home network. The simplest way to achieve a connected first screen is to use a ‘connected TV’. These are TVs which support internet connectivity and have the ability to run TV apps. The major TV manufacturers such

as Samsung, LG, Toshiba, Panasonic, Sony and Sharp started to incorporate this functionality in their flagship TVs from 2011 onwards and gradually other new TVs have incorporated the same functionality. Connected TVs accounted for almost 20% of all TVs shipped in Q1 2012. It is probable that under half of new ‘first screen’ TVs shipped in 2013 would be capable of being connected. However TVs are bought on a long replacement cycle (~10 years). In addition, many of these ‘connected TVs’ remain unconnected by consumers in the home and internet enabled STBs and games consoles typically show much higher connection rates. Together, these explain the Ofcom finding that the current installed base of connected TVs is only around 5%.

“With their long lifecycles, TVs are simply not the right device to be the hub of the digital home. Instead, devices that are regularly replaced, including smartphones, tablets, set-top boxes, media streamers and games consoles, will be the key devices in the digital home experience [...] Informa estimates that in 2017 more than half of the 800 million Smart TV sets by that time will only be used as dumb screens”

The latest generation of Virgin and Sky set top boxes also have internet and LAN connectivity: Virgin TiVo and Sky+. YouView is an OTT service which also connects to the internet.

Finally, there are TV streaming boxes such as the Apple TV and Roku which supply content from the internet. The new app iMediaShare provides streaming functionality to connected TVs through the second screen without needing a set top box.

6.3 Connected second screens

The majority of second screen apps are designed to run on a smartphone or tablet.

Apple products (iPhone and iPad) run the iOS operating system whereas most others run Android. There are two alternatives with much lower takeup: the proprietary Blackberry system and versions of Microsoft Windows.

As apps must be written specifically for a given operating system, not all apps are available for all smartphones. We found few second screen apps written for anything other than iOS and Android. iOS is better supported in the second screen world than Android. Furthermore the version of a device e.g. iPhone5 and/or the operating system that it runs e.g. iOS6 (iPhone3GS onwards) affects its functionality, and also what apps can be run.

iOS and Android devices differ markedly in the software versions in use. Figure 4 shows that the overwhelming majority of Apple devices are running iOS V5 and above (96.3%). By virtue of supplying both the hardware and the operating system, Apple can support its devices for a long time if it so chooses.

The accessibility features introduced with iOS V3 (iPhone 3GS) onwards mean accessibility is an all but universal feature on iOS devices.

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36 http://www.theregister.co.uk/2012/06/12/displaysearch_says_world_smart_tv_sales_surge/
The situation is rather different for Android devices. The software versions are denoted by version numbers or names such as ‘Gingerbread’. Figure 5 shows that V2.3.3 – 2.3.7 (Gingerbread II) is by far the most popular iteration of Android in use, followed by V4.0.X (Ice-Cream Sandwich) and V.4.1.X (Jellybean I). The accessibility features of Android were improved from V4 onwards.

Among Android devices there can be differences in the functionalities supported. For example, Flash is supported only in ARM-based architectures but not Intel-based architectures. Further details of the features of the operating systems are given in Appendix F.

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40 http://forums.adobe.com/message/3620136
6.4 WiFi in-home connectivity

It is estimated that 57% of UK homes have a wireless LAN (WiFi) installed. Most home routers run the 802.11 a, b and g variants of the WiFi standard. Some high end routers implement the latest version 802.11 n standard which offers higher data rates and enhanced reliability.

WiFi within the home is the main way for consumers to connect their second screen devices to the internet. Although, consumers have become accustomed to WiFi, it still exhibits some problems. Security within a WiFi network is one of the major concerns. It has been reported that many consumers do not change their default WiFi settings for example.

The technology has some shortcomings as well. WiFi networks usually use the same 2.4 GHz ISM band, which is prone to congestion when multiple adjacent WiFi networks are run together (in apartment blocks or office buildings). Connection drops and hence loss of internet connectivity is common especially when multiple devices connect to the same network. It has also been reported that WiFi connectivity in some cases is affected by second screen device software upgrades.

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41 Wikipedia (March 4, 2013) [http://en.wikipedia.org/wiki/Android_(operating_system)]
6.5 Conclusions
The equipment requirements of second screen depend crucially on the type of app and the functionalities being sought. But the technical capabilities of second screen devices are fragmented, meaning that not all apps will run on all second screens. One consequence is that ‘technology universality’ is not currently easy to guarantee on the second screen.
7 The technologies of second screen

7.1 The data flow model
To assist in our discussion of the technologies we have produced a simple representation of the data flows and building blocks of a generic second screen system, Figure 6.

The top of this diagram shows the services and platforms that the user’s devices connect with. On the left are broadcast services and on the right are IP services which we refer to as ‘the service cloud’. The bottom of the diagram shows the user’s devices – the first screen and the second screen corresponding in general terms to the broadcast/IP distinctions above. The ‘first screen’ includes set-top-boxes and any other devices which routinely provide linear TV content for viewing on the TV.

The arrows represent possible data flows. The data can be content, metadata, control signals, state data or synchronisation information. The solid lines are direct data flows between two entities in the ecosystem, whereas the dashed lines are mediated flows via a third entity in the ecosystem. The data links are used as described below.
• Data link 1 is the ‘traditional’ link from broadcaster to a TV receiver, and is typically used for linear ‘broadcast’ content. It pre-dates second screen applications. On this link, content is multiplexed with metadata which describes the delivery system, content and scheduling of broadcast data streams.

• Data link 2 is a direct two-way Internet Protocol (IP) link between the service cloud and the first screen. It provides an alternative way for the first screen to receive content but is mainly used for catch-up or on-demand content.

• Data links 3 and 3’ are two-way Internet Protocol (IP) links between the first screen and the second screen, used in any application where the second screen interacts with, or responds to, the first screen. There are two ways in which this link can be implemented: directly (link 3) through a home network and indirectly (link 3’) via a remote server. In the latter case, the first and second screens do not need to be on the same network.

• Data link 4 is a two-way Internet Protocol (IP) link between the service cloud and the second screen and is the backbone for second screen applications.

• Data link 5 is a two-way Internet Protocol (IP) link between broadcasters and the ‘service cloud’. It carries scheduling information, metadata and viewer analytics.

• Data link 6 is a two-way Internet Protocol (IP) link between the broadcaster and the second screen. Built from data links 4 and 5, it allows broadcasters to interact with second screens. The link applies to integrated platforms where a broadcaster or platform operator has control of the delivery chain including the second screen application itself.

These data links and the issues surrounding them are explored in detail in Appendix H. In the appendix we examine the role of each data link, how the link operates, and the issues or problems that may arise. The model enables us to take a systematic approach to the technologies involved. Table 7 shows the consolidated findings from the data flow analysis. The second column shows the general impacts of technology architecture on the growth and performance of second screen systems; for example we found that data link 1 imposes an unpredictable amount of latency so that some form of synchronisation technology is needed if the first and second screens are to be in sync. The third column shows where there are specific impacts which could affect consumers by favouring one provider versus another. So, following the observation made in respect of data link 1, data links 3 and 3’ would be where synchronisation technologies are deployed. But the lack of a universal non-proprietary synchronisation architecture is a potential barrier to some companies that would like to operate in this space. The main finding from the analysis is that while there are several impacts for second screen in general, only data link 3/3’ imposes specific impacts.
Assessing the impact of second screen

Table 7: General and specific impacts from the data links

<table>
<thead>
<tr>
<th>Data link</th>
<th>General impact on second screen ecosystem</th>
<th>Specific impact on second screen apps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data link 1</td>
<td>Latency and the need for synchronisation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Migration of Interactivity to second screen</td>
<td></td>
</tr>
<tr>
<td>Data link 2</td>
<td>Fragmented device and platform capabilities</td>
<td></td>
</tr>
<tr>
<td>Data links 3 and 3’</td>
<td>Interoperability - Fragmented connectivity and remote control technologies</td>
<td>Synchronisation - Lack of a universal non-proprietary synchronisation infrastructure</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data link 4</td>
<td>Complementary content delivery to second screen</td>
<td></td>
</tr>
<tr>
<td>Data link 5</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Data link 6</td>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>

While the issue of fragmentation is noted in respect of both data link 2 and data link 3/3’, the effects are different. First screen fragmentation requires the developers of first screen apps to create different versions for different smart TVs. This complication would tend to encourage apps to migrate to the second screen as a less fragmented alternative. But second screen devices are fragmented in terms of their operating systems and in terms of the way in which connectivity is handled. Ultimately the question for developers is where development effort will be better rewarded – first screen or second screen?

The remainder of this chapter will focus on data links 3 and 3’ where the specific impacts of interoperability and synchronisation reside.

7.2 Introduction to data link 3/3’ technology stacks

To enable second screen features across the various data links, a number of open and proprietary standards are used. A technology stack is an implementation of software components and layers within a device or device family. Components include transport protocols, data and content formats, physical connections and interfaces.

We will describe the most significant technology stacks in use or in development in three groups: home networking connectivity stacks (section 7.3), cloud services stacks (section 7.4) and content identification and synchronisation (section 7.5).

Table 8 shows the home networking and cloud service technologies against the features they support.
7.3 Home Network connectivity stacks (Data link 3)

This is where both devices are on the same home network (either via Ethernet, WiFi or powerline communication) or paired peer to peer via Bluetooth or WiFi Direct. Devices on the same network can discover and use services offered by networked devices through the following approaches:

1. **UPnP**: an open standards approach used by all major consumer electronics products apart from Apple;
2. **DLNA**: A certified scheme to improve interoperability, supported by many consumer electronics products;
3. **Manufacturer proprietary mechanism**: usually based on UPnP, however its use and access may be controlled by the manufacturer;

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45 Where support is not native to Android, it may be supported via the application
46 Requires DLNA certification approval
47 Proprietary to Apple
48 Legacy support difficult as it requires hardware enhancement
49 Requires server infrastructure
50 Where an application on iOS device needs to use the UPnP stack to communicate with a second screen device, the stack would be implemented directly in the application by the developer.
4. Apple Airplay: Zeroconf configuration protocols and its implementation via Bonjour. It is officially only used in Apple iOS devices.

5. Emerging standards such as Miracast, DIAL and BBC UCP. More detail is given in Appendix I.

7.3.1 Universal Plug and Play (UPnP)
Universal Plug and Play (UPnP) is a set of protocols that allows devices on a network to discover one another identify their properties and functionality and interact with each other. The UPnP protocol stack is the most widely adopted and deployed standard. UPnP protocols are independent of any particular operating system, programming language, or physical medium. More detail is given in Appendix I.

7.3.2 Digital Living Network Alliance (DLNA)
Digital Living Network Alliance is an organisation set up by consumer electronics manufacturers in 2003. It determines a universal set of rules and guidelines so devices from any manufacturer can share digital media. DLNA covers computers, cameras, televisions, set top boxes, network storage devices, smartphones and tablets.
DLNA constrains the UPnP specifications considerably making interoperable implementations possible. It adds profiles of media codecs and transports mechanisms to facilitate streaming between devices.
The DLNA Remote User Interface (RUI) technology defines a way for the main screen device to render its own user interface on remote clients which can be used to control any device.
DLNA supports three standards-based RUI technologies. RVU and CE-HTML are included in the current guidelines and HTML5 will be included in the future. Each RUI technology is suited for different needs. Service providers select an RUI based on their own unique requirements. More detail is given in Appendix I.

7.3.3 DLNA/UPnP Stack Implementation
The UPnP stack of protocols is not supported natively within the Android or the iOS platforms. As a result, second screen application developers have to support UPnP control functionality from within the application. Several open source frameworks have been used by applications developers to enable a UPnP framework.
Main screen internet enabled devices almost universally support, as a minimum, the UPnP server implementation. The exception is Apple TV. The DLNA stack is also being supported especially by TV and STB manufacturers where DLNA certification is being sought.

7.3.4 Manufacturer proprietary methods
As it can be seen from Table 9, many TV manufacturers offer second screen application to control their Smart TV sets and connected BluRay Players. These applications emulate the full set of functionality provided by the traditional IR remote control as a minimum.

51 http://www.dlna.org/
Assessing the impact of second screen

Table 9: Manufacturers’ support for remote control APIs on top of UPnP

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Second screen Application</th>
<th>Protocol Stack used</th>
<th>Connected TV version</th>
<th>Application implementation notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Samsung</td>
<td>Samsung AllShare Remote</td>
<td>AllShare Framework</td>
<td>Available on Samsung Smart TV and Mobile devices only.</td>
<td>Technology on Samsung devices only however framework has some open features to developers.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Convergence Application framework – use of HTTP over UPnP protocols stack</td>
<td>Smart TV with SDK 4.0 and 3.5</td>
<td>Android devices may use CyberLinkForJava UPnP stack</td>
</tr>
<tr>
<td>LG</td>
<td>LG TV Remote</td>
<td>LG UDAP 2.0 Universal Discovery and Access protocol</td>
<td>Based on UPnP however it is an LG proprietary protocol stack. Some information is available on LG developer network.</td>
<td></td>
</tr>
<tr>
<td>Panasonic</td>
<td>Panasonic Viera remote</td>
<td>Uses the UPnP stack</td>
<td>2011 and 2012 Smart Vierra models.</td>
<td>Adopted the CyberLinkForJava stack</td>
</tr>
<tr>
<td>TPVision (formerly Philips TV)</td>
<td>Philips MyRemote App</td>
<td>Remote control, share pictures, music and videos, EPG.</td>
<td>2010 models onward</td>
<td>Available on iOS and Android</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WiFi Smart Screen</td>
<td>2012 models only</td>
<td></td>
</tr>
</tbody>
</table>

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52 http://www.cybergarage.org/twiki/bin/view/Main/CyberLinkForJava
53 http://www.gracenote.com/case_studies/sony/
54 More information available from http://developer.lge.com/
55 http://www.cybergarage.org/twiki/bin/view/Main/CyberLinkForJava
56 Philips TV Division was bought by TPVision
57 http://www.philips.co.uk/c/my-remote/298826/cat/
The detailed functionality of remote control protocols enabled within these applications is not available. However, it would appear that most of these applications run on UPnP/DLNA networking stack over a WiFi home network. The UPnP/DLNA protocols provide ways for devices to discover and pair with each other, however the specific techniques built on top to control the main screen are not publicly available. LG does not use a UPnP/DLNA-based protocol but instead uses a variant protocol akin to UPnP called UDAP (Universal Discovery and Access Protocol).

Several manufacturers are attempting to consolidate their connected TV specifications through various consortia and standardisation bodies. Two of these are noteworthy: the Smart TV Alliance and the Hybrid Broadband Broadcast TV (HbbTV) consortium. Although the general trend of remote control APIs suggests that manufacturers favour integration with their own devices and applications, if standardisation were to happen across a range of brands, the Smart TV Alliance and HbbTV could be possible umbrella bodies to coordinate such efforts.

Standardisation looks unlikely at present. Neither the latest Smart TV Alliance SDK 2.0 nor the HbbTV specification support an API for second screen application remote control functions or a unified protocol stack for device discovery over the home network.

### 7.3.5 Apple AirPlay

Apple devices using iOS 4.2 (introduced on Nov 22, 2010) operating system or higher come with a feature called AirPlay. It allows users to wirelessly stream content such as video and audio from an iOS device to an Apple TV or an Apple certified sound system. AirPlay requires home network connectivity but, unlike the UPnP/DLNA approach, it uses a different protocol stack for device discovery, pairing and messaging between devices.

More importantly, other than audio streaming to sound systems, AirPlay currently is still a proprietary protocol stack to be used with Apple iOS devices or for complementary products to them.

Although AirPlay is a restricted technology, its use and popularity with iOS users have paved the way for standards bodies to work on delivering similar functionality; WiFi Miracast and the DIAL protocols are two examples.

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59 LG, Toshiba and TP Vision formed the Smart TV Alliance. Panasonic and Vestel are now also members. The objective is to make a common software development kit for main screen TV applications across the range of its members’ connected TV models.


61 Latest version of the HbbTV specification was approved by ETSI as ETSI TS 102 796 v1.2.1 in November 2012 [http://www.etsi.org/deliver/etsi_ts/102700_102799/102796/01.02.01_60/ts_102796v010201p.pdf](http://www.etsi.org/deliver/etsi_ts/102700_102799/102796/01.02.01_60/ts_102796v010201p.pdf).

7.3.6 Emerging Standards

7.3.6.1 Discovery And Launch Protocol (DIAL)
The DIAL protocol, proposed by Netflix and YouTube allows applications on second screen devices to discover, install and launch applications on the first screen device. It allows media discovered on the second screen device to be played on the first screen.

The protocol works on devices connected to the home network and is built upon the protocols for device discovery defined in UPnP. It also allows information to be exchanged that subsequently enables two-way communication between the two applications so long as the applications continue to run on the two devices and the content on the main screen continues to be presented by the application in question.

It is an open specification that is without royalties. Both Sony and Samsung have helped develop the protocol and it is expected to be implemented widely by CE manufacturers. At the same time, some broadcasters and content on-demand providers have shown interest by registering their applications within the DIAL Application registry.

7.3.6.2 WiFi-Direct – Miracast
This is a peer to peer wireless screencast standard created by the WiFi-Alliance. It allows a second screen device to mirror its display on a main screen device, where both devices are from different manufactures. Similar to DLNA, WiFi Miracast was developed by an industry consortium of all the major CE manufacturers and chip makers.

Miracast is currently supported by over a 100 different devices. It is limited to WIFI-Direct devices. At the moment, only Android 4.2 devices support it.

The use of Miracast with WiFi-Direct allows the second screen application to connect directly with the main screen without the need for a wireless hotspot or a home network router (gateway).

In the short term, it is unlikely for Miracast and Wifi Direct to be used widely for second screen applications as it requires a hardware upgrade for both the TV receiving device (buying a new WiFi Dongle) and the handheld device (where current support is only for the latest Android version).

Miracast provides an example on how slow technology diffusion is within horizontal platforms compared to vertical platforms such as Apple iOS where AirPlay adoption and support was almost instant.

7.3.6.3 BBC Universal Control Protocol (BBC UC API)
The BBC R&D labs have developed a demonstrator universal control API for controlling main screen devices. This uses a RESTful architecture and enables remote control applications on a second screen

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65 [http://www.miracast.co.uk/](http://www.miracast.co.uk/)
67 REST: Representational State Transfer: it is the predominant web API design model, the most widely used REST application is the web itself, essentially any application that uses the HTTP protocol as the main mechanism for data transport.
device. UC API exposes the underlying state of the main screen device on which it runs for example the channel the main screen is tuned to, the contents of the EPG or the list of recording.

Second screen applications can also receive near-real time notifications when a main screen status changes.

Other than control applications, UC APIs can expose more information about the content displayed on the main screen such as a content identifiers and playout position information. The information can be used on the second screen to identify content and synchronise any additional content delivered to it.

The BBC Universal Control protocol is a proof of concept implementation that demonstrates that second screen applications requirements can be met with current technologies. The main innovation is in integrating functionality within the TV receiver and opening up services between devices.

7.4 Cloud services network stacks (Data link 3’)

In the cloud services case the second screen application transmits commands to the first screen by relaying these to the server and the server then relays those commands down to the first screen device. Likewise the process is similar in reverse. If the first screen device changes status, for example in the case of channel change, pause or ad skipping, this information is forwarded to the server. The second screen app can then query the server about the current first screen status.

These servers are usually operated by an integrated platform operator providing an application to control their devices (for example Virgin and YouView) or by a smart TV video on demand application developer (YouTube) providing a second screen application to control the main TV app.

This approach is used to enable true nomadic control as in the YouView EPG and Remote record booking application and on the Virgin Media TV Everywhere application.

It is also used by the YouTube remote control application, however in this case, the communication link is established between two applications: one on the main screen and the other on the second screen.

7.5 Content identification and synchronisation (Data link 3/3’)

Two problems need to be solved to enable content to be delivered synchronously across the main device and the second screen device: content identification and synchronisation information:

- **Content identification**: where the second screen application learns about the status of the main screen device identifying:
  
  a. **Channel ID**: the channel the device is tuned to
  
  b. **Content ID**: an identifier for the content shown on the main screen

- **Synchronisation Information**: the following information is needed by the second screen application in order to synchronise its status with content shown on the main screen:
  
  c. **Content timeline**: content play timeline information.
  
  d. **Time codes**: timing information from within the content, the broadcast stream or network clocks.
  
  e. **Triggers**: a mechanism to prompt the second screen application to change its status.
  
  f. **Level synchronisation**: accuracy depends on the type of content delivered to the application; it can be divided into four levels:
1. **Programme sync**: for incidental content such as social networking activity streams
2. ~5 sec latency: for main screen channel status changes and undemanding apps;
3. **Lip Sync (~30ms)**: for delivering subtitles, audio description streams or alternative language audio streams or in some cases alternative viewing angles of the same content;
4. **Frame accurate (20ms)**, the maximum achievable.

### 7.5.1 Analysis and comparison

Content identification and synchronisation can be achieved using the following techniques:

#### Behavioural inference

Apps can infer first screen content ID from selections made in a second screen app. For example, the social page selected in Zeebox or programme check-in in TV-Check.

#### Remote control inference

Apps can infer channel ID from channel selections made in a second screen app which acts as a remote control. This is an inference because the app would not know if an infra-red remote control had been used to change channel subsequently.

#### IP Synchronisation

The second screen application establishes a connection to a remote sever; the server then drives changes in the application by sending messages appropriately timed with the main content playout. The accuracy is limited by the latencies in the two data links.

#### Audio Watermarking

Audio watermarks are pieces of information inserted (‘tags’) within content that are imperceptible to humans but can be picked up by a second screen device microphone. Provided an appropriate second screen application is running, an individual tag triggers a specific action on the second screen.

#### Audio Fingerprinting

Segments of audio are analysed using signal processing techniques and used to generate a unique sound signature (or ‘identifier’). This signature is then sent to a cloud service which matches it to a database of content and returns the correct match.

#### Video Fingerprinting

Similar to audio fingerprinting, a collection of video frames are used to generate the fingerprints.

#### Linked Devices

Content identification and synchronisation is enabled by transmitting metadata and time codes over a connection between the main screen and second screen device (enabled by the home network or a cloud service).

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The individual techniques are discussed further in Appendix J together with their pros and cons. Table 10 shows which functions of content identification and synchronisation are supported by each of the techniques.

Table 10: Comparison of content identification and synchronisation techniques listed in order of sync accuracy

<table>
<thead>
<tr>
<th>Technique</th>
<th>Function</th>
<th>Channel ID</th>
<th>Content ID</th>
<th>Content Timeline</th>
<th>Time codes</th>
<th>Triggers</th>
<th>Level of sync accuracy</th>
<th>Support for time shifted content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavioural inference</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Program Synch</td>
<td>Possibly</td>
</tr>
<tr>
<td>Remote control inference</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Program Synch</td>
<td>No</td>
</tr>
<tr>
<td>IP Sync</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>No</td>
<td>Yes</td>
<td>~5 sec</td>
<td>No – only live content</td>
<td></td>
</tr>
<tr>
<td>Audio watermarking</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>N/A</td>
<td>Yes</td>
<td>Lip Sync</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Audio fingerprinting</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>N/A</td>
<td>Yes</td>
<td>Lip Sync</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Video fingerprinting</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>N/A</td>
<td>Yes</td>
<td>Lip Sync</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Linked devices</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Up to Frame Accurate</td>
<td></td>
<td>Yes</td>
</tr>
</tbody>
</table>

In summary:

- Programme sync is adequate for many social media-type functions and can be achieved reasonably well through inference methods.
- IP sync can be used in conjunction with programme sync to provide certain types of contextual enhancement such as additional information in a documentary. It is limited to live content and can only deliver discrete events to the application.
- Watermarking and fingerprinting techniques provide all the necessary information to deliver content identification and synchronisation at near lip synchronicity but require that either the broadcast playout is manipulated or that a fingerprint infrastructure exists.
- Linked devices are the ideal but this requires a high level of real time connectivity between all devices. Such connectivity is found in the vertical platforms – Virgin, Sky and YouView.

### 7.6 Platforms for second screen applications

Applications need to be specifically built for every target platform. Thus, application developers must take into account the number and types of target platforms in order to address the application to each one's individual needs. It is not only a matter of brands (e.g. iPhone, Android, BlackBerry, etc), but also a question of the platform version (Android, for example, has a large number of versions with different features depending on the device manufacturer). When an application needs to be supported by a new platform, it must be rewritten using the platform’s native programming language (Java for Android, Cocoa and Objective-C for iOS) and native functions that create the platform’s look and feel. Different platforms have different Software Development Kits (SDKs), style guidelines and development infrastructures.
As the development of an application for a particular platform requires specific knowledge of that platform, developers must employ staff with platform-specific skills. The more platforms covered, the higher the development costs.

App developers will typically write for the lowest specification of operating system that will support the functions they want to provide. For example, Sony told us that its TV SideView software does not handle premium content on the tablet device, and therefore content security is not an issue. The TV SideView app is therefore OK with the earlier versions of Android. Sony thought that developers would consider later versions of Android if content security were required.

Technologies supported in second screen operating systems may be dropped at a very short notice. This happened recently in the case of Adobe Flash Player on Android for example. In 2012, Adobe dropped its support for Adobe Flash Player for Android devices in favour of HTML5; despite this having been one of key differentiating features between iOS and Android devices. Several popular applications (such as BBC iPlayer on Android) rely on Flash Player to function. This case illustrates a risk application developers take in developing applications for second screen devices.

The pace of innovation and novel technology adoption within second screen devices and operating systems is very fast indeed. In just 5 years, iOS went through six major changes to the operating systems with several updates in between.

It should be noted that other parts of the second screen ecosystem are starting to present similar risks. Relying on open and free web APIs to power some functionality, such as Twitter and Facebook, can cause problems if and API provider decides to make drastic changes its access rules.

Additionally, inherent security issues with successive Android versions may restrict application providers from providing premium content through their apps. This was well captured by Netflix in 2010; where the Netflix App was not available for Android. In a blog, Greg Peters from Netflix product development explained how it was affecting the Netflix app:

“The hurdle has been the lack of a generic and complete platform security and content protection mechanism available for Android. The same security issues that have led to piracy concerns on the Android platform have made it difficult for us to secure a common Digital Rights Management (DRM) system on these devices.”

Moreover, Android has been a prime target for malicious software. A recent study by ESET (computer security specialists) has revealed a 17 fold increase in Android malware between 2011 and 2012.

70 Twitter API changes have caused issues on some applications http://techcrunch.com/2012/08/27/twitter-api-changes-are-already-posing-challenges-to-tweetbot-developers/
72 It should be noted that Netflix have worked on such issues and managed to launch an Android App for a ‘range’ of phones and now it can be supported as far back as Android 2.3.
73 The following papers have documented Android malware issues: http://www.f-secure.com/static/doc/labs_global/Research/Mobile%20Threat%20Report%20Q4%202012.pdf
Such security threats could explain the reasons why Amazon has ‘forked’ a version of Android and built its own secure system around it. This allowed Amazon to extend access to the rich premium content catalogue available on its servers. The Kindle Fire (Amazon’s Tablet) is now the second most popular tablet. Other Android device manufacturers are following a similar pattern by building systems on the top of Android to provide a more secure way for content services to be available.

7.7 ‘Worked examples’ of second screen applications

This section will explore how the technologies described above are being used within second screen applications including the different choices available to each. We chose Zeebox, Sky+ and Virgin TV Anywhere in order to look at implementations from two distinct angles. From a third party developer, independent of the broadcast value chain with no control over any of its components (Zeebox) and one from an integrated TV platform with control over almost the whole TV broadcast chain including the equipment at the viewer’s premises and the second screen application itself.

7.7.1 Zeebox

Currently Zeebox only provides support for live content. Catch-up and on-demand content is to be supported next.

7.7.1.1 Availability

Zeebox is available on four platforms.

1- On the web as an enhanced social electronic programme guide
2- Android devices from version 2.2 or higher
3- iOS devices with version 4.3 or higher
4- Blackberry devices with OS 6.0 or above

7.7.1.2 Remote control

Zeebox provides remote control functionality for many Smart TV receivers, Sky+ and Virgin TiVo Set top boxes. Almost all these receivers implement a UPnP server stack for device discovery on the home network, as result it can be safely assumed that Zeebox implements a control point UPnP stack on the application. This would enable Zeebox to discover and pair to supported devices within the home network.

Information about specific control APIs built on the top of UPnP on the TV receiver are not publically available. Access to those controls may be granted via a one to one agreement with the first screen TV manufacturers.

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75 In open source development, this happens when a developers take a copy of the source code and start independent development on it, creating a distinct software [Source Wikipedia: http://en.wikipedia.org/wiki/Fork_(software_development)].

76 http://techcrunch.com/2013/03/15/the-samsung-galaxy-s-4-and-its-de-googling-of-android-suggests-we-might-see-a-split/

77 See http://zeebox.com/uk/help/remote-control-supported-devices
7.7.1.3 **Electronic Program Guide**

The metadata to build the electronic program guide is widely available either freely from internet sources such the bbc.co.uk/programme via several commercial metadata service providers under fair and reasonable terms\(^\text{78}\). As a result, obtaining the metadata for building a standard electronic programme guide is not an issue. At the same time, the delivery of Metadata to the application is done via common web standard formats and transport protocols\(^\text{79}\), which makes its easy and cheap to integrate within second screen applications.

7.7.1.4 **Social network activity streams**

Social networks’ APIs from Facebook\(^\text{80}\) and Twitter\(^\text{81}\) can be used to enable this feature. If the family-friendly feature is enabled, the activity streams will be moderated automatically by Zeebox servers before delivery.

7.7.1.5 **Zeetags**

Zeetags are ‘keywords’ that link to extra content the viewer may wish to consume while watching content. It provides a semantic link to extra content. The keyword itself represents key semantic information on what is being watched. Observing zeetags reveals that it can be categorised as: people, locations, events, related content clips (YouTube) or programme website, products.

Depending on the zeetag, the link takes the viewer to a Wikipedia page, the TV programme page or an e-commerce site directly from within Zeebox without having to move to another application.

Zeetags are driven by artificial intelligence algorithms involving natural language processing on the broadcast stream probably using the subtitles, social networks activity stream and any other relevant live informational feed.

7.7.1.6 **Search and discovery**

Searching for content within Zeebox returns three types:

1- Scheduling information of the programme: on which date, time and channel is available with ability to book viewing.

2- If content is available from an e-commerce site such as iTunes

3- Related applications from the device’s app store

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\(^{78}\) RedBee Interview

\(^{79}\) JSON and XML are the most widely used data formats on the internet. HTTP and SOAP are the two most widely used protocols for data transport.

\(^{80}\) [http://developers.facebook.com/](http://developers.facebook.com/)

\(^{81}\) [https://dev.twitter.com/](https://dev.twitter.com/)
7.7.2 Sky+
The Sky+ second screen application provides a full electronic programme guide, ability to pair the application with the Sky+ set top box. The pairing allows not only remote control functions but nearly fully transfer of all user interface capabilities of the set top box to the second screen application.

Viewers can browse the EPG, book programmes for viewing or search, play, pause, rewind and fast forward their recordings.

The Sky+ application can be considered an example of how a remote user interface is transferred to the second screen. Although the underlying features and specifications of the Sky+ set top box are not common knowledge, it can be safely assumed that UPnP and DLNA network stacks form the basis of their implementation.

Exposing some of the remote control functionality to third party application is strictly restricted to only Sky partners.

Each Sky+ box and application is paired to the customer subscribers ID. This is used by the operator to deliver nomadic control signals to the set top box through its cloud servers. This allows users to remotely book shows for recording while outside the home.

7.7.3 Virgin TiVo

Virgin TiVo’s second screen application is TV Anywhere. It works the same way as Sky+, where the full user interface functionality is rendered on the application. One added feature is place-shifting. The application let users stream live and on-demand content from 47 channels on the move, the delivery of content is done through the operator’s own content delivery network.

7.8 Conclusions

The survey and analysis in this chapter has shown that the technologies involved in second screen are substantially closed:

- Virgin, Sky and YouView employ proprietary platform APIs
- TVs and set top boxes employ proprietary APIs
- Where watermarking is used, the techniques are proprietary
- Where fingerprinting is used, the techniques and databases are proprietary.

One consequence of the closed nature of second screen is that functionality is easier to provide when one player controls or has access to the technologies involved across the entire ecosystem. Consequently, the vertically integrated platforms such as Virgin and Sky are potentially able to offer viewers a better integrated experience.

Through a systematic survey we have shown that the majority of entry barriers occur around the link between first and second screens, (denoted data link 3/3’in our schema). These are:

- interoperability, and
- synchronisation.

The interoperability problem is being addressed by the BBC which has created an open API, and is promoting it through standards bodies. In our interviews we did not find great enthusiasm for the BBC’s approach, however.

This is partly because TV manufacturers are assumed to want to keep control of the look and feel of their products, and partly because closed APIs are not seen as a major barrier. The RNIB told us:
“Although an open API would bring significant benefits for accessibility and would allow organisations and developers to build accessible apps, it’s not a battle we think we can win ... and we like to choose our battles. Instead we say to manufactures and service providers: ‘If you choose to keep your API closed, than it is your responsibility to ensure that the apps created with it are accessible with the built-in zoom and text-to-speech accessibility features of second screen devices’.”  

When looking at open and closed standards a key question is whether innovation is promoted or discouraged. We have found that innovation is occurring widely throughout the ecosystem:

- The vertical platforms have created apps that control their set top boxes and introduce remote recording and additional streaming to the second screen;
- Manufacturers are innovating in the use of both screens to access distributed content;
- Third parties such as Shazam and Zeebox are investing in innovative techniques for content recognition and synchronisation. They also innovate in their use of open metadata and social network concepts;
- Where necessary, closed protocols are being reverse engineered, a possibility which is made easier by the tendency to build the closed APIs on top of standard open technology stacks such as DLNA and UPnP.

One interviewee, an app developer, took a different view:

“The current uptake of TV control apps has been disappointing. Unless a mobile phone can discover a TV and access the services within it, there won’t be sufficient critical mass to create and sustain a market for these types of app. Guaranteed interoperability is a necessary part of this experience”

Clearly there are different views but overall we conclude at this stage that the predominantly closed technologies of second screen are not working against the interest of consumers.

Our analysis has recognised in most cases that second screen devices will enjoy some form of connectivity, typically via a wireless network. Such data will often then be conveyed on the internet. So the use of second screen apps will often raise traffic levels both within the home and outside it. The greatest source of congestion from second screen devices would be where content is streamed to the second screen via the internet and wireless network. This transmission mechanism is relatively inefficient compared to the ways of delivering content to the first screen.

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82 RNIB interview
83 UBIAPPS interview
8 The commercial picture

8.1 Background – the questions this chapter will address
This chapter identifies key considerations in relation to the commercial environment surrounding second screen applications and services.

These include:
- What are the fundamental commercial drivers behind second screen?
- Which are the key commercial players in the second screen ecosystem?
- Which types of player produce each type of app that exists in the second screen ecosystem?
- What is motivating each type of player to engage in second screen?

8.2 The battle for eyeballs defines second screen
The fundamental commercial driver behind second screen is the battle for viewers’ attention – sometimes called the ‘battle for eyeballs’. Crucially, the battle is not just between different players, it is between completely different types of player:

“The fight over eyeballs is on, and every stakeholder is looking for a business model that fits.”84

Traditionally, commercial TV broadcasters monetised their viewers’ attention through the sale of TV advertising spots. Whilst public funding of broadcasting via the license fee pre-dated this commercial model, and subscription and on-demand models have developed since, there is a universal need to engage and maintain viewers’ attention:

“Watching television with a smartphone or tablet device is quite simply one of the most popular leisure activities of the mobile era”85

Competition for viewer attention in the living room has emerged and intensified over recent decades as a result of the availability of portable, personal communication devices such as mobile phones, laptops, netbooks, tablets and smart devices. These devices offer a range of functions to users, from consumption of text or rich media content to real time social interaction, whether via text messages or online social networks. As a result of the increased availability and functionality of such devices, ‘multi-tasking’ has evolved as second nature for many viewers and for younger viewers in particular. It is easy to see how ‘multi-tasking’ shifts attention away from the TV screen, for example as viewers switch their attention between TV, smartphone, tablet and laptop.

Assessing the impact of second screen

A natural accompaniment of this ‘attentional drift’ from the TV screen to the second screen would be a shift of monetisation - from the TV screen to second screen. It is therefore unsurprising that there is so much discussion of second screen. The stakes are high.

Additionally, second screen applications differ from first screen because they can provide a more targeted, personalised and timely advertising proposition compared to first screen. Given a critical mass of users, second screen could provide an alternative or augmentation to TV advertising. In the limit, this points to disruption to the traditional commercial TV value chain, and to a need for entities in the traditional TV value chain to respond, as illustrated below.

*Traditional linear models of engagement based on demographics are giving way to psychographics based on experience, preference, behaviour, attitudes and aspirations.*  

Whilst being ‘busy’ on a second screen can distract from adverts on a first screen – it also reduces the likelihood of consumers changing channel. *In fact many use second screens to find out more about products and brands they see on TV.*

“As a broadcaster, our observation is that TV drives app usage. There is no evidence of the opposite (apps driving TV viewing).”

So, even though the industry is at an early stage of development, entities in the traditional TV value chain are responding. Platforms and broadcasters, for example, are starting to get involved in second screen application provision. They are doing so in several ways:

1. Broadcaster/platform involvement in IP and apps (e.g. Sky, Virgin, YouView);
2. Broadcaster-controlled innovation (e.g. BBC’s Antiques Roadshow second screen app triggered by signals from first screen); and
3. Platform investment in engaging second screen content providers (e.g. Sky buying a stake in Zeebox).

But broadcasters and broadcast platforms are only one group of entities in the second screen ecosystem. Others are CE manufacturers and third parties. The focus, strengths and second screen advantage of each are discussed in the following section.

**8.3 Which commercial entities produce what types of application?**

As logic would predict, second screen commercial entities focus on their strengths and in the apps they develop tend to reflect their role(s) in the TV and second screen value chain. Figure 7 shows that there are three types of commercial entity in the second screen ecosystem. Each has specific areas of strength on which it is able to capitalise in the second screen market.

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88 ITV interview
Figure 7: Entities in the second screen ecosystem shown by dotted lines

Figure 8 overleaf illustrates how the logic has played out. On the left hand side of the figure, is a Venn diagram developed within this project which shows the constituent uses within three types of second screen function (‘control and access’, ‘search and discovery’ and ‘contextualised enhancement’) and how the three types of function overlap. On the Venn diagram we have mapped the nine different types of application identified in Chapter 3. The right hand side of Figure 8 is a key or aide memoire to the reader for what the abbreviations for each of the nine types of app used on the Venn diagram stand for. This diagram was introduced earlier in the report but we focus here on the types of player, coded by colour.
Analysis of Figure 8 shows that the largest number of types of app fall into the category ‘contextualised enhancement’ (six of our types), relative to the four of our types which fall in to each of ‘control and access’, and ‘search and discovery’.

It also shows that whilst there is broad diversity in the ecosystem, different commercial entities are addressing second screen in ways that are consistent with their strengths and interests. We turn to these next.
8.3.1 Technical preconditions

Table 11 indicates the technical preconditions for each of the functionalities.

Table 11: Technical preconditions

<table>
<thead>
<tr>
<th>Control and access</th>
<th>Search and discovery</th>
<th>Contextual enhancement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel change</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full Remote control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nomadic control</td>
<td></td>
<td></td>
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<tr>
<td>Content sharing</td>
<td></td>
<td></td>
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<tr>
<td>Enhanced accessibility</td>
<td></td>
<td></td>
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<tr>
<td>Rich EPG</td>
<td></td>
<td></td>
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<tr>
<td>Socially enhanced EPG</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social viewing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Programme enrichment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Related content and services</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Content Identification and Synchronisation (data link 3)

- Home network connectivity & control (data link 3)
  - No privileged access
  - Able to use
  - No access

Cloud connectivity & control (data link 3')

- No access
  - Able to use
  - No access

Data link 3 is the only aspect of the system that involves technical preconditions. Table 12 shows which types of player possesses each of the preconditions, i.e. is not locked out through technical barriers.

Table 12: Possession of technical preconditions

<table>
<thead>
<tr>
<th>Broadcasters</th>
<th>Platforms</th>
<th>CE manufacturers</th>
<th>Third parties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Content Identification and Synchronisation (data link 3)</td>
<td>Able to insert watermarks</td>
<td>Vertical platforms know ID through data link 1. Can synchronise to frame accuracy</td>
<td>No privileged access</td>
</tr>
<tr>
<td>Home network connectivity &amp; control (data link 3)</td>
<td>No privileged access</td>
<td>Able to use</td>
<td>Able to use</td>
</tr>
<tr>
<td>Cloud connectivity &amp; control (data link 3')</td>
<td>No access</td>
<td>Able to use</td>
<td>No access</td>
</tr>
</tbody>
</table>
8.3.2 Consumer electronics (CE) manufacturers

CE manufacturers are the gatekeeper to the two screens. In principle they could have a key role in the TV value chain. First, they are the entity with whom the customer has entered the single biggest transaction (the purchase of the TV or smartphone/tablet). Second, they are the provider of the viewer’s ‘handshake’ with the TV on a daily basis, the remote control.

CE manufacturers have a strong technical position in the second screen market centred around:

- full control over the codes, protocols and standards to access and control the CE device and settings;
- partial control over the apps selected to appear on the smart landing/app page on the CE device.

Some CE manufacturers have additional strengths if they are also producers the second screen device (e.g. Samsung, LG, Sony) in that they can incorporate advanced control between the first and second screen devices providing for advanced functionality such as content sharing.

Companion services can unlock a new source of ad revenue for TV providers. 89

In practice however, CE manufacturers have focused on (i) second screen as an extension and enhancement of the remote control, and (ii) exchanging content between the screens. While these are pragmatic enhancements that make immediate sense to consumers, they may show a limited conception of the potential of second screen. CE manufacturers have generally not succeeded in making connected TV (via first screen apps) into a compelling proposition.

8.3.3 Broadcasters

As the traditional entity in the TV value chain to monetise viewer attention, as described in section 8.2 above, broadcasters have a strong position in the first screen market. Strengths that all broadcasters have are centred on:

- access to high quality video (TV) content;
- a place in the hearts and minds of millions of viewers as a result of being known and trusted brands.

Broadcasters see second screen as an adjunct to programme making. They ask the question “Will my programme be better with a second screen app?”. So far, the use of second screen apps is limited, both in overall numbers, and in the genres of programme addressed. Live mass audience shows, games shows and contests are the main genres in the UK. The apps allow viewers to play along with the live content. Compared with other types of app, these are normally dependent on some form of synchronisation between the broadcast and the second screen content.

From BBC’s point of view, the lowest-cost option is to offer “companion screen services” based only on knowledge of which TV programme is being watched. According to BBC R&D,

“This is relatively simple, utilises existing online content, and has no impact on workflow. But making a truly integrated editorial proposition does impact workflow, and would be offered much more selectively as a result. Trials are helping us understand the costs involved. The latter should be 100% reliable (BBC has high production values) which is currently unachievable. Due to the latency

89 Fragmentation holding back companion screen revenue” http://www.totaltele.com/view.aspx?ID=480188
introduced by content traversing the broadcast chain, or delivered over the Internet, accurate synchronisation must be based on information about the content as it presents on the TV screen, which is provided by the TV (STB) and the delivery mechanism.”

We also spoke to the department in the BBC responsible for second screen output.

“The BBC considers second screen to be one of a number of ways of accessing its rich offer of online and red button programme-related content. Bespoke second screen apps have been developed for Antiques Roadshow and the Voice and both have been appreciated by viewers. However, the value of ‘programme-based’ apps is still to be determined. The BBC continues to commission programme related content and experiences and to explore the best ways of getting these to audiences.”

ITV told us that there won’t be 2nd screen content for every programme.

“As a broadcaster, our observation is that TV drives app usage. Entertainment shows with mass audiences like Britain’s Got Talent and The X Factor lend themselves to second screen, and in particular, big live shows do well in this environment. Our experience to date shows that apps are not suitable for every programme or genre however, so ITV is selective in its use of second screen apps and content.”

At present, broadcasters appear to be selective in their enthusiasm for second screen. Overall, it’s a ‘nice to have’ rather than an essential feature.

A problem mentioned by BT is the user demands associated with starting and stopping apps.

“You can only look at one app at a time, and have to initiate the engagement. It’s not a very ‘smooth’ user experience. There is no mechanism in use today that automatically opens and closes apps based on what’s being shown on TV. If the viewer jumps across live TV channels, VoD content, or content previously recorded on DVRs, it’s up to them to find the associated app and start it manually. In all, it’s not a smooth ‘joined up’ experience.”

Rovi made a related point “Consumers want a coherent and consistent second screen experience”.

8.3.4 Platform operators

Platforms differ from broadcasters in that they control content distribution (in broadcast and IP space), and the first screen (via writing technical specification of set top boxes).

Their second screen apps are positioned in the overlap of control and search and discovery. Some also provide another functionality – the ability to use the second screen to play streamed TV content. Virgin TV
Anywhere enables the live streaming of TV channels, as does Sky Go\(^{95}\). Both Sky and Virgin told us that their second screen apps had been popular with viewers.

As the incumbent monetisers of attention in the TV ecosystem, platforms and broadcasters have the most to lose if they do not prevail in the second screen ecosystem – to the new entrants who will win a share of the attention.

Platforms have a uniquely powerful position in the second screen ecosystem, as they control both the content and technology underpinning first and second screen. Common ownership of ecosystem technical components enables functions to be implemented in the absence of standards. However, second screen is not being pursued aggressively.

Second screen devices could in principle make advertising more valuable through the analytics and targeting that are possible on second screen devices. TVs are generally shared devices but second screens may – or may not – be personal. Effective user targeting means not muddling up the family. In practice the collation of meaningful analytics from second screens is therefore complex. According to an app developer\(^{96}\), the untangling of personal and shared data adds “significant complexity” to the use of second screen in advertising. There are also privacy concerns in the use of personal data to control a shared device.

### 8.3.5 Third parties

Third parties are the newest entrants to the TV ecosystem via second screen, and as such have the greatest capacity to disrupt old ‘rules’ in the TV value chain. Third parties produce web-based social media and information services, and include generic social media services (Facebook, Twitter, Google+, SoundCloud, Pinterest, LinkedIn) and those more explicitly linked to TV (e.g. Fanatix, Zeebox, TVGuide).

The third party produced content is accessible via the internet, via their own apps on smart devices (for various platforms: mainly iOS and Android, and as feeds via APIs to apps which aggregate feeds from multiple third parties. A good example of this latter variety is Flipbook, which integrates feeds from Facebook, Twitter, Google+, SoundCloud, Pinterest, LinkedIn and others.

When such aggregating apps also integrate with EPG data and can control the first screen when on the same network, they become the most comprehensively functional second screen app – enabling control and access, search and discovery, and contextual enhancement.

Third parties’ disruptive potential in the second screen ecosystem is based on their:

- ability to influence viewers’ programme selections independently of the EPG (and EPG regulation) for example via curated or social recommendations;
- ability to monetise eyeballs and recommendations via advertising models from the online world (targeted advertisements funded on a click-through model);
- ability to offer and monetise added-value contextual enhancement (e.g. shopping, betting) to a TV programme independent from TV regulations;

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\(^{95}\) Sky Go is not a second screen app according to the definition in this report

\(^{96}\) UBIAPPS interview
• ability to enable viewers to watch video on their first screen even if it is streaming through the second screen (e.g. iMediaShare) so providing an opportunity for viewers to cord cut.

Third parties have started where barriers to entry are low, specifically combining EPGs and social media feeds, where data is available and relatively cheap, and where they have existing infrastructures applicable to enhance viewer experience of TV; for example, real time betting/gaming. Third parties have mostly tended to avoid applications that require technically challenging elements (e.g. synchronisation) or standards for interoperability – the latter because standards do not yet prevail. However a few third parties such as Zeebox and Shazam have been investing in challenging technology development.

8.3.6 IP Video Providers (eg Netflix, YouTube)

IP video providers are relatively new entities in the TV ecosystem, and have a range of potential -but to date under-realised - roles, spanning:

• OTT (over the top) service provision, e.g. Netflix, LoveFilm and YouTube
• Catch-up TV (e.g. BBC iPlayer, SkyPlayer, ITVPlayer, 4OD, Demand5 etc.)
• Managed service IPTV provision, e.g. BT who provide video on demand services as a hybrid broadcast/IP service (“BT Vision”).

The role of IP video providers in the second screen market is centred around:

• partial control over the functionality of apps which appear on the smart landing/app page on a CE device (portal).
• ability to simultaneously stream video services to a first screen (via data link 2 from Figure 6) alongside additional information to a second screen.

8.4 What motivates different commercial entities?

Understanding the motivations of the main types of entity to engage in second screen can be stated in terms of both the customer value they aim to bring, and their potential for generating new, or maintaining old, revenue streams. While these two overall goals are relevant to each type of entity, different components are relevant for different entities, as shown in Figure 9, below.
8.5 Conclusions

The second screen space is partly defined by the types of app and partly by the type of player that created it. The picture we have presented is a snapshot at the start of the market. Effectively, each type of commercial entity has different core motivations and is using apps in different ways, see Table 13.

Table 13: Motivations and app strategies by type of entity

<table>
<thead>
<tr>
<th>Motivation</th>
<th>Achieved via</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broadcasters</td>
<td>To maintain viewer attention and to monetise it</td>
</tr>
<tr>
<td>Platforms</td>
<td>To monetise viewer attention</td>
</tr>
<tr>
<td>CE manufacturers</td>
<td>To differentiate their products from the competition</td>
</tr>
<tr>
<td>Third parties</td>
<td>To win viewer attention to monetise it</td>
</tr>
<tr>
<td>Other</td>
<td>Enhance proposition through providing TV and TV-like content/streaming services i.e. Xbox360</td>
</tr>
</tbody>
</table>

In this context, the interests and motivations of content and platform companies are in competition with those of third parties. Understanding this conflict demonstrates the strong rationale for content and platform companies (e.g. Sky), investing in first on market third parties who are willing to co-operate with a platform (e.g. Zeebox).
9 Electronic Programme Guides (EPGs)

9.1 First screen EPGs
Current first screen EPGs are generally lists or grids presented in order of logical channel number (LCN). The platforms each have different orderings. Current legislation (Communications Act 2003 section 310) and regulation (Ofcom’s EPG code) requires that Public Service Broadcasting channels (PSBs) receive ‘appropriate prominence’ in linear EPGs, but without defining ‘appropriate prominence’.

9.2 Current second screen EPGs
EPG functionality has become one of the core functionalities provided in second screen apps and is included in apps from CE manufacturers, platform operators and third parties. It is easy to see why EPG functionality is attractive to app developers:

- For CE manufacturers a second screen EPG is a natural extension of the first screen EPG and an opportunity for the manufacturer to provide a consistent user interface
- For platform operators a second screen EPG is both a natural extension of the set top box EPG and also a way to interest viewers in additional content such as VOD
- For third parties, EPG metadata is easy to obtain and can form the core of a widely used product offering.

In interviews we found that the second screen is considered to be a convenient, or even preferable, device on which to provide this functionality. The reasons given in favour of second screen EPGs were:

- The better user interface of handheld devices i.e. touchscreen and QWERTY keyboards
- The ‘always on/always near’ character of mobile phones
- The more personal choices that can be offered by a device that pertains to a person rather than a household
- Richer and more diverse influences on content offer – e.g. social media
- Easier to integrate content from different platforms or sources within one guide
- Using a second screen avoids disrupting a programme for other viewers
- The second screen can be used to preview content
- Faster response because second screen EPGs are updated using IP rather than through the slow carousel approach for broadcast metadata.

Virgin has found that users of its TV Anywhere app like the built-in EPG.
Second screen EPGs can be used regardless of whether they have a remote control/channel change function. In an email exchange with Anthony Rose of Zeebox, he emphasised that browsing programmes through Zeebox is not dependent on having a first screen available at the same time.

If second screen EPGs are ‘better’ than first screen EPGs for the reasons cited above, it is plausible that in practice EPG functionality will tend to migrate to second screen. We did not find evidence that first screen EPGs and infra-red remote controls would be withdrawn, however.
The extent and speed of migration will vary by demographic owing to equipment ownership and propensity to use non-traditional EPGs. Younger people will be far more likely to use second screen EPGs.

9.3 The evolution of second screen EPGs

First screen EPGs were constrained by the technologies available at the time they were developed. Second screen EPGs by contrast can draw on a wider range of technologies and also on a different set of user interface paradigms, namely those used in internet applications such as Google and YouTube. These are typically search based, unstructured techniques in which diverse sources of content are integrated in one portal.

First screen EPGs are a relatively unsophisticated tool for helping viewers discover the content they might want to watch. There are already alternatives which use viewer profiling, content search mechanisms and social-networks to produce far more individualised recommendations. Consequently it is likely that second screen EPGs will involve:

- Erosion of distinction between linear, catchup and VOD content
- Greater use of social recommendation or buzz
- Greater use of personalised recommendation based on past viewing or stated preferences
- Greater use of promotion
- Correspondingly less use of channel order as the organising principle for content selection.

Most of these developments are possible on the first screen but are catalysed by the improved user interface, processing power and data communication capabilities of second screen devices.

9.4 Prominence in the second screen context

If EPG functionality migrates to the second screen as suggested above, grids and lists will tend to be supplemented or replaced by richer alternatives. It follows that the linear position (LCN) of a channel will have less effect on its effective prominence.

The experience so far is that second screen apps do not adhere to just one principle vis-à-vis prominence. Thus an individual app typically allows users the opportunity to display content according to popularity, buzz, tweets per minute, friends’ activity and recommendations as well as grid-based guides.

Accordingly, the static prominence determined by LCN could become replaced by a form of dynamic prominence based effectively on viewer behaviour: social recommendation, viewing figures, buzz, past viewing patterns or stated preferences. Both in principle and in practice, prominence will be more complex to manage on second screens.

The BBC commissioned the media strategy firm Communications Chambers to produce a report on the future of the regulation of prominence97. The report argues that (i) primary legislation should be updated to cover EPG functionality provided through the core elements of ‘user interfaces’, once such interfaces are used by a significant number of end-users to access TV-like content; (ii) the regime should apply where the ordering/organisation of the content is curated by the user interface provider (i.e. excluding purely objective ordering like A-Z, chronological or ‘most watched’); and (iii) the definition of PSB services within

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97 BBC (2012) PSB prominence in a converged media world. Communications Chambers
http://www.bbc.co.uk/aboutthebbc/insidethebbc/howwework/reports/bbc_psb_prominence.html

© Technologia 2014
the scope of prominence regulation should include on-demand content such as the BBC iPlayer or Channel 4’s 4OD and not only linear channels. The report acknowledges that ‘Given the rapidly changing market and multiplicity of different types of content gateway, it would not be sensible now to specify the precise meaning of prominence or the detailed form it should take’ in primary legislation. Instead, the report argues that this should be set out in the Ofcom Code of Practice, which would be regularly reviewed to assess market and technology developments and audience needs.

This paper was followed up in an interview to explore whether the BBC had arrived at any specific proposals in respect of second screen EPGs. The BBC still considers this to be ‘early days’ in respect of second screen take-up. For future proofing, the BBC suggested that it may be prudent for Government and Ofcom to consider whether any future regulatory regime should be capable of extending to the core aspects of a second screen user interface if the relevant regulatory criteria are met, including becoming a significant means for users to access TV-like content.

The dynamic form that prominence could take on second screens will render regulation somewhat more difficult to specify and enforce than hitherto on first screens.
10 Access services

10.1 Introduction
Second screen devices should in principle have a role in improving the accessibility of TV. The reasons include the following:

- **Native accessibility features**
  Tablets and smartphones often include native accessibility features such as a screen reader, a zoom function to make touch navigation easier, and swipe gesture control. There are differences between iOS devices and Android devices here. All iOS devices include a screen reader, a zoom function and gesture control while Android version 2.6 onwards had a basic screen reader and later versions improved on this and added other features.
  
  TV apps such as EPGs can be used in conjunction with the native accessibility features to create accessible TV apps. For example, instead of having to develop a separate ‘talking EPG’ app it is sufficient to enable the iOS screenreader and apply it to a standard EPG app.

- **Transformed economics**
  One of the barriers to improved accessibility is the cost of building such features into TV equipment. It is often argued that the cost cannot be justified in the case where only a small number of TVs or STBs would benefit from any one development programme. Second screen apps have the potential to be used across multiple brands and models of first screen, thereby serving a wider constituency and potentially being more able to recoup costs. The transformed economics should in principle enable more forms of accessibility impairment to be addressed.

- **Personalisation**
  Second screen devices are typically both personal (not shared) and personalisable with personal data. These characteristics are generally supportive of improved access. For example it would be possible to provide a user interface specifically tuned to an individual and their accessibility needs. Facilities such as touch control are inherently appropriate to personal devices.

- **New interfaces**
  The touch screens and processing power of second screen devices enable new forms of interface to be developed. For example, swipe gesture commands can be used to control basic functions of a TV or set top box.

- **More processing power**
  Second screen devices are a low cost way of acquiring processing power. By contrast, TVs and set top boxes have less headroom in terms of processing power, and are therefore less good candidates for real time functions related to accessibility.

- **Shorter replacement cycle than TVs**
  Second screen devices are replaced more frequently than TVs and when replaced are likely to be far more advance than their predecessors. Thus, the available processing power will increase faster in second screen devices than in first screen devices.

Despite their acknowledged potential role, second screen devices are not a priority for the organisations representing people with disabilities. Several overarching reasons were found:
• **Lack of open standards**

The economic benefits would be strongest if second screen devices could communicate with a wide range of TV receivers and STBs. This would require the manufacturers of TVs and STBs making the control codes and other communication protocols open. In practice, however, manufacturers are unwilling to open up their control codes and architecture to other companies lest it leads to an erosion of their product uniqueness.

• **Ownership of devices and infrastructure lower than average**

Many disabilities occur through the aging process, with the result that disabled people tend to have an older age profile than the population as a whole. The ownership of smartphones and tablets decreases with age. In addition average incomes are lower among disabled people. Together these factors conspire to ensure that the proportion of people with accessibility needs that own a smartphone or tablet is lower than the population average.

• **Implementation problems cause accessibility to be less good than anticipated**

Tablets and smartphones are recent entrants to the market. They are evolving rapidly and their accessibility features are improving. But at the moment there are many problems (bugs) which make second screens a lot less useful in this context than might be imagined.

Consequently, second screen is not at the moment seen as the ideal solution for all blind and partially sighted people by organisations such as RNIB. That said, the RNIB does believe that when the penetration of second screen devices amongst blind and partially sighted people reaches a tipping point, second screen will have an increasingly important role and the topic is being monitored carefully.  

### 10.2 Analysis of second screen accessibility roles

There are two domains in which accessibility matters in the context of TV:

- **The control** of TV equipment – changing channel, changing the volume etc.
- **Accessing content** – audio description, subtitles etc.

RNIB were clear that for their members, control was a bigger problem than content. The Digital Accessibility Centre sees control as the more mature of the two areas. So *control* rather than *content* is where second screen has been most used so far.

#### 10.2.1 Blind and partially sighted people

In relation to blind and partially sighted people there are several ways in which second screen is relevant.

- **Screen reader**

iOS devices and Android devices from V2.6 onwards include a text to speech facility. If an EPG can be displayed then the screen reader can read it, enabling a voice-interface remote control. We were told that these “work quite well”. We were told on more than one occasion that iOS works better than Android which can “be a bit hit and miss”.

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98 RNIB interview
Virgin told us that an important consideration in developing the TV Anywhere app was accessibility. The EPG and other control functionalities are compatible with the iOS screen reader and Virgin has received very positive reports from blind and partially sighted consumers. Sky commented positively on the native capabilities of iOS 6 (e.g. the screenreader) when used in conjunction with the Sky+ app.

- **Swipe gesture control**
  Gesture control can be used on second screen devices and are incorporated in apps such as Virgin TV Anywhere (see Figure 10 below).  


There are differences between iOS gesture control and Android; in addition these gestures are not intuitive and users must be taught how to use them.

- **Audio description (AD)**
  We were told by several organisations that audio description could usefully be provided on a second screen device. This would have the advantage, it is claimed, that audio description can be provided through earphones to the people who need it, thereby avoiding delivering AD to people who do not.

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RNIB told us, however, that this is a theoretical idea that, as far as they know, has not been delivered into the market. The BBC has built a demonstrator which uses their Universal Control API. RNIB were concerned at the potential isolation this scheme could produce:

“No one has asked blind people if they want to wear earphones and be cut off from other people in the room. As far as we are aware, there’s been no research that indicates that this model would meet a real user need. As with all our work, we only support propositions that are based on user needs, so we do not actively support this idea.” 100

- **Voice control**

Voice control is mainly being added to TVs as a control methodology for the mainstream market but can be useful for blind and partially sighted people too. This is a less well developed technology, and to be effective it needs to be combined with speech feedback to be practically useful for blind and partially sighted people. Without speech feedback it can be impossible to know whether a command has been correctly understood and implemented.

- **Dynamic Braille**

A possibility mentioned by a few interviewees is the use of Braille interfaces, as illustrated in Figure 11 which shows a future concept phone. If such displays were to become mainstream in the future, dynamic Braille would become one application for the display.

The app envisioned by interviewees would also involve converting subtitles and/or audio description into text as an intermediate step. DVB subtitles in the UK and subtitles on DVDs are not encoded as text but as pictures. This means that the raw text is not available to the receiver device (TV or set top box) to send to an app. OCR might be suggested to get round this but it takes a lot of processing power and the results may be unreliable results. The solution would be for broadcasters to transmit subtitles and audio description as text as well as embedded video or audio. This could be done via the internet instead as an adjunct to the broadcast signal.

Subtitles on their own would not show the action on the screen so the system would have to mix subtitles and audio description feeds. With Braille, spelling mistakes can become totally incomprehensible when converted into contracted braille so accuracy issues with live subtitling would be compounded.

According to RNIB101, fewer than 1% of the two million visually impaired people in the UK are users of Braille (18-20,000 people). Braille is generally used either where precision is required (such as computer programming), privacy is required (a user doesn’t want the information read out and doesn’t want to use headphones) or the user also has hearing loss (although people who are deafblind from birth often cannot learn the language skills needed to acquire reading)102.

Despite the technical complexity and other limitations, it might be argued that internet delivery of subtitle and audio description text should be relatively simple to implement and would provide a platform for innovation.

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100 RNIB interview

101 Peter Osborne chief Braille officer at the RNIB quoted in http://www.bbc.co.uk/news/magazine-16984742

102 RNIB interview
In conclusion the main current application of second screen for blind and partially sighted people is in the control of TVs and STBs via a screen reader and, in some cases, gesture control. The screen reader approach works quite well, although we were told by several interviewees that iOS implementations generally give fewer problems than Android. Importantly, the problems with this application are mainly practical rather than matters of principle; we might therefore expect accessibility features to improve over time as the problems gradually get solved.

10.2.2 Deaf people

There are fewer identified applications of second screen technology for deaf people. It is feasible to stream subtitles to a second screen device but there would be few situations in which this was preferable to having subtitles on screen. If subtitles were presented on a second screen while content is presented on the first, then the viewer’s gaze would need to keep shifting between the screens. While a few interviewees mentioned this idea as a theoretical possibility, we do not envisage that it would be welcomed by users.

10.3 Problems and practical considerations

Various issues were raised in interviews, as listed below.

- **Fragmentation of operating systems**
  Elsewhere in this document it has been noted that the operating systems of second screen devices can be fragmented, leading to differences in whether any individual device will support any particular app or accessibility feature. While there are differences between iOS and Android, with fewer problems with iOS, the issues might be interpreted as temporary/implementational rather than insoluble matters of principle. Nonetheless, it is clear that the tablet and smartphone space is unlikely to ‘settle down’ in the near future. In this regard, there could be a number of concerns over relying on second screen devices for essential accessibility features. Software support for legacy operating systems or hardware might be withdrawn, functionalities might no longer be supported, and users may effectively be locked in to a frequent upgrade cycle for second screen quite different from the much less frequent first screen replacement cycle.

- **Screenreader differences between iOS and Android**
  There are significant differences between iOS and Android. All iOS devices have an effective screen reader whereas Android only had text to speech from v2.6 onwards. Accessibility was built into standard interface components in v4. Only the high end models have the latest version Android, the cheaper phones won’t have the latest. Android is always fragmented with newer and later versions on different phones. This contrasts with iOS. According to the RNIB, “It’s a bit hit and miss on Android” 104.

- **Adobe Air**
  Some programming languages hinder the ability of the device to read text. Apps built on the mobile version of Adobe Air are known to be incompatible with the iOS screenreader. This limitation does not affect the version of BBC iPlayer used on tablets and smartphones, however, because the mobile version of iPlayer does not use Adobe Air. Furthermore, while BBC iPlayer desktop is powered by Adobe Air, the full Windows version supports text to speech.

- **Open and closed standards**
  While the economics of accessibility would change with open standards, the disability bodies do not see open standards as a battle they are likely to win, and neither do they see such standards as pivotal.

- **Tablet vs phone**
  RNIB told us that an app typically works better with a screen reader on a smartphone than its equivalent on a tablet. This is because the smaller screen on a smartphone means that there is less information, and therefore less on screen that needs to be navigated by touch and sound. Tablets have larger screens therefore have more on them, implying a greater navigation requirement. So the discipline of a small screen is generally helpful in the context of screen readers.

- **Battery drain**

104 RNIB interview
Another potential problem is that although second screen devices might have ample processing power, using this capability could rapidly drain second screen batteries. It is easily possible to imagine a housebound user running down the charge in tablet battery during the course of a day so that by the evening the accessibility capabilities have become lost. The implication is that second screen is not a panacea for accessibility despite the undoubted capabilities.

- **Lack of awareness**

  There are standards use cases which are often not known about. Also iOS screenreader guidelines are not always known about or followed by app designers.

- **Finding accessible apps**

  It was noted that accessible apps are hard to find, by virtue of the user’s disability as well as there being listed on app stores that do not afford them relevant significance for particular users. It was argued that regulation is not appropriate in this context but some efforts to help users locate the right apps would deliver benefits for certain constituencies.

### 10.4 Policy concerns

One factor in the apparent lack of enthusiasm for second screen devices from the disability groups is the differing level of regulation. TV is seen as being regulated whereas second screen is not. The disabled community has won important battles with respect to the provision of accessibility via TV, namely the inclusion of subtitles and audio description in broadcasts and the inclusion of decoding capabilities in the ‘D-Book’ specification for TV receivers. So it is possible to see the potential migration of accessibility functionalities to the second screen as a threat to hard won gains.

### 10.5 The future

We have shown how second screen devices can already be utilised to achieve improved accessibility but that their use is not a panacea. Second screen is not seen as a ‘golden bullet’ solution to the current, established, problem of achieving improved accessibility. Looking ahead we can envisage other developments which could be deployed to improve accessibility:

- Greater availability of metadata feeds such as audio description, subtitles transmitted as text, maybe in different languages, standard use of contextual tags and markers, all able to be fully synchronised with content;
- Division of audio into multiple channels including clean audio;
- Native accessibility of second screen devices getting better and becoming practically universal;
- Developments in user interfaces, e.g. tactile screens, voice input, other input modalities (not driven primarily by accessibility);
- Pace of development in tablets and smartphones slowing down in order that they become a more stable and predictable platform.

The possible outcomes are listed and described below. In each case we give an assessment of the likelihood of their being realised within **three to five years**.
<table>
<thead>
<tr>
<th>Trend</th>
<th>Description</th>
<th>likelihood</th>
</tr>
</thead>
<tbody>
<tr>
<td>Second screen as the preferred option for control of 1st screen (channels, volume, on/off etc)</td>
<td>Mainly making use of many additional native features in second screen devices the second screen becomes the preferred way of controlling the first screen</td>
<td>H</td>
</tr>
<tr>
<td>Personalised processing of video and audio for optimal personalised accessible content</td>
<td>Second screen processing power able to take content feeds either from 1st screen or via IP cloud and synchronised, and create personalised accessible content.</td>
<td>M</td>
</tr>
<tr>
<td>Specialised second screen apps for low prevalence accessibility issues</td>
<td>Second screen becomes a cost effective platform for specialised assistive technologies which are currently deployed on expensive low volume hardware.</td>
<td>L</td>
</tr>
</tbody>
</table>
11 Public policy impacts

11.1 Introduction
Until recently, ‘TV’ was a relatively well-defined world of broadcasters and a few platforms, all regulated under the Communications Act 2003. Second screen is just one of a number of developments which have served to complicate and destabilise these regulations.

We have focused on issues that have either exclusively arisen through second screen or are significantly changed or accelerated through second screen. We have identified five main areas of public policy impact:

1. Issues arising from content, advertising and service delivery over the second screen
2. PSB prominence in the second screen world
3. Technology and competition
4. Accessibility
5. ‘Technology universality’.

11.2 Issues arising from content, advertising and service delivery over the second screen

11.2.1 Regulations
Current regulations treat audiovisual editorial and advertising content on first and second screens differently. This is traceable to the Communications Act that sets the standards for broadcast and on-demand programme services (ODPS) regulation. Linear television and ODPS are currently regulated in the UK to very different standards. VOD services are regulated in accordance with the minimum requirements of the AVMS Directive, set at a European level, and are subject to far fewer standards protections compared to linear broadcast services licensed in the UK. The underlying rationale for the differences is that broadcast TV is seen as being ‘pushed’ to the viewer whereas other forms of content are seen as being called up electively, or ‘pulled’.

The relevant regulations and regulatory authorities are listed in Table 14.
Table 14: Regulations for first and second screens

<table>
<thead>
<tr>
<th></th>
<th>First screen</th>
<th>Second screen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broadcast TV</td>
<td>Notified VOD and catch-up TV</td>
<td></td>
</tr>
<tr>
<td>Editorial content</td>
<td>The Ofcom Broadcasting Code(^{105}) (Ofcom)</td>
<td>ATVOD Rules and Guidance(^{106}) (ATVOD)</td>
</tr>
<tr>
<td></td>
<td>BBC Trust for BBC</td>
<td>None(^{107})</td>
</tr>
<tr>
<td></td>
<td>Both transpose and supplement EU Directives</td>
<td></td>
</tr>
</tbody>
</table>

In respect of editorial content, the first screen is regulated more heavily than the second screen and broadcast content is regulated more heavily than notified VOD services.

In respect of advertising, the distinction is made between broadcast (BCAP Code) and non-broadcast (CAP Code). VOD and the second screen are regulated as non-broadcast but the regime is not so much ‘lighter’ than ‘different’.

While material that complies with the BCAP code would comply with the CAP code editorially, scheduling is also taken into account. So a programme that complies with the BCAP code could fall foul of the CAP code if it were inappropriately scheduled. A significant aspect of broadcast compliance, particularly concerning the protection of minors, is the application of scheduling restrictions.

Key differences in the regulations are listed in Table 15.


\(^{107}\) Where a second screen device was being used as a means to display first screen content such as linear TV and notified VOD content it would be covered by the regulations that apply to first screens – i.e. the regulations are technology-neutral. However this usage of second screen devices is not included in the definition of ‘second screen’ for the purposes of this report (see Section 2.4).

\(^{108}\) [http://www.cap.org.uk/Advertising-Codes/Broadcast-HTML.aspx](http://www.cap.org.uk/Advertising-Codes/Broadcast-HTML.aspx)

\(^{109}\) [http://www.cap.org.uk/Advertising-Codes/Non-broadcast-HTML.aspx](http://www.cap.org.uk/Advertising-Codes/Non-broadcast-HTML.aspx)
Assessing the impact of second screen

Table 15: Key differences in regulations

All of the below would be captured by relevant law.

<table>
<thead>
<tr>
<th>Topic</th>
<th>First screen broadcast TV</th>
<th>First screen VOD and catch-up TV</th>
<th>Second screen</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Editorial content</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed/scheduling</td>
<td>Absolute application of 9pm watershed</td>
<td>PIN required before watershed</td>
<td>No regulation</td>
</tr>
<tr>
<td>Harmful material: protection of under 18s</td>
<td>Wide ranging rules to ensure that children are not exposed to material that is potentially harmful or unsuitable for them. Rules cover: scheduling; violence; sexual material; dangerous ‘imitative’ behaviour; drugs and alcohol use; offensive language and child participation in programmes.</td>
<td>One rule which prevents children being able to access R18 material. Content must be behind a Content Access Control System</td>
<td>No regulation</td>
</tr>
<tr>
<td>Sponsorship</td>
<td>Sponsorship of news or current affairs show is prohibited&lt;br&gt;Must not affect editorial independence&lt;br&gt;Sponsorship must be made clear to viewers&lt;br&gt;No channel or programme may be sponsored by a sponsor that is not allowed to advertise on television&lt;br&gt;Sponsorship must comply with both the advertising content and scheduling rules that apply to television</td>
<td>The rules for editorial content on VOD services broadly reflect the rules for broadcasting</td>
<td>No regulation</td>
</tr>
<tr>
<td>Impartiality</td>
<td>Required for news programmes and programmes dealing with matters of political or industrial controversy and matters relating to current public policy</td>
<td>Notregulated</td>
<td>No regulation</td>
</tr>
<tr>
<td>Harmful material likely to be prohibited</td>
<td>Not permitted</td>
<td>Not permitted</td>
<td>Outside ATVOD’s remit but</td>
</tr>
<tr>
<td>Topic</td>
<td>First screen broadcast TV</td>
<td>First screen VOD and catch-up TV</td>
<td>Second screen</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>---------------------------</td>
<td>----------------------------------</td>
<td>-------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>incite hatred</td>
<td></td>
<td></td>
<td>subject to UK law against racial and religious hatred.</td>
</tr>
<tr>
<td>Competitions</td>
<td>Must be conducted fairly etc</td>
<td>Not regulated</td>
<td>Not regulated</td>
</tr>
<tr>
<td>Product placement</td>
<td>Regulated</td>
<td>Regulated</td>
<td>No regulation</td>
</tr>
<tr>
<td>Product placement for specific genres</td>
<td>Prohibited in news and children’s programmes. Also prohibited in religious programmes, consumer advice programmes and current affairs programmes if made under UK jurisdiction.</td>
<td>Prohibited in news and children’s programmes</td>
<td></td>
</tr>
<tr>
<td>Premium rate telephony services (PRS)</td>
<td>Regulated under the Broadcasting Code</td>
<td>Not regulated</td>
<td>This would be regulated by PhonePay Plus.</td>
</tr>
</tbody>
</table>

**Advertising**

<table>
<thead>
<tr>
<th>General</th>
<th>BCAP Code applies to broadcasters</th>
<th>CAP Code applies to advertisers</th>
<th>CAP Code applies to advertisers</th>
</tr>
</thead>
<tbody>
<tr>
<td>High fat high sugar foods (HFSS)</td>
<td>Special rules for advertisements for HFSS products directed at pre-school or primary school children</td>
<td>Not regulated</td>
<td>Not regulated</td>
</tr>
<tr>
<td>Political advertising</td>
<td>Not permitted</td>
<td>Not regulated</td>
<td>Not regulated</td>
</tr>
<tr>
<td>Pornographic images</td>
<td>BBFC rated R18 or equivalent material is prohibited. ‘Adult-sex material’ can be shown only between 10pm and 5.30am and behind mandatory restricted access</td>
<td>No specific reference to pornography, but rule which states that “marketing communications addressed to, targeted directly at or featuring children must contain nothing that is likely to result in their physical, mental or moral harm”</td>
<td>Not regulated</td>
</tr>
</tbody>
</table>

**Access services**

| Subtitles         | Statutory duty to make content accessible | Statutory duty to make content accessible | No regulation |

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11.2.2 Broadcasting Code
The following extract from the Broadcasting Code is relevant:

Under the Act, the provider of a service is the person with “general control” over which programmes and other facilities and services are comprised in the service (section 362(2) of the Act). General control is wider than editorial control in that it includes control over services and facilities to which access is provided (for example through the inclusion in the main service of a link or facility to interactive features) and over which the broadcaster may not have editorial control.

Although a link included in the service may lead to features outside of that service which are not regulated by Ofcom, the provision of access to those features by, for instance, the inclusion of a link, is within the control of the broadcaster and so within Ofcom’s remit. Ofcom may therefore require such a link or facility to be removed where Ofcom has concerns, in the light of its statutory duties and, in particular, the standards objectives set out in section 319 of the Act, about the material to which it leads. In any event, the transition from broadcaster to third-party control must be clear to the viewer, so as to manage both audience expectations regarding the material to which they are being led and the risk to the broadcaster of being found in breach of this Code (for example Rules 1.2 and 2.1).

11.2.3 Situation where issues could arise
Both through the exercise of imagination and through talking to ATVOD and the ASA/CAP we have identified situations where issues could arise. Both ATVOD and ASA stressed to us that there had not yet been a problem with second screen material but that they were starting to consider the issues that might arise in future. Both organisations stated that it was too early to make changes to regulations.

As the above review has shown, regulation of the second screen editorial content is considerably lighter than regulation of the first screen. For advertising, it’s a question of slightly different rules rather than an entirely different order of regulation. Consumer harm could arise where content which might reasonably be assumed to be regulated under heavier regulations is able to circumvent such regulations by virtue of being served on a second screen. Examples are as follows:

- Broadcast material streamed to the second screen initially which is then mirrored or redirected to the second screen;
- Automatic (fingerprinted or watermarked) links between first screen content the second screen which have the effect of calling-up content on the second screen without user intervention;
- Advertising published on the second screen by a third party app that ‘knows’ what TV channel is being watched;
- ‘Guerrilla’ advertising or sponsorship, to circumvent restrictions: for example an advert for high-fat, high-sugar content food displayed on the second screen during children’s TV; a form of advertising prohibited on the first screen;
- Apps running simultaneously on the second screen that link to the broadcaster of content on the first screen. The first screen content would be regulated by Ofcom whereas the second screen content may not be;
- Third party apps running on the second screen that are designed to relate to editorial content on the first screen;
- ‘Click through’ apps that pop up in sync with first screen adverts and make it easy to make purchases prompted by programmes or adverts on the first screen. The ASA has commented that “If the product is permitted for broadcast advertising (as it is in this scenario), then just facilitating purchase isn’t likely to be a problem”. There may however be problems if it is too easy for children to make unauthorised purchases. While click through is designed to make purchasing easier for adults, the corollary is that it would make it easier for children too; and,
• Spoiler advertising. It is possible to imagine second screen advertising being used against first screen advertisers. For example, when the first screen shows an advert for one company, the second screen shows an advert for a competitor.

We have been directed to two recent complaints which have implications for second screen:

• The second screen also introduces interactivity to advertising – as per the recent example of the Prometheus advert on Channel 4 (Ofcom Broadcast Bulletin: Issue Number 216, 22 October 2012: P 33)\(^{110}\) where it created confusion about whether it was an advert or editorial content. Viewers were shown two adverts, the first asking for comments on a movie trailer via Twitter; the second advert, in the following ad break, then displayed some of the comments. The line between advert and Channel 4 branding/continuity announcer was blurred in this instance. Ofcom notes that the confusion was compounded by the fact that “viewer tweets shown in the second advertisement were wholly positive about the film”, suggesting some editing had occurred. The conclusion was that the necessary steps were taken to distinguish it as an advert through the use of audio cues and logos that made it distinct from the programme that was on at the time. However, this is an interesting case of where the use of second screen starts to challenge existing regulation. That said, it is also a good example of how the existing rules were adequate to deal with to new formats made possible by second screen interactivity; Ofcom had no difficulty in finding or applying a relevant rule.

• Ofcom’s decision on Northern Birds/Essex Babes/Sportxxx Girls/Livexxx Babes illustrates the current approach to broadcast advertising of adult services. In this case, the broadcast advertising content included a URL on which pornographic content might be viewed, and was found to breach the BCAP Code.

According to the ASA, a broadcast ad that included a watermarked link to second screen content that included pornographic material would probably be approached the same way: the second screen content itself might be non-broadcast, but the link contained in the broadcast advertising could be regulated under the BCAP Code.

The lack of maturity of second screen, and the lack of a widespread infrastructure to sync first and second screens means that viewers currently have to make a positive choice to receive either editorial or advertising content on a second screen. The need for positive choice is may differentiate second-screen from broadcast content.

ATVOD and the ASA generally take the view that existing regulations provide sufficient powers, at least, for now.

It was also noted that very few complaints have been received about second screen content, which might be because many users are in younger age groups that are typically less inclined to make complaints\(^ {111}\). It was also argued that, at present, much of the concern currently relates to ‘potential’ issues as opposed to techniques that had been seen in practice.

An example of a potential issues is the scenario where the second screen behaves ‘automatically’ in response to first screen content, without requiring the user to make an active choice to pull down the content, or indeed, the capability to receive and respond to content. In this situation the content would

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\(^{110}\) http://stakeholders.ofcom.org.uk/binaries/enforcement/broadcast-bulletins/obb216/obb216.pdf

\(^{111}\) “88% of all complainants to the ASA are aged over 35”. CAP interview
have all the characteristics of ‘push content’, which would normally be more heavily regulated, but would probably be regulated lightly by virtue of being on the second screen.

Ofcom’s existing powers appear to include the ability to remove the links between the first and second screens if those links are provided through watermarking. But some forms of synchronisation such as fingerprinting or electronic linkages between devices may not be subject to the Broadcasting Code. This represents a possible gap in the regulations.

11.2.4 The international dimension
The second screen could be more open to international content than the first screen.

Ofcom and ASA’s regulatory jurisdiction is limited to the UK. However where content originating outside of the UK circumvents the ASA’s codes, the ASA is able to refer complaints about non-broadcast advertising content to self-regulatory partners in other countries through the European Advertising Standards Alliance112 (including a number of non-European countries) which is self-regulatory but represents a coordinated response which respects differences in culture, legal and commercial practices.

11.2.5 Convergence
Towards the end of this study the House of Lords published a report on Media Convergence113. While second screen was not covered specifically, the report highlighted that, in a converged world, regulated and unregulated content, and licensed and unlicensed services, are increasingly hard to distinguish.

“Convergence brings three key challenges too: potential erosion of trust and confidence in content we consume; challenges to the future of public service content; and outmoded regulation, which is slow to adapt to changing markets and audience expectations”

While the Lords report considers existing regulation to be “outmoded” we have not found clear evidence for this in second screen apart from in respect of certain new forms of synchronisation as mentioned above.

11.2.6 Policy
If a policy response were required, it might be difficult to write rules for second screen while there is still so much innovation occurring and ‘second screen’ is not possible to define perfectly. However there is a potential gap in regulations where a first screen could call-up content on the second screen but without this being the result of a link in the first screen content.

11.3 PSB prominence in the second screen world
While the regulation of prominence was originally framed for linear TV, recent years have seen attention turn to the prominence of catch-up services. Second screen could add apps to the list of PSB output for which the PSBs may seek prominence.

At present the lack of a widespread infrastructure to sync first and second screens means that third party apps cannot easily duplicate or compete with the more sophisticated broadcaster apps. If such an infrastructure existed then the entry barriers for a contextual enhancement app would be lower and the issue of app prominence could arise.

112 http://www.easa-alliance.org/
113 House of Lords, Media Convergence: http://www.parliament.uk/business/committees/committees-a-z/lords-select/communications-committee/report-media-convergence/
The prominence issues associated with EPGs are discussed in chapter 9.

11.4 Technology
A few aspects of the technology infrastructure are not ‘sorted out’: namely synchronisation and interoperability between first and second screens

But many second screen apps do not require these functions and we did not detect a strong demand for open standards. App developers find workarounds in many instances.

While there is the potential for harm via closed standards or unfair commercial influence, these were not highlighted to any great extent in interviews.

11.5 Accessibility
Accessibility is discussed in chapter 10. It is already clear that the screen reader capabilities on iOS and later versions of Android can be beneficial for blind and partially-sighted people in conjunction with second screen EPGs. There may be a future decision as to whether providing accessibility through the second screen is an acceptable alternative to meeting the mandatory accessibility requirements of first screen devices.

iOS is currently more suitable for users with accessibility issues than Android, and it is not uncommon for users or specialist organisations discover various incompatibilities related to the model or their device or the version of its operating system. There could be a case for doing more to encourage best practice in page design so that EPGs are accessible in so far as they are able to exploit the native accessibility capabilities of devices and their operating systems and are as ‘backwards compatible’ in terms of their operating system compatibility as practicable.

During our interview with the Digital Accessibility Centre it was noted that the iOS screen reader (known as VoiceOver) was not compatible with some programming languages such as Adobe Air which renders iOS unable to read the screen. For VoiceOver to be able to identify and read user interface elements on the screen, these elements have to arise from native iOS controls. It was also noted that users might benefit from a specific location for the discovery and recommendation of appropriate devices and apps, something like an accessibility app store or consumer champion.

11.6 ‘Technology universality’
Public service broadcasting has a strong commitment to universal access, i.e. that all license fee payers should have access to the same service wherever they are located. By analogy, some form of ‘technology universality’ might be expected whereby all consumers have access to all PSB services. In practice, this would be difficult and uneconomic to provide for second screen devices because not all app developers will support all devices and operating systems. Decisions are inevitably necessary as to which operating systems and devices to support.

11.7 Conclusions
Much of the evolution of second screen has involved a pragmatic relocation of existing first screen functions and the evolution of traditional behaviours and technologies. There is no one issue that gives rise to immediate concern, nor warrants intervention in the view of the content and advertising regulators we have interviewed.
12 Integration and the future of second screen

12.1 An integration framework
An objective of the project was to develop a framework for assessing the level of integration (both technical and commercial) between a given second screen application and TV broadcasts. Figure 12 shows our suggested framework. The axes are synchronisation and interoperability, these being the technical barriers identified in section 7.1. The app functionalities are shown on the graph. Perhaps surprisingly many apps are close to the origin, i.e. not dependent on much of either form of integration.
The area close to the origin can be regarded as ‘non-integrated’ or ‘standalone’. The graph is consistent with the comment from Antony Rose, founder of Zeebox:

“Second screen apps have been designed to work just fine standalone – in fact many of the use cases (e.g. finding things to watch, planning your viewing, getting involved in the chat around a show) don’t need you to be near or in front of a TV at all.” 114

12.2 Themes with the potential to define the future of second screen

One of the objectives for this project is to show how second screen might develop. Through a concerted analysis of technical, commercial, and viewer insights obtained within the project we have identified a broad range of themes or trends which have the potential to substantially define the future of the second screen ecosystem. These themes are listed and described below, grouped according to theme. In each case we give an assessment of the likelihood of their being realised within three to five years.

Table 16: Nascent and potential trends in the development of 2nd screen

<table>
<thead>
<tr>
<th>Trend</th>
<th>Description</th>
<th>Likelihood</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st screen ads extend to 2nd screen</td>
<td>2nd screen becomes an extension of 1st screen advertising estate, with interactive augmentation of 1st screen advertising on 2nd screen.</td>
<td>H</td>
</tr>
<tr>
<td>1st and 2nd screens combined for retail</td>
<td>Applications are designed to enable 1st screen and 2nd screen to work in concert as a retail channel. E.g., 1st screen as shop window, 2nd screen as shop and click-through.</td>
<td>H</td>
</tr>
<tr>
<td>A market develops in tags for advertising and click-through</td>
<td>Insertion of watermarks to editorial and/or commercial 1st screen content to enable synchronised interaction between 1st and 2nd screen content becomes common and is exploited to the benefit of viewer experience. A market develops to make these tags available to media buyers.</td>
<td>M</td>
</tr>
<tr>
<td>2nd screen ad revenues start eroding 1st screen ad revenues</td>
<td>Advertising migrates enough to the second screen that 1st screen revenues are depressed</td>
<td>L</td>
</tr>
</tbody>
</table>

Editorial use of second screen

<table>
<thead>
<tr>
<th>Trend</th>
<th>Description</th>
<th>Likelihood</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd screen output accompanies 1st screen editorial as standard</td>
<td>It becomes very rare for 1st screen editorial productions not to include accompanying 2nd screen output across a wide range of genres.</td>
<td>L</td>
</tr>
</tbody>
</table>

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114 Email from Antony Rose, 25/3/2013
### User experience

<table>
<thead>
<tr>
<th>Trend</th>
<th>Description</th>
<th>Likelihood</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPG and control of connected 1st screens migrates to 2nd screen</td>
<td>2nd screen becomes the main means of exploring and navigating EPG and controlling connected 1st screens.</td>
<td>H/M</td>
</tr>
<tr>
<td>2nd screen the norm for younger viewers</td>
<td>2nd screen becomes a significant and important part of the TV viewing experience for younger viewers (&lt;35 years of age.) For such viewers watching 1st screen without 2nd screen will be rare.</td>
<td>H/M</td>
</tr>
<tr>
<td>2nd screen becomes primary device</td>
<td>Viewers’ close personal relationships with the 2nd screen are exploited effectively by OTT and managed service streaming providers, so the 2nd screen effectively becomes a controller/selector/streamer (direct or from cloud) to 1st screen. This reduces the value of broadcast TV service providers to viewers, supporting cord-cutting.</td>
<td>L</td>
</tr>
<tr>
<td>2nd screen the norm for all viewers</td>
<td>2nd screen becomes a significant and important part of the TV viewing experience for all viewers.</td>
<td>L</td>
</tr>
</tbody>
</table>

### Industry structure

<table>
<thead>
<tr>
<th>Trend</th>
<th>Description</th>
<th>Likelihood</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd screen a route for large players to enter broadcast ecosystem</td>
<td>Large scale international Internet and media players are able to leverage their very large user bases to exploit 2nd screen through new apps and service (e.g., new social and recommender services around shared viewing).</td>
<td>H</td>
</tr>
<tr>
<td>2nd screen a route for large players to disrupt broadcast ecosystem</td>
<td>Large scale international Internet and media players are able to leverage their very large user bases to exploit 2nd screen through new apps and service (e.g., new social and recommender services around shared viewing) which they are able to monetise, substantially disrupting the current value chain of the broadcast ecosystem.</td>
<td>M/L</td>
</tr>
</tbody>
</table>

### Analytics

<table>
<thead>
<tr>
<th>Trend</th>
<th>Description</th>
<th>Likelihood</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd screen analytics drive 1st screen ads</td>
<td>The 2nd screen advantages of personalisation and targeting are exploited in new ways to present ads on 1st screen in a better targeted way (e.g., ads shown in a break on 1st screen will differ dependent on type of viewer as revealed by 2nd screen analytics).</td>
<td>M/L</td>
</tr>
</tbody>
</table>

Two key uncertainties apparent from a review of Table 16 are the extent to which 2nd screen will be adopted and exploited for commercial means (advertising and retail), and the extent to which they will be adopted and exploited to enrich editorial content (programmes across a wide range of genres).
12.3 Scenarios
To further address the question of how second screen might develop, in this section we have created a series of four scenarios which consider the impact of the uncertainties identified above. The axes for the scenarios are
(a) the importance of second screen in advertising and commerce
(b) the editorial importance of second screen, for example in programme apps.

“Just for you”
- Two screen viewing as the norm
- Sync infrastructure in place
- De facto or de jure standards in place
- Cost of second screen ad slots comparable to 1st screen
- Dominated by platforms
- Highly personalised

“Expand your mind”
- Most broadcasters use second screen to enhance programmes
- Traditional advertising remains on 1st screen; some use of click through
- Dominated by top broadcasters
- Sync handled by broadcasters

“Search and chat”
- Used for content search and discovery, and for social media comments about programmes
- No universal sync infrastructure

“Buy, buy, buy”
- Used extensively to complement 1st screen advertising and provide click through
- Dominated by retailers
- Universal sync infrastructure

Figure 13: Future scenarios 3-5 years

“Just for you” is a world where second screen is the norm, and where personalised, synchronous content is delivered both in programmes and advertising and click-through slots. To enable this to happen, the platforms have taken the lead in developing the ability to provide a lip-sync infrastructure which lowers the cost of producing second screen content. Viewers choose a platform app such as Virgin TV Anywhere or the Sky+ app, and additional content synchronises automatically. Third parties have developed workarounds.

As a measure of the success of second screen, the cost of advertising slots approaches that of first screen. Most programmes use feeds from the second screen to give instant audience feedback and involvement.
Creativity on the part of broadcasters has led to even ‘dry’ programmes such as news being reformulated as an interactive experience. Viewers vote on which items to include next. In drama, it is not unusual for audiences to be involved as participants in the plot.

‘One screen viewing’ is seen as outdated, much as black and white TV is completely eclipsed by colour.

In this scenario, platforms and broadcasters could cooperate. Platforms can deliver frame accurate synchronisation and by cooperating, platforms provide the infrastructure for programme apps and advertising. It’s win-win for both parties. Not to be left out, third party app suppliers create fingerprinting and control infrastructures as work-arounds. There is an ongoing shake out to leave a small number of comprehensive app providers, each with proprietary technology. CE manufacturers are marginalised in this process.

The result is head to head competition between a platform/broadcaster alliance using a “work within” strategy and third parties using a “work around” strategy.

**Figure 14: Possible competitive space**

“Expand your mind” is a world in which the initial promise of second screen advertising failed to live up to expectations, and where second screen is used mainly as an adjunct to editorial content. Broadcasters have been driving progress in this scenario, with most programmes having a second screen presence. While there are similarities with ‘just for you’, there has been less effort and resources behind second screen technology with the result that each broadcaster uses its own synchronisation technology.
“Buy, buy, buy” is a world in which the main use of second screen is in conjunction with advertising and shopping. The main second screen apps are from internet retailers, who have developed the ability to sync 1st screen and second screen commercial content. The retailer apps have access to past personal shopping data and therefore send personalised ads in sync with the first screen. The market was initially kick started by companies that sold advertising in competition with the first screen. This forced 1st screen advertisers onto the second screen, initially as a defensive measure.

“Search and chat” is a world where second screen has not taken off. On the editorial side, viewers started to ignore second screen in all but a few genres such as games shows and contests. Second screen continues to be used for click through but the field is dominated by third party app suppliers who have formed alliances with retailers who regard TV as yet another channel to market, not as a major plank of strategy. CE manufacturers are potentially strong in this scenario.
13 Conclusions and recommendations

1. The second screen space is only a few years old. As a result, many aspects are still in a state of flux, including: the definition of second screen as a category, the functions and features offered, the technologies and infrastructures involved, and the business models of the players in second screen. Consequently any conclusions are necessarily based on a snapshot of this immature market.

2. Nevertheless the field is developing fast, so Ofcom should consider acting to give itself maximum flexibility in whether and when to update regulation in recognition of the wider use of second screen, or where some other intervention might be warranted. We have highlighted such areas for Ofcom’s consideration according to the three main functionalities identified in our survey.

3. In the functional area of ‘accessibility and control’, the technologies are still largely proprietary. The BBC has proposed an open standard (the Universal Control API) but this shows little sign of becoming adopted. In the area of synchronisation there are no standards. The lack of standards for both control and synchronisation raises entry barriers and therefore could discourage the development of new apps. There is no sign that the lack of open standards is currently harming innovation but the situation may change and Ofcom should keep the issue under review.

4. In relation to ‘accessibility’, despite the fact that second screen is not at this point a priority for organisations such as the RNIB, Ofcom should consider how the requirement for, or the promotion of, accessibility on the first screen might evolve to encompass the second screen. In the longer term, ideas such as dynamic Braille would be accelerated if enabling data including real time subtitles and audio description text were made available on the internet.

5. In the functional area of ‘contextual enhancement’, there is a potential loophole in that content being called up on a second screen but without using watermarking of first screen content (e.g., via a synchronised time stamp) is not currently subject to broadcast regulation. Current regulations enable all content on the first screen – including web addresses and embedded data – to be regarded as ‘content’ and regulated accordingly. If an audio watermark transmitted in a broadcast signal elicited inappropriate content to appear on a second screen then the broadcaster would be accountable for the watermark. However, some second screen synchronisation methods do not involve the insertion of content in the broadcast signal. Thus a second screen app could potentially offer synchronous, related, content to the first screen, behaving in effect as ‘push’ content but not necessarily being capable of being regulated as broadcast content. This loophole will need to be addressed; consideration should be given to the circumstances when second screen content would legitimately be seen as part of first screen content and need to be regulated as such.

6. To inform future policy on second screen Ofcom should consider adding questions to its surveys to try to track the level and type of usage of second screen apps, perhaps referencing the main functionalities established through the our survey.
Appendix A Terms of reference

There have been proliferations of second screen applications running on hand held devices such as laptops, tablets and smart phones facilitating interaction with content viewed on TV. Examples include Zeebox, Shazam, Sky’s iPad app, and Samsung’s TV app.

Ofcom has adopted a modified version of the DVB’s definition of second screen as a starting point for discussion:

“Second screen are a class of connected devices or applications that are designed to be complementary to TV watching or radio listening by presenting content that is contextual and/or synchronised to what is showing on the primary screen whether that is live or on-demand. The second screen may be completely integrated with the TV content and/or with the television set”.

Examples of second screen applications include; tweet about a TV show using the twitter app on tablet, or using Zeebox app on smart phone. However unrelated activities while watching TV such as sending emails or tweeting about an unrelated subject are not considered as second screen applications.

This type of application can provide a range of features, including:

- Viewing of associated programmes or video clips;
- Interaction with friends on social networks;
- Pre-view TV content before playing on TV;
- Vote/interact with TV programs;
- Finding details on advertised products;
- Enhanced EPG functionality, with search, recommendation and the ability to change the channel on the TV

Furthermore, second screen applications have potential to create new revenues streams for broadcasters/operators/CE manufacturers through targeted advertising and enhanced TV viewing measurement services along with improved customer satisfaction levels. They could also disrupt existing business models such as existing TV viewing measurement and television interactive services using premium rate calls and sms.

Objectives
We wish to commission a report covering the following areas:

Scope and Definition
- What are the industry’s definition, features/characteristics & functionality of second screen?
- Develop a framework for assessing (assessment framework) the level of integration (both technical and commercial) between a given second screen application and TV broadcasts.

Technology & Interoperability
- Details on architectural choices for providers of second screen applications such as closed systems (proprietary software/hardware/operating systems) vs. open systems (standardized technologies) e.g. Sky/Virgin vs. DTG
- Details on technical architecture or technology stack underlying existing second screen applications; including details on protocols/components/APIs used for inter connection of underlying technology blocks e.g. how does the second screen application(for example, second screen app running on a tablet) control the TV? How does the application know what channel the TV is tuned to? How can content on main TV screen be viewed on second screen? e.g. DLNA Use of
proprietary and standardised technologies and moves to develop further standards and increase interoperability.

- Do any technical barriers exist which have a negative impact on the ability of new market entrants to launch services or on the scope of applications? (Examples could include fragmentation of operating systems/platforms and use of closed APIs.)

**Review of current services and market size**

- Who are the existing players in domestic and international markets? For example Zeebox, Shazam, Samsung remote, BBC red button, Virgin Media TV Anywhere. Provide details on differences or similarities of product or service features, adoption rates and revenues and map them to the assessment framework.
- What are the alternatives to fully integrated/synchronized second screen applications? For example twitter, WhatsApp, or SMS texting vs. Zeebox or Shazam. What are their adoption rates and usage? Identify incremental benefits to consumers associated with fully integrated (synchronized with television set/TV content) second screen applications.
- What are the value networks of second screen applications in current TV eco system along with details on vertical integration, partnerships, and exclusive relationships etc? What is relative position of second screen apps within social media ecosystem?

**EPGs and Access Services**

- In depth analysis of the significance of second screen applications in providing new access services to consumers. What are the opportunities to improve the TV viewing experience for consumers with disabilities? What, if any, are the barriers (technical or commercial) to these services being developed?
- What are the opportunities and threats for EPGs? For example, implications for PSB prominence on EPGs, disruption of value chain, improved search/recommendation and personalisation. What, if any, are the barriers (technical or commercial) to these services being developed? Is there a risk of consumer harm?

**Future Developments**

- What are the future trends in second screen applications? What are the possible associated benefits or consumer harm? For example, will parents be able to rely on the same levels of editorial control on second screen applications that they expect from broadcast content? Will lack of technical interoperability result in barrier to switching between service providers or CE manufacturers?
## Appendix B Listing of interviewees and their organisations

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Role</th>
<th>Interviewees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advertising Standards Authority</td>
<td>Regulator</td>
<td>Catherine Thomas, Code Policy Executive</td>
</tr>
<tr>
<td>Agora Media Innovation</td>
<td>Service provider and commentator</td>
<td>Richard Kastelein, Founder</td>
</tr>
<tr>
<td>Arqiva</td>
<td>Transmitter platform operator</td>
<td>Keith Hayler, Principal Technologist</td>
</tr>
<tr>
<td>ATVOD</td>
<td>Regulatory issues, VOD</td>
<td>Cathy Taylor, Policy Manager</td>
</tr>
<tr>
<td>BBC</td>
<td>Broadcaster</td>
<td>Jerry Kramskoy, Senior Technologist</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Paul Caporn, Senior Technology Architect</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Helen Keefe, Senior Policy Advisor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Matt Garside, Senior Adviser, TV &amp; iPlayer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tom Williams, Development Editor, TV &amp; iPlayer</td>
</tr>
<tr>
<td>BT</td>
<td>Platform provider</td>
<td>Ian Kegel, Head of Future Content Research, BT TSO</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Andy Gower, Future Consumer Applications and Services, BT Research &amp; Innovation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tim Pennick, Senior Researcher, BT TSO</td>
</tr>
<tr>
<td>Deloitte</td>
<td>Consultant and commentator</td>
<td>Paul Lee, Deloitte Research Technology, Media &amp; Telecommunications</td>
</tr>
<tr>
<td>Digital Accessibility Centre (DAC)</td>
<td>Accessibility testing experts</td>
<td>Gavin Evans, Head of Operations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cam Nicholls, Director of Sales and Service Development</td>
</tr>
<tr>
<td>Digital Television Group (DTG)</td>
<td>Standards and coordination body</td>
<td>Simon Gauntlett, Technical Director</td>
</tr>
<tr>
<td>Intellect</td>
<td>Trade association</td>
<td>George Fullam, Head of Technology, Consumer Electronics</td>
</tr>
<tr>
<td>Intrasonics</td>
<td>Audio watermarking</td>
<td>John Barrott, Technical Director</td>
</tr>
<tr>
<td>ITV</td>
<td>Broadcaster</td>
<td>Sheena Peirse, Editorial Director of Online</td>
</tr>
<tr>
<td>Opera</td>
<td>Software provider</td>
<td>Giuseppe Pascale, Software Developer and Standards</td>
</tr>
<tr>
<td>RedBeep Media</td>
<td>EPG and metadata provider</td>
<td>David Padmore, Director: Access and Editorial</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Richard Kirk, Head of Development, Metadata</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Matt Simpson</td>
</tr>
<tr>
<td>RNIB</td>
<td>Blind and partially sighted</td>
<td>Leen Petre, Principal Manager, Media and Culture Department</td>
</tr>
<tr>
<td>Organisation</td>
<td>Role</td>
<td>Interviewees</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>-------------------------------------</td>
<td>-------------------------------------------------------------</td>
</tr>
<tr>
<td>Rovi</td>
<td>EPG technology</td>
<td>Ray DeRenzo, SVP Marketing, Rovi Corp</td>
</tr>
<tr>
<td>Sky</td>
<td>Platform operator</td>
<td>Holly Knill, Product Development Director, Sky Go</td>
</tr>
<tr>
<td>Sony Home Entertainment Europe</td>
<td>Consumer Electronics Equipment Supplier</td>
<td>Mark Londero, Head of Requirements and Strategy</td>
</tr>
<tr>
<td>UBIAPPS</td>
<td>App development</td>
<td>Nick Allott</td>
</tr>
<tr>
<td>Virgin</td>
<td>Platform operator</td>
<td>Ian Mecklenburgh, Director, Consumer Platforms</td>
</tr>
<tr>
<td>Zeebox</td>
<td>Second screen app company</td>
<td>Anthony Rose, Founder and CEO</td>
</tr>
</tbody>
</table>
### Appendix C Listing of the majority of UK second screen apps

<table>
<thead>
<tr>
<th>App</th>
<th>Description</th>
<th>Website</th>
<th>Implementation</th>
<th>Second screen device</th>
<th>Functional class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apple TV</td>
<td>Streamed video box plus app for phones and tablets</td>
<td><a href="https://itunes.apple.com/app/remote/id284417350?mt=8">https://itunes.apple.com/app/remote/id284417350?mt=8</a></td>
<td>Hardware plus apps</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>BBC Antiques Roadshow app</td>
<td>Playalong app. Synced via audio watermarking</td>
<td><a href="http://www.bbc.co.uk/programmes/b006mj2y/features/play-along-app">http://www.bbc.co.uk/programmes/b006mj2y/features/play-along-app</a></td>
<td>App</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#BBCQT</td>
<td>This is a curated feed closely integrated with the programme</td>
<td><a href="https://twitter.com/bbcqt">https://twitter.com/bbcqt</a></td>
<td>App and website</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Britain’s Got Talent</td>
<td>A second screen extension of the popular ITV show – with additional content and ‘buzz’ interactive feature</td>
<td><a href="http://talent.itv.com/2012/mobile/">http://talent.itv.com/2012/mobile/</a></td>
<td>App</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Dijit</td>
<td>Universal remote control</td>
<td><a href="https://play.google.com/store/apps/details?id=com.dijit.urc&amp;hl=en">https://play.google.com/store/apps/details?id=com.dijit.urc&amp;hl=en</a></td>
<td>Website and app</td>
<td>✓</td>
<td>✓</td>
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<td></td>
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<tr>
<td>Facebook</td>
<td>The world’s biggest social network</td>
<td><a href="https://www.facebook.com/">https://www.facebook.com/</a></td>
<td>Website and app</td>
<td>✓</td>
<td>✓</td>
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<td></td>
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<tr>
<td>Fanatix</td>
<td>Sports specific EPG</td>
<td><a href="http://www.fanatix.com/">http://www.fanatix.com/</a></td>
<td>App</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>App</td>
<td>Description</td>
<td>Website</td>
<td>Implementation</td>
<td>Second screen device</td>
<td>Functional class</td>
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</tr>
<tr>
<td>Foursquare</td>
<td>Location based social network that allows you to “check in” to venues, earn points and win badges</td>
<td><a href="https://foursquare.com/">https://foursquare.com/</a></td>
<td>Website and app</td>
<td>✓ ✓ ✓ ✓</td>
<td>✓ ✓</td>
</tr>
<tr>
<td>Google Plus</td>
<td>Wide ranging social media service</td>
<td><a href="https://plus.google.com/u/0">https://plus.google.com/u/0</a></td>
<td>Website and app</td>
<td>✓ ✓ ✓ ✓</td>
<td></td>
</tr>
<tr>
<td>iMediaShare</td>
<td>‘Connect a TV to your home network, start the iMediaShare app on your phone and enjoy video, music and stills on the big screen.’</td>
<td><a href="http://www.imediashare.tv/">http://www.imediashare.tv/</a></td>
<td></td>
<td>✓ ✓ ✓ ✓</td>
<td>✓ ✓</td>
</tr>
<tr>
<td>LG TV Remote</td>
<td>Allows phones and tablets to function as remote controls. Also allows second screen to mirror main screen, or display TV content etc</td>
<td><a href="http://www.lg.com/uk/cinema3d/cinema3d/smarttv.jsp">http://www.lg.com/uk/cinema3d/cinema3d/smarttv.jsp</a></td>
<td>Apps</td>
<td>✓ ✓ ✓ ✓</td>
<td></td>
</tr>
<tr>
<td>Livesport.co.uk</td>
<td>Sports related TV listings and win prizes</td>
<td><a href="https://play.google.com/store/apps/details?id=com.scothosts.apps.livesport&amp;feature=search_result#?t=W251bGwsMSwyLDEsImNvbS5zY290aG9zdHMuYXBwc29yZSlc3BvcnQXQ">https://play.google.com/store/apps/details?id=com.scothosts.apps.livesport&amp;feature=search_result#?t=W251bGwsMSwyLDEsImNvbS5zY290aG9zdHMuYXBwc29yZSlc3BvcnQXQ</a>.</td>
<td>Website and app</td>
<td>✓ ✓ ✓ ✓</td>
<td></td>
</tr>
<tr>
<td>Million pound drop live</td>
<td>The Million Pound Drop Play Along game is available to play online during LIVE shows at: <a href="http://www.channel4.com/drop">http://www.channel4.com/drop</a></td>
<td><a href="http://www.channel4.com/drop">http://www.channel4.com/drop</a></td>
<td>App</td>
<td>✓ ✓ ✓ ✓</td>
<td></td>
</tr>
<tr>
<td>App</td>
<td>Description</td>
<td>Website</td>
<td>Implementation</td>
<td>Second screen device</td>
<td>Functional class</td>
</tr>
<tr>
<td>-------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
<td>----------------</td>
<td>-----------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Panasonic Viera remote</td>
<td>Allows phones and tablets to function as remote controls. Also allows second screen to mirror main screen, or display TV content etc</td>
<td><a href="http://panasonic.jp/support/global/cs/tv/vremote/index.html">http://panasonic.jp/support/global/cs/tv/vremote/index.html</a></td>
<td>Apps</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Pinterest</td>
<td>Photo sharing website for hobbies, collections and events</td>
<td><a href="http://pinterest.com/">http://pinterest.com/</a></td>
<td>Website and app</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Shazam</td>
<td>Content recognition. The TV companion aspect of Shazam is not yet implemented in the UK but does exist in the USA. A UK launch has been announced</td>
<td><a href="http://www.shazam.com/">http://www.shazam.com/</a></td>
<td>App</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>
## Assessing the impact of second screen

<table>
<thead>
<tr>
<th>App</th>
<th>Description</th>
<th>Website</th>
<th>Implementation</th>
<th>Second screen device</th>
<th>Functional class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sony TV SideView</td>
<td>Allows phones and tablets to function as remote controls. Also allows second screen to mirror main screen, or display TV content etc</td>
<td><a href="http://www.sony.co.uk/hub/lcd-television/benefits/skype-app-tv">http://www.sony.co.uk/hub/lcd-television/benefits/skype-app-tv</a></td>
<td>Apps</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>TV Check</td>
<td>Social TV app. Live TV image recognition technology means you can simply point your mobile phone at the screen to 'check-in' using your phone’s camera</td>
<td><a href="http://tvcheck.com/uk/index.html">http://tvcheck.com/uk/index.html</a></td>
<td>App</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>TV Guide</td>
<td>Interactive listings</td>
<td><a href="http://www.tvguide.co.uk/">http://www.tvguide.co.uk/</a></td>
<td>App</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Twitter</td>
<td>Microblogging. Note that tweets can be user generated or broadcaster led</td>
<td><a href="https://twitter.com/">https://twitter.com/</a></td>
<td>App and website</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>App</td>
<td>Description</td>
<td>Website</td>
<td>Implementation</td>
<td>Second screen device</td>
<td>Functional class</td>
</tr>
<tr>
<td>-------------------------</td>
<td>------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
<td>-------------------------</td>
<td>----------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td><strong>Unibet TV</strong></td>
<td>Sports TV guide showing odds on sports events broadcast on TV and Unibet live streaming. Option to invite your friends to participate.</td>
<td><img src="https://play.google.com/store/apps/details?id=com.unibet.sportstvguide&amp;feature=search_result#?t=W251bGwsMSwxLDEsImNvbS51bmltZXRoc3BvcnRzdHJndWlkZS1d" alt="Unibet TV" /></td>
<td>Website and app</td>
<td>✔️ ✔️ ✔️</td>
<td>✔️</td>
</tr>
<tr>
<td><strong>Virgin TV Anywhere</strong></td>
<td>Social enhancement, content streamer and controller for TiVo</td>
<td><img src="https://my.virginmedia.com/discover/tv/tivo/your-tivo/apps.html" alt="Virgin TV Anywhere" /></td>
<td>App for Virgin box</td>
<td>✔️ ✔️ ✔️ ✔️ ✔️ ✔️ ✔️</td>
<td>✔️</td>
</tr>
<tr>
<td><strong>William Hill</strong></td>
<td>Betting. Note that live TV is not necessarily required</td>
<td><img src="http://www.williamhill.com/mobile/en/" alt="William Hill" /></td>
<td>App and website</td>
<td>✔️ ✔️ ✔️ ✔️ ✔️ ✔️ ✔️</td>
<td>✔️</td>
</tr>
<tr>
<td><strong>X-Factor</strong></td>
<td>A second screen extension of the popular ITV show – with additional content and curated Twitter feeds</td>
<td><img src="https://play.google.com/store/apps/details?id=com.tellybug.xfactor2012&amp;feature=search_result#?t=W251bGwsMSwxLDEsImNvbS50ZWxseWJ1Zy54ZmFjdG9yMjAxMiJd" alt="X-Factor" /></td>
<td>App</td>
<td>✔️ ✔️ ✔️</td>
<td>✔️</td>
</tr>
<tr>
<td><strong>YouTube</strong></td>
<td>The world’s most popular video sharing website. Majority user-generated; some original content</td>
<td><img src="http://www.youtube.com/" alt="YouTube" /></td>
<td>Website and app</td>
<td>✔️ ✔️ ✔️</td>
<td>✔️</td>
</tr>
<tr>
<td><strong>YouTube clips</strong></td>
<td>Additional content/clips</td>
<td><img src="http://www.youtube.com/" alt="YouTube" /></td>
<td>Website</td>
<td>✔️ ✔️ ✔️</td>
<td>✔️</td>
</tr>
<tr>
<td><strong>YouTube Remote</strong></td>
<td>Send playlists of videos to your first screen using your mobile, tablet or laptop</td>
<td><img src="https://play.google.com/store/apps/details?id=com.google.android.ytremote&amp;hl=en" alt="YouTube Remote" /></td>
<td>App</td>
<td>✔️ ✔️ ✔️</td>
<td>✔️</td>
</tr>
</tbody>
</table>
### Assessing the impact of second screen

<table>
<thead>
<tr>
<th>App</th>
<th>Description</th>
<th>Website</th>
<th>Implementation</th>
<th>Second screen device</th>
<th>Functional class</th>
</tr>
</thead>
<tbody>
<tr>
<td>YouView app</td>
<td>Remote control app. (Note that YouView’s main function - streamed video enhancement of broadcast TV – is not second screen)</td>
<td><a href="http://www.youview.com/">http://www.youview.com/</a></td>
<td>Hardware plus apps</td>
<td>✓ ✓</td>
<td>✓ ✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Appendix D Listing of main non-UK second screen apps

The table below includes the main non-UK apps in the S-EPG cluster.

<table>
<thead>
<tr>
<th>App</th>
<th>Description</th>
<th>Website</th>
<th>Implementation</th>
<th>Second screen device</th>
<th>Functional class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tunerfish</td>
<td>Social TV App. Check in and earn rewards</td>
<td><a href="https://play.google.com/store/search?q=tunerfish">https://play.google.com/store/search?q=tunerfish</a></td>
<td>App</td>
<td>✓ ✓</td>
<td>Control/ access ✓ Search and discovery ✓ Contextual enhancement ✓</td>
</tr>
<tr>
<td>Miso</td>
<td>Social TV app, allowing 'check-ins' but with eventual plans that will allow people to 'watch with an expert'</td>
<td><a href="https://play.google.com/store/apps/details?id=com.bazaarlabs.miso&amp;feature=nav_result#?t=W251bGwsM5wyLDNd">https://play.google.com/store/apps/details?id=com.bazaarlabs.miso&amp;feature=nav_result#?t=W251bGwsM5wyLDNd</a></td>
<td>App</td>
<td>✓ ✓</td>
<td>✓ ✓</td>
</tr>
<tr>
<td>ConnecTV</td>
<td>Discussion</td>
<td><a href="http://www.connectv.com/home">http://www.connectv.com/home</a></td>
<td>App</td>
<td>✓ ✓</td>
<td>✓ ✓</td>
</tr>
<tr>
<td>Yap.tv</td>
<td>Social TV guide</td>
<td><a href="http://www.yap.tv/">http://www.yap.tv/</a></td>
<td>App</td>
<td>✓ ✓</td>
<td>✓ ✓</td>
</tr>
</tbody>
</table>
Appendix E Download data and population statistics for Chapter 4

The table shows the number of downloads (not active users) and then the percentage per platform for each app. All data was obtained from http://xyo.net/ and accessed on 3rd April 2013.

Generally speaking, where there is no information available, that app has not been made available for that operating system yet.

In order to establish the impact of second screen it is important to calculate its significance in relation to the number of TV households in the United Kingdom. The most recent statistics from TV Licensing show that there are 26.8m TV households in the UK representing 97% of homes. To break this down slightly by platform, figures from summer 2012 are as follows:

- 10.6m Freeview (of which 4.4m [41.5%] were Freeview HD)
- 9.4m Sky
- 2m Freesat
- 3.8m Virgin Media
- 700,000 BT Vision.

Note that since these figures were compiled, digital switchover has concluded so there are no more analogue homes and the UK has seen the launch of another platform, YouView.

The installed base of Smart TVs is 2.9m. Panasonic’s market share is 20%. This gives the installed base of Panasonic Viera TVs as 580,000.

---

115 http://www.tvlicensing.co.uk/about/foi-licences-facts-and-figures-AB18/
116 TV Market in the United Kingdom: http://mavise.obs.coe.int/country?id=14
117 http://www.one-publication.com/2013/03/19/uk-tv-market-points-to-the-future-for-3d-smart-tvs-and-tablets/
118 http://www.theregister.co.uk/2012/06/12/displaysearch_says_world_smart_tv_sales_surge/
Assessing the impact of second screen

The average audience for X-Factor was 11m\(^1\). Britain’s Got Talent achieved 11.8m viewers\(^2\).

YouView is estimated to have gained 230,000 subscribers since its launch in February 2013\(^3\). The UK population is 62.6m\(^4\).


\(^3\) [http://www.guardian.co.uk/media/2013/feb/05/youview-230000-subscribers-july-launch](http://www.guardian.co.uk/media/2013/feb/05/youview-230000-subscribers-july-launch)

## Assessing the Impact of Second Screen

<table>
<thead>
<tr>
<th>App</th>
<th>Android</th>
<th>iPhone</th>
<th>iPad</th>
<th>Windows</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>BBC Antiques Roadshow app</td>
<td>14,500</td>
<td>11,000</td>
<td>3,000</td>
<td>No Info.</td>
<td>28,500</td>
</tr>
<tr>
<td></td>
<td>50.9%</td>
<td>38.6%</td>
<td>10.5%</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Britain’s Got Talent</td>
<td>No info</td>
<td>173,000</td>
<td>1,000</td>
<td>No info</td>
<td>174,000</td>
</tr>
<tr>
<td></td>
<td>99.5%</td>
<td>0.5%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dijit</td>
<td>54,600</td>
<td>10,000</td>
<td>12,000</td>
<td>No Info.</td>
<td>76,600</td>
</tr>
<tr>
<td></td>
<td>71.3%</td>
<td>13.1%</td>
<td>15.7%</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Facebook</td>
<td>41,200,000</td>
<td>14,600,000</td>
<td>2,800,000</td>
<td>592,000</td>
<td>59,192,000</td>
</tr>
<tr>
<td></td>
<td>69.6%</td>
<td>24.7%</td>
<td>4.7%</td>
<td>1.0%</td>
<td></td>
</tr>
<tr>
<td>Fanatix</td>
<td>No Info.</td>
<td>11,000</td>
<td>7,000</td>
<td>No Info.</td>
<td>18,000</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>61.1%</td>
<td>38.9%</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Google Plus</td>
<td>11,700,000</td>
<td>378,000</td>
<td>89,000</td>
<td>No Info.</td>
<td>12,167,000</td>
</tr>
<tr>
<td></td>
<td>96.2%</td>
<td>31.1%</td>
<td>0.7%</td>
<td></td>
<td>-</td>
</tr>
</tbody>
</table>
### Assessing the impact of second screen

<table>
<thead>
<tr>
<th>App</th>
<th>Android</th>
<th>iPhone</th>
<th>iPad</th>
<th>Windows</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panasonic Viera remote</td>
<td>85,600</td>
<td>29,000</td>
<td>10,000</td>
<td>No Info.</td>
<td>124,600</td>
</tr>
<tr>
<td></td>
<td>68.7%</td>
<td>23.3%</td>
<td>8.0%</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Roku</td>
<td>No Info.</td>
<td>11,000</td>
<td>No Info.</td>
<td>No Info.</td>
<td>11,000</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>100%</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Shazam</td>
<td>3,400,000</td>
<td>3,580,000</td>
<td>110,000</td>
<td>35,600</td>
<td>7,125,600</td>
</tr>
<tr>
<td></td>
<td>47.7%</td>
<td>50.2%</td>
<td>1.5%</td>
<td>0.5%</td>
<td></td>
</tr>
<tr>
<td>Sky Plus</td>
<td>No Info.</td>
<td>1,980,000</td>
<td>624,000</td>
<td>No Info.</td>
<td>2,604,000</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>76%</td>
<td>24%</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>TV Guide</td>
<td>620,000</td>
<td>1,770,000</td>
<td>285,000</td>
<td>31,300</td>
<td>2,706,300</td>
</tr>
<tr>
<td></td>
<td>22.9%</td>
<td>65.4%</td>
<td>10.5%</td>
<td>1.2%</td>
<td></td>
</tr>
<tr>
<td>TV24</td>
<td>376,000</td>
<td>883,000</td>
<td>No Info.</td>
<td>No Info.</td>
<td>1,259,000</td>
</tr>
<tr>
<td></td>
<td>29.9%</td>
<td>70.1%</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>App</td>
<td>Android</td>
<td>iPhone</td>
<td>iPad</td>
<td>Windows</td>
<td>Total</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------</td>
<td>--------</td>
<td>------</td>
<td>---------</td>
<td>-------</td>
</tr>
<tr>
<td>Twitter</td>
<td>12,200,000</td>
<td>2,610,000</td>
<td>458,000</td>
<td>272,000</td>
<td>15,540,000</td>
</tr>
<tr>
<td></td>
<td>78.5%</td>
<td>16.8%</td>
<td>2.9%</td>
<td>1.8%</td>
<td></td>
</tr>
<tr>
<td>Virgin TV Anywhere</td>
<td>No Info</td>
<td>194,000</td>
<td>75,000</td>
<td>No Info</td>
<td>269,000</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>72.1%</td>
<td>27.9%</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>William Hill</td>
<td>No Info</td>
<td>509,000</td>
<td>75,000</td>
<td>No Info</td>
<td>584,000</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>87.2%</td>
<td>12.8%</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>X-Factor</td>
<td>2,500</td>
<td>431,000</td>
<td>114,000</td>
<td>No Info</td>
<td>547,500</td>
</tr>
<tr>
<td></td>
<td>0.5%</td>
<td>78.7%</td>
<td>20.8%</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>YouTube</td>
<td>35,000,000</td>
<td>703,000</td>
<td>135,000</td>
<td>No Info</td>
<td>35,838,000</td>
</tr>
<tr>
<td></td>
<td>97.7%</td>
<td>2.0%</td>
<td>0.4%</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>YouTube Remote</td>
<td>246,000</td>
<td>No Info</td>
<td>No Info</td>
<td>No Info</td>
<td>246,000</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>
### Assessing the impact of second screen

<table>
<thead>
<tr>
<th>App</th>
<th>Android</th>
<th>iPhone</th>
<th>iPad</th>
<th>Windows</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>YouView app</td>
<td>No Info.</td>
<td>27,000</td>
<td>No Info.</td>
<td>No Info.</td>
<td>27,000</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>100%</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Zeebox</td>
<td>No Info.</td>
<td>160,000</td>
<td>59,000</td>
<td>No Info.</td>
<td>219,000</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>73.1%</td>
<td>26.9%</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
## Appendix F Version features of iOS and Android

### F.1 Android

<table>
<thead>
<tr>
<th>Version</th>
<th>Name</th>
<th>Release Date</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.2.X</td>
<td>Jelly Bean (II)</td>
<td>Nov 13, 2012</td>
<td>1.6%</td>
</tr>
<tr>
<td>4.1.X</td>
<td>Jelly Bean (I)</td>
<td>Jul 09, 2012</td>
<td>14.9%</td>
</tr>
<tr>
<td>4.0.X</td>
<td>Ice-Cream Sandwich (ICS)</td>
<td>Dec 16, 2011</td>
<td>28.6%</td>
</tr>
<tr>
<td>3.2</td>
<td>Honeycomb</td>
<td>July 15, 2011</td>
<td>0.9%</td>
</tr>
<tr>
<td>3.1</td>
<td>Honeycomb</td>
<td>May 10, 2011</td>
<td>0.3%</td>
</tr>
<tr>
<td>2.3.3 – 2.3.7</td>
<td>Gingerbread (II)</td>
<td>Feb 09, 2011</td>
<td>44%</td>
</tr>
</tbody>
</table>

**Accessibility features introduced**:
- Better able to distinguish between touch exploration and accessibility gestures
- Feedback type for Braille devices
- Revised APIs improve on existing accessibility features including gesture control
- Tutorials introduced to help users configure and use their services
- Explore by touch feature: explore and interact with on-screen content on devices without physical buttons
- TalkBack introduces KickBack and SoundBack functionality

123 Wikipedia (March 4, 2013) [http://en.wikipedia.org/wiki/Android_(operating_system)]
125 Android Developers [http://developer.android.com/about/versions/jelly-bean.html#accessibility]
126 Android Developers [http://developer.android.com/about/versions/jelly-bean.html#accessibility]
127 Honeycomb is only available on tablet devices
Assessing the impact of second screen

2.3 – 2.3.2  Gingerbread (I)  Dec 06, 2010  0.2%

2.2  Froyo  Mar 10, 2010  7.6%

Accessibility features introduced:
• Power button ends call

2.0 – 2.1  Eclair  Oct 26, 2009  1.9%

Accessibility features introduced:
• Text to speech engine

1.6  Donut  Sep 15, 2009  0.2%

F.2 iOS

<table>
<thead>
<tr>
<th>Version</th>
<th>Name</th>
<th>Release Date</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.X</td>
<td>iPhone</td>
<td>Jun 29, 2007</td>
<td></td>
</tr>
<tr>
<td>2.X</td>
<td>iPhone 3G</td>
<td>Jul 11, 2008</td>
<td></td>
</tr>
<tr>
<td>3.X</td>
<td>iPhone 3GS</td>
<td>Jun 19, 2009</td>
<td></td>
</tr>
</tbody>
</table>

Accessibility features introduced (3GS only):
• VoiceOver: gesture-based screen reader - touch screen once to read/twice to select
• Zoom: magnifies entire screen up to five times and allows you to navigate around as needed
• White on Black: changes display to white on black
• Mono Audio: if users hearing is limited to one ear
• Speak Auto-text: works with VoiceOver to automatically speak auto-corrections and auto-capitalisations

4.X  iPhone 4  Jun 24, 2010  3.7%

128 Mac Rumours /Chitika Insights (Feb 25, 2013) http://www.macrumors.com/2013/02/26/ios-6-1-2-adoption-hits-35-in-less-than-a-week/
Assessing the impact of second screen

5.X  iPhone 4S/iPad/iPad 2  Oct 14, 2011  11.9%

*Accessibility features introduced:*
- Hearing aid mode
- Ability to set left or right for mono audio
- Help Centre: learn more about every option in the settings app

6.X130  iPhone 5/iPad 2 onwards131  Sep 21, 2012  5.4% (6.0)
  15.6% (6.0.1)
  1.8% (6.0.2)
  22.8% (6.1.0)
  3.8% (6.1.1)
  34.9% (6.1.2)

*Accessibility features introduced:*
- Guided Access:
  - Allows user to lock exited an app in single app mode
  - Allows user to disable certain controls within a specific app
  - Locks the home button from being used
- Speak selection
  - Allows selected text to be read using the same text-to-speech that powers VoiceOver
  - Allows speech rate and dialect to be changed and words to be highlighted as they are read
  - When in use, infers language from context, and when no context is available, offers a choice. Pause/resume is available

129 Every device earlier than iOS5
130 iPhone3GS onwards
131 Apple stopped supporting iPad at V 5.1.1 – all other iPads, from 2 onwards have been updated to the latest version of iOS (6.1)
## Appendix G Technology stacks of mobile platforms

<table>
<thead>
<tr>
<th>Features</th>
<th>Android 4.2</th>
<th>iOS 6</th>
<th>Blackberry 10</th>
<th>Windows Phone 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Native programming language</td>
<td>C, C++, Objective</td>
<td>C, C++, Java</td>
<td>Java</td>
<td>.NET C#, VB.NET, Silverlight, C/C++</td>
</tr>
<tr>
<td>Multimedia</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Audio formats supported: AAC (8 to 320 Kbps), Protected AAC (from iTunes Store), HE-AAC, MP3 (8 to 320 Kbps), MP3 VBR, Audible (formats 2, 3, 4, Audible Enhanced Audio, AAX, and AAX+), Apple Lossless, AIFF, and WAV</td>
<td>Audio formats supported: AAC (8 to 320 Kbps), Protected AAC (from iTunes Store), HE-AAC, MP3 (8 to 320 Kbps), MP3 VBR, Audible (formats 2, 3, 4, Audible Enhanced Audio, AAX, and AAX+), Apple Lossless, AIFF, and WAV</td>
<td>Audio formats supported: AAC-LC, MP3, WMA Std 9.2, WMA Pro, AMR-NB, AAC-LC+, eAAC+</td>
<td>Audio formats supported: AAC-LC, MP3, WMA Std 9.2, WMA Pro, AMR-NB, AAC-LC+, eAAC+</td>
<td></td>
</tr>
<tr>
<td>Video formats supported: H.264 video up to 1080p, 30 frames per second, High Profile level 4.1 with AAC-LC audio up to 160 Kbps, 48kHz, stereo audio in .m4v, .mp4, and .mov file formats; MPEG-4 video up to 2.5 Mbps, 640 by 480 pixels, 30 frames per second, Simple Profile with AAC-LC audio up to 160 Kbps per channel, 48kHz, stereo audio in</td>
<td>Video formats supported: H.264 video up to 1080p, 30 frames per second, High Profile level 4.1 with AAC-LC audio up to 160 Kbps, 48kHz, stereo audio in .m4v, .mp4, and .mov file formats; MPEG-4 video up to 2.5 Mbps, 640 by 480 pixels, 30 frames per second, Simple Profile with AAC-LC audio up to 160 Kbps per channel, 48kHz, stereo audio in</td>
<td>Video formats supported: H.264 video up to 1080p, 30 frames per second, High Profile level 4.1 with AAC-LC audio up to 160 Kbps, 48kHz, stereo audio in .m4v, .mp4, and .mov file formats; MPEG-4 video up to 2.5 Mbps, 640 by 480 pixels, 30 frames per second, Simple Profile with AAC-LC audio up to 160 Kbps per channel, 48kHz, stereo audio in</td>
<td>Video formats supported: H.264 video up to 1080p, 30 frames per second, High Profile level 4.1 with AAC-LC audio up to 160 Kbps, 48kHz, stereo audio in .m4v, .mp4, and .mov file formats; MPEG-4 video up to 2.5 Mbps, 640 by 480 pixels, 30 frames per second, Simple Profile with AAC-LC audio up to 160 Kbps per channel, 48kHz, stereo audio in</td>
<td></td>
</tr>
<tr>
<td>Image formats</td>
<td>Image formats</td>
<td>Image formats</td>
<td>Image formats</td>
<td></td>
</tr>
<tr>
<td>BMP, WBMP, JPG, GIF, PNG, TIFF, SGI, TGA</td>
<td>BMP, WBMP, JPG, GIF, PNG, TIFF, SGI, TGA</td>
<td>BMP, WBMP, JPG, GIF, PNG, TIFF, SGI, TGA</td>
<td>BMP, WBMP, JPG, GIF, PNG, TIFF, SGI, TGA</td>
<td></td>
</tr>
<tr>
<td>Audio &amp; video formats</td>
<td>Audio &amp; video formats</td>
<td>Audio &amp; video formats</td>
<td>Audio &amp; video formats</td>
<td></td>
</tr>
<tr>
<td>3GP, 3GP2, M4A, M4V, MOV, MP4, MKV, MPEG-4, AVI, ASF, WMV, WMA, MP3, MKA, AAC, AMR, F4V, WAV, MP2PS, MP2TS, AWB, OGG, FLAC</td>
<td>3GP, 3GP2, M4A, M4V, MOV, MP4, MKV, MPEG-4, AVI, ASF, WMV, WMA, MP3, MKA, AAC, AMR, F4V, WAV, MP2PS, MP2TS, AWB, OGG, FLAC</td>
<td>3GP, 3GP2, M4A, M4V, MOV, MP4, MKV, MPEG-4, AVI, ASF, WMV, WMA, MP3, MKA, AAC, AMR, F4V, WAV, MP2PS, MP2TS, AWB, OGG, FLAC</td>
<td>3GP, 3GP2, M4A, M4V, MOV, MP4, MKV, MPEG-4, AVI, ASF, WMV, WMA, MP3, MKA, AAC, AMR, F4V, WAV, MP2PS, MP2TS, AWB, OGG, FLAC</td>
<td></td>
</tr>
<tr>
<td>Audio &amp; video encoding/decoding</td>
<td>Audio &amp; video encoding/decoding</td>
<td>Audio &amp; video encoding/decoding</td>
<td>Audio &amp; video encoding/decoding</td>
<td></td>
</tr>
</tbody>
</table>

Assessing the impact of second screen

<table>
<thead>
<tr>
<th>Video Formats</th>
<th>Video file formats</th>
<th>Streaming Protocols</th>
<th>Control and Sharing Content</th>
<th>Browser Engine</th>
<th>App Store Rules</th>
</tr>
</thead>
<tbody>
<tr>
<td>H.263</td>
<td>.m4v, .mp4, and .mov file formats; Motion JPEG (M-JPEG) up to 35 Mbps, 1280 by 720 pixels, 30 frames per second, audio in ulaw, PCM stereo audio in .avi file format</td>
<td>RTSP (RTP, SDP) HTTP/HTTPS progressive streaming HTTP/HTTPS live streaming MPEG-2 TS media files only HTTP, HTTPS HTTP Live Streaming</td>
<td>Wifi Miracast Peer to peer via Wifi Direct Multicast DNS discovery AirPlay DLNA Certified</td>
<td>Webkit (WebKit)</td>
<td>Developers can distribute apps from their own sources Discriminates based on country and own Apple policies Discriminates by country and manufacturer</td>
</tr>
<tr>
<td>H.264 AVC</td>
<td>VORBIS</td>
<td>HTTP, HTTPS</td>
<td>Play To (DLNA) available on some devices</td>
<td>Trident (Internet Explorer)</td>
<td>Third party software</td>
</tr>
<tr>
<td>MPEG-4 SP</td>
<td></td>
<td>HTTP 133 HTTPs</td>
<td></td>
<td>133</td>
<td>134</td>
</tr>
<tr>
<td>VP8</td>
<td></td>
<td>HTTP Live Streaming</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

133 [http://developer.blackberry.com/devzone/develop/supported_media/bb10_pbos_streaming_support.html](http://developer.blackberry.com/devzone/develop/supported_media/bb10_pbos_streaming_support.html)

Appendix H The data flows of second screen

To assist in our discussion of the technologies we have produced a simple representation of the data flows and building blocks of a generic second screen system, Figure 15.

The top of this diagram shows the services and platforms that the user’s devices connect with. On the left are broadcast services and on the right are IP services. The bottom of the diagram shows the user’s devices – the first screen and the second screen corresponding in general terms to the broadcast/IP distinctions above. The ‘first screen’ includes set-top-boxes and any other devices which routinely provide linear TV content for viewing on the TV.

The arrows represent possible data flows. The data can be content, metadata, control signals, state data or synchronisation information. The solid lines are direct data flows between two entities in the ecosystem, whereas the dashed lines are mediated flows via a third entity in the ecosystem.

Figure 16 shows how this model applies to the three main functional categories of applications and services. The data links in red are the ones that are activated in any given functional category. For example, control and access uses links 3 or 3’.
As can be seen, second screen applications are relatively complicated in that they tend to involve multiple data links. Table 17 summarises the data flows expected on each link.
Table 17: Data types for the six types of link

<table>
<thead>
<tr>
<th>No.</th>
<th>Origin</th>
<th>Destination</th>
<th>Data types</th>
<th>Content, technology or standard</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Content, Metadata, Control signals, State data, Sync</td>
<td>Broadcast Recorded or Live Content; Video, Audio, Subtitles, Audio description</td>
</tr>
<tr>
<td>1</td>
<td>Broadcaster/platform first screen</td>
<td>first screen</td>
<td>Yes</td>
<td>Metadata: DVB SI Tables (EIT, EITp/f), Content and resource identification (CRIDs and DVB URIs)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Yes</td>
<td>EIT: Event Information Table</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Yes</td>
<td>Data Carousel: DSM-CC, events to control sent through</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Yes</td>
<td>Broadcast triggers, Push Video On Demand, PVR controls, DRM</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Yes, Yes</td>
<td>Standards: DVB, MPEG</td>
</tr>
<tr>
<td></td>
<td>first screen</td>
<td>Broadcaster/Platform</td>
<td>Yes, Yes, Yes</td>
<td>Integrated platforms with a reverse path – Virgin TiVo</td>
</tr>
<tr>
<td>2</td>
<td>Service cloud</td>
<td>first screen</td>
<td>Yes</td>
<td>Broadband Content: recorded or live, broadcast content can be delivered via IP to the main screen.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Yes</td>
<td>Extra broadband content: Alternative Live Content streams, Catch-up content and video on demand portals</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Yes, Yes</td>
<td>Private and Public APIs for serving platform specific data, extra metadata, social media networks information</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Yes, Yes</td>
<td>HTML5, CSS3 and JS for web technologies.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Yes, Yes</td>
<td>Adobe Flash for Flash applications.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Yes</td>
<td>Streaming Protocols:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Apple’s HTTP Live Streaming HLS,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Microsoft’s Smooth Streaming,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Adobe’s HTTP Dynamic Streaming HDS</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• and MPEG Dynamic Adaptive Streaming over HTTP standard DASH</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Yes, Yes</td>
<td>Digital Rights Management: PlayReady, Widevine, Marlin</td>
</tr>
<tr>
<td></td>
<td>first screen</td>
<td>Service cloud</td>
<td>Yes</td>
<td>Audience Measurement and viewers usage data</td>
</tr>
<tr>
<td>3</td>
<td>first screen</td>
<td>second screen</td>
<td>Yes</td>
<td>UPnP/DLNA - Server Based approaches – proprietary methods</td>
</tr>
</tbody>
</table>
## Assessing the impact of second screen

<table>
<thead>
<tr>
<th>No.</th>
<th>Origin</th>
<th>Destination</th>
<th>Data types</th>
<th>Content, technology or standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>second screen</td>
<td>first screen</td>
<td></td>
<td>Content ID and Synchronisation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>UPnP/DLNA - Server Bases approaches – proprietary methods</td>
</tr>
<tr>
<td>4</td>
<td>Service cloud</td>
<td>second screen</td>
<td></td>
<td>Native Applications: Android, iOS, Windows RT, BB.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>Web Applications developed using: HTML5, CSS3 and JS.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>Synch data: timestamps, fingerprints or watermarks delivered to the second screen via a cloud service.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>Social networks APIs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>Ad networks APIs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>Web delivered services</td>
</tr>
<tr>
<td>5</td>
<td>Service cloud</td>
<td>Broadcaster/platform</td>
<td>✓</td>
<td>Extensible Metadata formats (use of XML, RDF, JSON, MXF)</td>
</tr>
<tr>
<td></td>
<td>Broadcaster/platform</td>
<td>Service cloud</td>
<td>✓</td>
<td>Social networking statistics</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>Content delivered to CDNs – Content Distribution Networks</td>
</tr>
<tr>
<td>6</td>
<td>Broadcaster/platform</td>
<td>second screen</td>
<td>✓</td>
<td>Content, associated metadata and identification/synch information is delivered to the second screen application</td>
</tr>
</tbody>
</table>

135 Application state data
Assessing the impact of second screen

<table>
<thead>
<tr>
<th>No.</th>
<th>Origin</th>
<th>Destination</th>
<th>Data types</th>
<th>Content, technology or standard</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>second screen</td>
<td>Broadcaster/platform</td>
<td></td>
<td>Usage and measurement data collected by application or the second screen device. Data formatted in XML and transmitted. Second screen device and apps also use cookies.</td>
</tr>
</tbody>
</table>
H.1 Data link 1 – Broadcaster to/from first screen

H.1.1 Role and importance of this data link
Data link 1 is the ‘traditional’ link from broadcaster to a TV receiver, and so pre-dates second screen applications. A broadcaster transmits content to the first screen linearly one piece after the other and such content is aggregated in different channels. The protocol has evolved since the introduction of digital to offer more functionality and to be more efficient.

Content is multiplexed with metadata which describes the delivery system, content and scheduling of broadcast data streams. The receiver uses this information to generate a linear (or grid) Electronic Programme Guide (EPG), to present guidance information to viewers for parental control purposes, to signal the availability of access services and in some cases to trigger events to control the home digital video recorder (DVR)\(^\text{136}\). The Broadcast EPG is the traditional content discovery method and it is powered by broadcast metadata.

In the case of cable television systems, data link 1 can also include control data upstream from the TV receiver to the platform operator. This, for example, is how Virgin’s catch-up TV service is implemented.

H.1.2 Technical implementation
This data link operates across five platforms in the UK: Freeview, Virgin Media, Sky, Freesat and YouView. The downstream broadcast data transport operates according to established and generally open protocols (Mainly mature DVB\(^\text{137}\) standards) which are uniform across all UK TV platforms. But the platforms differ in their capacity, data rates and latency (the time taken to transfer data from broadcaster to screen). The variation in latency means that a given piece of content can differ in arrival times across and even within platforms by several seconds.

Each platform employs a different broadcast interactive technology or middleware. MHEG is used on the horizontal terrestrial and satellite platforms (Freeview and Freesat); Open TV on Sky; and TiVo on Virgin. Broadcast interactive applications are used to deliver simple data services like interactive play along games, news/sports/weather services and linking several complementary content streams (different viewing cameras in a Formula 1 race or different courts at the Wimbledon tennis tournament). The most widely-used broadcast interactive service is the BBC Red Button. Broadcast delivered interactive applications continue to operate when only data link 1 is available. Other middleware is used in other countries such as MHP in Italy and HTML in Germany.

Consequently, although each platform has well defined interactivity standards and high levels of conformance, developing interactive applications to work on multiple platforms is more complex and may therefore be easier to implement on the second screen than on the first screen.

The ability of this data link to evolve differs between vertical and horizontal platforms. Sky and Virgin operate a tightly controlled ecosystem from broadcast to receiving equipment, enabling functionalities and new features to be added relatively easily compared to a terrestrial platform like Freeview. Furthermore,

\(^\text{136}\) For example series linkage for recording a series’ episodes automatically

\(^\text{137}\) The Digital Video Broadcasting Project: [www.dvb.org](http://www.dvb.org), an industry consortium of over 200 members from the whole broadcast value chain. The DVB defines open technical standards for the delivery of digital television and data services over broadcast and IP networks.
in the case of Virgin, the set top boxes are owned by the company, making it feasible to swap out equipment or use economic incentives for its subscribers to upgrade. Freeview has to carefully accommodate legacy equipment owned by viewers when evolving the platform. The potential for upgrading this data link is therefore much weaker in the case of Freeview.

**Current technologies/standards for achieving data flows**

The Digital Video Broadcasting Project sets the standards for the delivery of digital television services over terrestrial, satellite, cable and IP platforms. These standards\(^{138}\) specify content format (video, audio and text), transport techniques and multiplexing techniques for metadata and interactive applications.

Access to these standards is open and free to any organisation, however modifying, proposing new features or removing any is limited to DVB members only. Also, DVB standards fulfil requirements from a wide range of broadcasters (public service or commercial), network and platform operators (horizontal and vertical platforms from countries all over the world. As a result, the specifications are complex and extensive and usually require profiling either by the vertical platform operator or in the case of the horizontal market by national or regional bodies (for example the Digital TV Group [UK]\(^{139}\) and Nordig [Nordic region\(^{140}\)])

**H.1.3 Technical issues and impact on second screen**

**Latency and the need for synchronisation**

The main impact of this link on second screen is the variation in timing of displayed video between platforms. This means that the time of arrival on the first screen of a particular item of content varies across households. Consequently, for second screen functionality dependent on very tight temporal synchronisation with first screen content, the second screen device cannot merely take timing signals from the IP cloud; it must be separately and individually sync’d to its first screen.

**Migration of interactivity to second screen**

In principle, there could be a choice between offering interactive services through the broadcast link with the first screen (data link 1) or the IP link between the service cloud and either the first screen (data link 2) or the second screen (data link 4). The broadcast link standards vary across platforms, making programme-related or third party interactive content generally harder to provide on the first screen than on the second screen. The result will be that interactivity will tend to migrate from the first screen to the second. However, the vertical platforms – Sky, Virgin and YouView are in a position to implement their own interactive services without this limitation.

**H.2 Data link 2 – Service cloud to/from - first screen**

**H.2.1 Role and importance of this data link**

Data link 2 is a direct 2-way Internet Protocol (IP) link between the service cloud and the first screen. It provides an alternative way for the first screen to receive content, typically catch-up or on-demand, although potentially live streamed content. It is bidirectional with:

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\(^{138}\) Full list of DVB standards is available from: [http://dvb.org/technology/standards/index.xml](http://dvb.org/technology/standards/index.xml)

\(^{139}\) www.dtg.org.uk

\(^{140}\) [http://www.nordig.org/](http://www.nordig.org/)
(a) the service cloud sending content and metadata to the first screen (IP), and

(b) the first screen sending state data, and also viewing behaviour data, to service cloud (IP).

First screens (either the TV itself, games console or a STB) can be connected to viewers’ home networks, and from the home router to the Internet. This enables the first screen device to receive content and services from the internet. As a result viewers are able to stream content from portals such as BBC iPlayer and YouTube on their first screens. Some TV receivers bring a level of web experience to the first screen by providing a web browser for accessing websites and the ability to access popular social networks (Twitter and Facebook), weather forecasts and other services.

Pertaining to second screen applications, data link 2 is used as part of data link 3’ to establish a two-way communication channel between the first and second screen via a proxy in the service cloud.

H.2.2 Technical implementation

The delivery of catch-up and on-demand content to the first screen is achieved through:

1- Smart TV applications: viewers download a catch-up or content on-demand application from the manufacturer app store. TV applications use standard web technologies such as Flash, HTML and CSS to render their user interface and content streaming protocols for delivering content. Some content protection mechanism may be used for the delivery of premium content such as movies and live sports.

2- Hybrid Broadband Broadcast Applications: content is accessed via interactive applications through the remote control red button. When launched, the broadcast delivered application then accesses additional data to enhance the application or access directly AV content for catch-up or live IP streams.

3- Enhanced EPG service: where the EPG offers viewers the option to ‘scroll back’ through the previous seven days, and where available links to catch-up content. Such a service is enabled by enhanced metadata where additional information related to the content is included. Enhanced metadata and content identifiers are the key two technologies enabling this service. The ‘life’ of this metadata limits the functionality to only 7 days, by which point, the data expires.

4- Depending on the platform and/or device, viewing behaviour and statistics can be collected by the first screen and transmitted to a device manufacturer, platform operator or IP content provider. The way this reporting is done and granularity of data collected differ from one platform to another; however data is formatted in standardised mark-up language such as XML. The use of HTTP Cookies is also widely adopted on all connected devices.

Some second screen applications were developed to control smart TV apps, for example the YouTube remote control application, details on how this is achieved can be found in section H.3.

H.2.3 Technical issues and impact on second screen

Fragmented Device and Platform capabilities

Though not strictly a second screen issue, most connected first screens have different software stacks and use slightly different implementations of standards to each other. As a result, application developers often have to optimise their applications for each manufacturer separately. This might encourage functionalities to move to second screens, though these suffer their own form of fragmentation (see Section 7.1).

H.3 Data link 3 and 3’– First screen to/from second screen (home and cloud based)

H.3.1 Role and importance of this data link

Data link 3 and 3’ is a 2-way Internet Protocol (IP) link between the first screen and the second screen, used in any application where the second screen interacts with, or responds to, the first screen.
It is a bidirectional and can operate in two ways:

(a) Directly (link 3) – for which the first and second screens must be on the same home network, and

(b) Indirectly (link 3') – via the service cloud and server based login/pairing, when the first and second screens do not need to be on the same network.

A communication channel between the second screen application and main screen enables various use cases for second screen applications such as remote control, data and content sharing between devices and synchronised content delivery to the second screen device.

Example direct (data link 3) applications include:

- CE manufacturer produced remote control apps
- Broadcaster produced apps to enrich viewer experience of TV content
- New entrant (third party) produced apps with capacity to change channel
- Accessibility related functions, though none was found in our survey.

Example indirect (data link 3') applications include:

- Platform produced apps to provide access to EPG and hard drive to manage recordings.

**H.3.2 Technical Implementations**

Technologies for establishing data link (3) and (3') can be divided into the following two main areas:

1. Remote control: functionality used to control the main screen;
2. Content identification and synchronisation between devices.

**H.3.3 Remote control**

There are two approaches for enabling the second screen application to control the main screen: through the direct link (3) or via a proxy server on the cloud as illustrated in data link (3').

**Direct**

A direct link (3) between the main screen and second screen would normally be established through a home LAN, using a wired or wireless connection between each device and the hub. It is not onerous to set up such a network, and the set top box suppliers point users to such technologies as power line communication to make installation easier. Some of the latest Smart TV models also allow devices to be connected in a peer to peer\(^{141}\) fashion using WiFi Direct. However this method is limited only to Android devices.

The functionality implemented on the main screen to enable control differs from one manufacturer to another. It appears that although the underpinnings of the remote control features are based on UPnP, propriety methods are built around or on the top of UPnP to enable an application programming interface (API) used by the manufacturer’s remote control applications. A detailed description of the different networking stacks used is in section 7.3.

\(^{141}\) A peer to peer connection does not require a home network or a residential network hub to be available.
Indirect

An indirect link (3’) requires every device (main screen or second screen) to connect to a remote server at a pre-defined address, and register its presence. Only the user can initiate the pairing process by enabling the network remote control feature on the main screen. Where it requires the user to input a unique code, presented to them by the main screen, onto the second screen application. Pairing establishes a permanent relationship between the two devices for the duration of the second screen experience. This technique is used by integrated platforms such as Virgin TV Everywhere App, the YouView EPG and remote booking apps or by content on-demand networks to control their main screen application such as YouTube.

Further details of this approach can be found in section 7.3.

H.3.4 Content Identification and Synchronisation

The second feature, data link (3) and (3’) enables is content identification and synchronisation. There are several approaches used but audio watermarking, audio fingerprinting and video fingerprinting techniques are currently the most prevalent technologies within the second screen apps ecosystem. This section will focus on these three approaches; a more detailed analysis including other techniques is included in section 7.5.

Audio watermarking

The broadcaster or content owner can add information about the content or control signals within its content as extra audio information. Through the use of clever algorithms, the added information is imperceptible to humans. The information can be picked up by the second screen device microphone and with some digital signal processing the data or commands can be recovered and acted upon. This approach is used to synchronise content offered on the second screen app with the main screen content, through carrying time codes within the watermark.

This approach usually used by broadcaster or content owners to synchronise second screen applications. The watermark can hold also information about: the TV channel the user is tuned to, content shown on the screen or a web resource location for extra content delivered through data link 4.

Audio fingerprinting

Audio fingerprinting is the process of using intrinsic characteristics of the audio stream to identify the content that it contains. It can be used on the whole content or on a small clip duration which allows strong temporal precision allowing precise identification of position of the audio clip in the original source.

The fingerprinting mechanism involves processing the original audio stream to generate ‘reference fingerprints’. The fingerprints are then stored in a reference database and linked to the original content information. At the second screen application, the user collects a short sound using the second screen device microphone and a fingerprint is generated using the same function applied on the reference content.

This fingerprint is then used as an index to access the reference database and retrieve information about content or any synchronisation information such timestamps. The precision of audio fingerprinting algorithms varies but some services claim to offer a precision of up to +/- 25ms.

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142 This approach is widely used for audience measurement capture by organisations like BARB

143 Unique fingerprints on 10 sec audio clips are possible
Video fingerprinting

This approach employs the second screen camera. The user must point their camera at the TV, the TV screen is imaged and an algorithm computes the content identifier. This ID is then matched to the source ID from the reference database. The service is offered by third party service providers where any content, including ads, can be indexed and stored in the reference database. Real time indexing of content is possible with services like www.tvtak.com which is the service behind the TVCheck app.

Section 7.5 provides a thorough analysis of all content identification and synchronisation techniques.

H.3.5 Technical issues and impact on second screen

Fragmented Remote Control Technologies

Main screen device manufacturers use different, in some cases proprietary, methods for enabling remote control applications. As a result access to this functionality is limited to the manufacture’s remote control application or through one to one agreement with application developers. Some third party remote control second screen application developers have been able to reverse engineer these protocols.

Application developers currently have to cater for each device on its own in order to enable a degree of ‘technology universality’ of their second screen applications.

Lack of a universal non-proprietary synchronisation infrastructure

Watermarking and fingerprinting synchronisation techniques are patented proprietary services developed and maintained either by second screen application developers or third party service providers. There isn’t a standardised way for doing second screen content synchronisation at the moment.

Audio based techniques, watermarking or fingerprinting, are susceptible to ambient noises, for example loud chatter in the living room may cause an application to miss a synchronisation point.

Video and image recognition techniques can be susceptible to changes in room lighting, content aspect ratio changes. Also, having viewers to point their smart phone cameras at the main screen can be disruptive.

Watermarking requires content modification which may tamper with audio quality. This modification is done at source point either at the production stage or within the broadcasting chain. Having rights over the content either as the owner or distributor is in some cases essential. As such, it is a mechanism favoured by content owners or platform operators.

Fingerprinting on the other hand is independent of content owners or the distribution chain. It can be performed live on the broadcast stream or content on-demand and. The need for a server infrastructure to host fingerprint databases can be cumbersome and there is a high processing load on the second screen device which results in extra battery drain.

H.4 Data link 4 – Service cloud to/from second screen

H.4.1 Role and importance of this data link

Data link 4 is a 2-way Internet Protocol (IP) link between the service cloud and the second screen. This is the backbone for second screen applications. It is bidirectional and can operate in two ways:

(a) Downstream: the Service cloud sends via the second screen app server in the content, metadata, or control signals to the second screen. Content can include aggregated content from other social media accounts (e.g. aggregating/mining twitter feed data and sending it via data link 4 to an app on the second screen).

(b) Upstream: the second screen app sends viewer response data (behaviour) and viewer initiated events (commands, messages, selections) to a receiving service in the service cloud. Once received by the service in the service cloud (e.g. TV Check) it can forward/publish viewer responses to services to which it has been given appropriate permissions.

Data link 4 is used in any application where the second screen interacts with, or responds to, the service cloud.

Example applications include:

- Downstream: Enhanced EPGs (social or rich), updated from service cloud, produced by platforms, broadcasters or third parties (e.g. social TV apps)
- Upstream: viewer initiated events (commands, messages, selections) from second screen, such as tweeting from within second screen app, publishing a comment to Facebook from within the second screen app etc.

H.4.2 Technical implementation

Second screen applications are developed to consume internet content and interact with web delivered servicers from a range of providers. It is a diverse mix of open, free and closed commercial services delivered on the open internet. These services predominantly transmit different types data to applications when requested, in second screen apps these can be social networking interactions, metadata about TV content, adverts and TV content or complementary TV content. In some cases, content identification and synchronisation data elements may be transmitted or integrated through this link.

Second screen applications collect usage and measurement data from their users, where the data is fed back to the application developer. This data is used to tailor and adapt the second screen experience and range of service delivered to each user.

We can broadly divide the data delivered to the second screen to two categories, (i) content and complementary content, and (ii) metadata, algorithmic and social networks data.

Content and complementary content

Similar to data link 2, content delivered to second screen devices needs to be formatted and packaged according to standards supported by the second screen devices.

These standards vary from one platform to another and in some cases vary widely between the successive versions of the same platform. If a developer, a service provider or a broadcaster wants to deliver content a second screen device, this has to be formatted, packaged and delivered according to the protocols the device supports.

Metadata, algorithmic data and social networks data
All these services use the concept of software as a service (SaaS), where data and software operations are stored, manipulated and managed within cloud servers. Second screen applications interact with these servers through Application Programming Interfaces (APIs). In simple terms, APIs abstract the way second screen applications access data from cloud-based services. An API allows developers to easily integrate content and data from public and private networks. These networks offer content and data to the second screen application such as complementary content, adverts, social networks integration, extra complementary information and e-commerce, shopping and online payment services.

The way data is formatted and transmitted between servers and applications is now mature and standardised by practice. As an illustration, a survey of 50 TV APIs on the programmable web website reveals that XML and JSON are the two most widely adopted data formats and REST, SOAP and JavaScript are three protocols used for data transport145 (see also further details in Appendix G).

H.4.3 Technical issues and impact on second screen
Complementary content delivery to second screen

Fragmentation in content delivery formats between the four screens over the internet (connected TVs, phones, tablets and computers) require broadcasters and content providers to have a carefully structured strategy for delivering content across all screens. In practice, only the devices with a large user base will be supported. As a result, it is impossible to guarantee ‘technology universality’ of the second screen experience.

H.5 Data link 5 – Broadcaster/platform to/from service cloud

H.5.1 Role and importance of this data link

Data link 5 is a 2-way Internet Protocol (IP) link between the Broadcaster and the Service cloud. It is bidirectional and can operate in two ways:

(a) From Broadcaster to Service Cloud: broadcasters send a range of content (e.g. video streams) and metadata (e.g. service information, extended service information, schedule information) to subscribing entities in the service cloud from where it can be aggregated and sent to first screen (via data link 2) or second screen (via data link 4).

(b) From Service Cloud to Broadcaster: data received from by a service in the service cloud can be forwarded to broadcasters/platforms on an individual (single viewer/single household) and aggregated (all viewers) basis.

Data link 5 is essential to the ecosystem in that:

• Broadcasters/Platform use it to provide the service cloud with data which populates second screen EPGs and indeed any application where the second screen interacts with, or responds to, the service cloud. Without it, essential data for populating second screen EPGs would be missing.

• Services in the service cloud use it to provide viewing and behavioural analytics data to broadcasters/platform. This is an important element for broadcasters/platforms which monetise their viewers via advertising.

H.5.2 Technical implementation
Broadcasters and content owners provide TV content, complementary content and metadata via their own servers or via professional cloud services companies such as the Amazon Cloud service. These servers are called content delivery networks (CDN). Content delivery networks receive content from broadcasters and prepare it, package it and distribute it in a format suitable for data link 2 and data link 4.

Content metadata is captured by the broadcaster throughout the lifecycle of content from production to transmission. The data is made available through commercial agreements between broadcasters and metadata service providers such as RedBeep Media and Rovi. The metadata service providers collect metadata from the different broadcasters and content owners and package it in a format suitable for data link 2 and data link 4. The format would need to be tailored to the range of content discoverable and accessible within the targeted platforms.

H.5.3 Technical issues and impact on second screen
There are no significant technical issues with this link. Content delivery to multiple screens, targeting main screens and second screens is a challenging and can be a costly task. It requires a clear strategy from the broadcaster and content owners to target specific devices and platforms, as mentioned earlier in previous sections, platforms and devices both main and second screen exist within fragmented ecosystems.

H.6 Data link 6 – Broadcaster/platform to/from second screen

H.6.1 Role and importance of this data link
Data link 6 is a 2-way Internet Protocol (IP) link between the broadcaster and the second screen built from data links 4 and 5. As with 4 and 5, it is bidirectional and can operate in the ways outlined in their respective descriptions (above). A key element to note in relation to data link 6 is that it applies only within an integrated platform. Here one entity controls the broadcast/platform (in broadcast and service cloud space), the first screen, and the second screen app. As such it controls all the data links between the components it controls across the integrated platform.

H.6.2 Technical implementation
Data link 6 applies to integrated platforms where a broadcaster or platform operator has control of the delivery chain including the second screen application itself. This approach offers the platform operator a lot of flexibility in choosing the technical components to enable their second screen experience.

These choices are mostly governed by commercial agreements between the platform operators and integrated service delivery network platforms.

H.6.3 Technical issues and impact on second screen
Due to the control of an integrated platform, this link creates no additional technical issues for the second screen.
Appendix I Additional technical topics

I.1 UPnP Stack

A few definitions before we start talking about the different layers within the UPnP stack (see Figure 17).

**UPnP Device**: is a container of services. For example a main screen device may contain a tuner service, a media transport service and a timing service. There are three types of UPnP devices:

- **Media Server (MS)**: used to serve the content to client devices in the context to second screen application, the main screen device acts as the Media Server in this case the TV set or set top box.
- **Media Renderer (MR)**: obtains content from Media Server and render it to the viewer. In the case of second screen applications, the Media Server and Render either the same device or physically connected via the HDMI or SCART cable (STB to TV).
- **Control Point (CP)**: it controls the operation of a UPnP device (Media Servers and Media Renderers). In the UPnP architecture, the second screen application acts as the control point.

**UPnP Service**: is the smallest unit of control in a UPnP network. A service exposes actions and models its state with state variables.

The UPnP stack consists of six layers:

1- **Addressing (optional)**: where devices gets allocated IP addresses. In home network environment, this is done via a Dynamic Host Configuration Protocol (DHCP) within the residential WiFi Router.
2- **Discovery**: through discovery, remote control applications search and find main screen device(s). The main screen device advertises its services to remote control applications/devices within the home network.
3- **Description**: this is where the application learns about the main screen device capabilities by retrieving a full description of the device and its capabilities.
4- **Control**: this is where the second screen application uses the main screen services to invoke control commands and receive responses indicating the result of those commands.
5- **Eventing**: this is where the second screen application listens to changes in the main screen status.
6- **Presentation**: this is where the second screen application renders a user interface of the main screen device.

UPnP uses open, standard protocols such as TCP/IP, HTTP, SSDP, GENA, SOAP and XML.
I.2 DLNA Stack
Figure 18 illustrates the DLNA stack and its interaction with other specifications.

<table>
<thead>
<tr>
<th>Protocols</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DTCP</td>
<td>Link protection: Digital Transmission Content Protection - how commercial content is protected around the home network</td>
</tr>
<tr>
<td>MPEG2, AVC/H2.64, LPCM, MP3, AAC LC, JPEG, XHTML+ optional formats</td>
<td>Media Formats: how media content is encoded and identified for interoperability</td>
</tr>
<tr>
<td>HTTP, Quality of Service</td>
<td>Media Transport: how media content is transferred</td>
</tr>
<tr>
<td>UPnP Audio and Video v 1.0</td>
<td>Media Management: how media content is identified, managed and distributed</td>
</tr>
<tr>
<td>UPnP Device Architecture v 1.0</td>
<td>Discovery and control: how devices discover and control each other</td>
</tr>
<tr>
<td>IPv4 Protocol Suite</td>
<td>IP Networking: how wired and wireless devices physically connected and communication</td>
</tr>
<tr>
<td>Wired: Ethernet, MoCA, Wireless: WiFi</td>
<td>Connectivity</td>
</tr>
</tbody>
</table>

Figure 18: Illustration of DLNA stack

I.3 Broadcast content identifiers
One of the problems second screen applications face is finding a way to easily search a programme for viewing.
Using a uniform way of referencing a programme before, during and after being broadcast across broadcast and broadband content will enable second screen applications to easily search for and access content. Identifying content is made more pressing if there is a second screen app associated with that content. The ideal situation is for each piece of content to have a permanent unique standardised identifier that is open to everyone similar to a web uniform resource locaters (web URLs) where these are fixed throughout the content lifecycle (production, packaging, trailers and reviews, broadcast, catch-up and archiving).

In this section, we will explore techniques used for content identification within broadcast services.

I.3.1 Content Reference Identifier (CRID)

Content Reference Identifiers (CRIDs) were standardised by the TV Anytime (TVA) Forum to unambiguously reference content regardless of their location (such as broadcast time, date and channel). The key concept in TVA content referencing is the separation of the reference to a content item - the CRID - from the information needed to actually retrieve the content item - the locator (for example a DVB URL or a WWW URL).

The CRID is a form of URI (Uniform Resource Identifier), it is a location independent – it is not expressed in terms of date, time or channel. The CRID have the following syntax:

   CRID://<authority>/<string>

Here, authority is the DNS (Domain Name System) name for the content provider, or broadcaster, which issues the CRID. They are known as the ‘CRID authority’, for example bbc.co.uk. The string is simply an identification string issued by the ‘CRID authority’.

Location resolution involves mapping a location-independent content reference (the CRID) to its location in time (e.g. scheduled transmission time in a broadcast system) and space (e.g. TV channel, IP address).

These CRIDs are used extensively in the Freeview and Freesat platforms to enable features of Digital TV Recorders (DTRs) such as Accurate Recording (when the programme moves time due to schedule changes), Series Linking (to identify several programmes as part of a series), Split Events (where a programme is split into two parts such as a film broken by a new bulletin) and Alternate Instances (programmes repeated on other channels at other times to allow recorders to intelligently manage recording schedule conflicts).

The CRID provides a uniform way for identifying TV content, much in the way the URL identifies content on the World Wide Web. Furthermore, this approach allows content to be described regardless of its’ source; it may be broadcast, stored locally, or stored on a remote server.

I.3.2 DVB Uniform Resource Locator (URL)

DVB defines a specific Uniform Resource Locator (URL) format which provides a general addressing mechanism intended to access broadcast services\(^{146}\) from interactive services\(^{147}\) or applications. The DVB URI syntax is as follow\(^{148}\):

\(^{146}\) In this context, a broadcast service is a channel, for example BBC1.

\(^{147}\) In this context an interactive service is an alternative channel accessible through the red button, for example channel 300.

\(^{148}\) Specified by ETSI TS 102 851 \url{http://www.etsi.org/deliver/etsi_ts/102800_102899/102851/01.01.01_60/ts_102851v010101p.pdf}
In this syntax, the various parts of the URI are:

- The Original Network ID: identifies the broadcaster that produced the content
- The Transport Stream ID: identifies a specific transport stream that the broadcaster is broadcasting
- The Service ID: refers to a service within that transport stream
- The Component Tag: refers to a specific elementary stream that has been tagged in the service information
- The Event ID: identifies a specific event that is part of the service
- The path to a file in a broadcast file system that’s being transmitted on that elementary stream.

For example:
- `dvb://123.456.789` (identifies a DVB service such as BBC1)
- `dvb://123.456.789;42` (identifies a DVB event such as Antiques Road Show)

This identifier is used extensively in DVB Service Information to provide linkages across broadcast services and components.

### I.3.3 Relationship between CRIDs, DVB URLs and WWW URLs

This is an example to illustrate the relationship between CRIDs, DVB URLs and WWW URLs.

<table>
<thead>
<tr>
<th>CRID</th>
<th>DVB URL (For the broadcast service)</th>
<th>Web URL (for catch-up content for example)</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>crid://bbc.co.uk/episode/b01rrm9s/MasterChef_Series_9</code></td>
<td><code>dvb://112.4a2.5sec;2d22~20121212T220000Z~PT01H30M</code></td>
<td><code>http://www.bbc.co.uk/iplayer/episode/b01rrm9s/MasterChef_Series_9_Episode_9/</code></td>
</tr>
</tbody>
</table>

The long-term goal is that CRIDs should be available for use by second screen devices, applications and main screen for fetching content, either from a broadcast stream or over IP-based networks.

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149 [http://www.interactivetvweb.org/tutorials/mhp/content_referencing](http://www.interactivetvweb.org/tutorials/mhp/content_referencing)
Appendix J Technologies for content ID and synchronisation

J.1 Behavioural inference
Apps can infer content ID from selections made in a second screen app. For example, the social page selected in Zeebox or programme check-in in TV-Check.

**Advantages**
- Low cost; requires no infrastructure
- No equipment preconditions.

**Disadvantages**
- Requires manual input from the viewer
- Prone to error (the wrong inference)
- Only able to provide programme sync.

J.2 Remote control inference
Apps can infer channel ID from channel selections made in a second screen app which acts as a remote control.

**Advantages**
- Low cost; requires no infrastructure
- No viewer involvement required

**Disadvantages**
- Prone to error if another device is used to select channel
- Only able to provide programme sync.

J.3 IP synchronisation
Synchronising the second screen application via IP messages is one of the earliest experiments on synchronised content delivery. Using the same protocols for internet instant messaging, the second screen application establishes a connection to a remote sever; the server then drives changes in the application by sending messages appropriately timed with the main content.

A BBC pilot experiment developed a second screen app for the National Lottery show Secret Fortune where IP based events sent to the second screen application via XMPP protocol. Another scenario for this approach is used to deliver of social networks activity streams. In this case protocols such as HTML5 web sockets are used establish a connection with the application server. The sever will then curate and drive content to the application appropriately.

It should be noted that signalling events from a server can only work for live content. At the same time, viewers watching live TV on different platforms (terrestrial, satellite and cable), see the programme at

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150 Open IP Messaging protocol used in many instant chat programs such as Google talk.
different times due to different broadcast chain delay. IP delivery of any content exhibits a variable delay profile, as IP packets are transmitted on the open internet and may choose different paths to get to their destination. The bandwidth and network congestion can also introduce further delays.

The final remark is on the scalability of IP messaging techniques. A pilot experiment of few thousands or may be hundred thousand users can be delivered however as broadcast TV is potentially watched by millions of viewers at times, it is questionable wither technologies such XMPP can scale to that capacity.

**Advantages**
- Simple to implement
- Uses web standards

**Disadvantages**
- Requires server infrastructure
- Only works for Live Content
- Limited to programme level synchronisation
- IP delivered events have variable delay (up to around 10 seconds)
- Live TV from different broadcast platforms have different delays
- Does not scale economically

### J.4 Audio watermarking

Audio watermarks are pieces of information inserted within content so that it is imperceptible to the human ear while it can be picked up by a second screen device microphone.

Audio watermarking is already in use to identify live broadcast content for audience measurement purposes. Nielson watermarks live broadcast content continuously to drive the BARB audience measurement panel.

The same techniques can be used to drive second screen experiences like the BBC Antiques Road Show application. Watermarks can be injected within the broadcast streams or inserted when content was produced. It can be considered as simple information carrying technique where the watermark can carry a content identifier, timing information, or special copyright information to trace illegal content.

While watermarking involves a microphone listening for a sound signature, as far as we know it does not entail transmitting audio from the viewers’ room to a third party data processing centre. So watermarking should not give rise to privacy issues.

**Advantages**
- Widely used already for audience measurement.
- As the watermark is injected directly onto the content before or at the time of broadcast, this technique is immune to broadcast chain delay between the different TV platforms.
- Once the watermarks are inserted, it can be used for the duration of content lifecycle, so content on catch-up services and video on demand portals will carry identification and synchronisation information.
- The watermark is closely linked to content owner or/and content distributor as it is inserted at either the production or broadcasting phase. The content owner and broadcaster can exert access control to the watermarks similar to content access controls.
- Previews and trailers can easily be distinguished from original content.
- Immune to PVR controls such as pausing and rewinding live content.

**Disadvantages**
- Requires content modification hence there is always a fight with content owners.
• Archived un-watermarked content cannot be used with this technique.
• There is limit to how many times content can be watermarked. A single watermark is designed to be
  imperceptible to the human ear however adding more can lead to degradation in content audio quality.
• Synchronisation accuracy is a trade-off between the frequency of the watermark and how much
  information is embedded within.
• Ambient noise may affect the detection of the watermark leading to increased latency or lost
  synchronisation.
• Algorithms used for encoding, inserting and decoding the watermarks are a proprietary and patented
  technology.
• Access to the watermarks by third party application developers may be limited.
• Requires additional content processing in the production and delivery chain.

**J.5 Audio fingerprinting**

This technology was made popular by music identification applications such as Shazam and Gracenote
music identification. Pieces of the content audio are analysed using signal processing techniques where a
unique identifier is generated.

Synchronisation can be established by fingerprinting at a high frequency or shorter internals within the
content itself.

While fingerprinting involves a microphone listening to ambient sound, this sound is not transmitted from
the viewers’ room to a third party data processing centre. Instead, a sound signature is computed which is
compressed and abstracted compared to the raw audio. Our understanding is that the signature would not
allow the audio to be reconstructed, and therefore should not give rise to privacy issues.

**Advantages**
• Once a fingerprint is generated for a piece of content, it can be used at all times, it acts as a universal
  identifier across mediums (broadcast, disks, video on demand) and time (live, recorded, catch-up).
• does not require any modification of the content
• Can be very fast (where it identifies content based on small query clips)
• Can be deployed independently on smart TVs and smart phones/tablets without a need to engage third
  parties.
• No additional hardware requirement in the broadcast workflow
• Allows advertisers and application developers a freedom to approach and engage viewers in a unique
  way
• Fingerprints can be generated by as many companies as possible, the only limiting factor is inventing
  and patenting the fingerprinting algorithms and building the infrastructure required for using them.

**Disadvantages**
• Requires a server infrastructure for databases to retrieve the data indexed by the fingerprints
• Network latency and buffering can cause unpredictable delays
• Fingerprint decoding can be processor hungry and drains battery power
• The identification process can fail if fingerprints mistake previews and trailers for the content itself.
• As the first few minutes of a drama series’ episodes are identical, it can take several minutes before the
  fingerprints related to a particular episode are detected.
Assessing the impact of second screen

- Fingerprinting algorithms are a proprietary and patented technology only accessible through service and commercial agreements with content identification companies.
- Ambient noise may affect the detection and decoding accuracy of the audio fingerprint

**J.6 Video fingerprinting**

Historically these techniques have been used for digital rights management to trace illegal distribution of content on the internet. Similar to audio fingerprinting, in this case a collection of video frames are used to generate the fingerprints. A fingerprint can be generated for the entire content or for shorter parts to allow for more accurate synchronisation.

Video fingerprinting has the same advantages as audio fingerprinting, it should be noted that in some cases a combination of both techniques is used to allow for more robust fingerprint.

The main disadvantage to using video fingerprinting is how to capture the video frames for decoding. Some application like TVCheck requires the user to hold their smart phone and point and align its camera to the main screen. The application captures few video frames and computes the fingerprint and then requests the content id from the application server. This process limits the usability of video fingerprinting for synchronisation and restricts it to only content identification for check-in purposes.

Real time indexing of content is possible with services like [www.tvtak.com](http://www.tvtak.com) which is the service behind the TVCheck App.

**Advantages**
- Same as audio fingerprinting
- Extremely robust mechanism
- Doesn't require additional content processing in the production and delivery chain.

**Disadvantages**
- Same as audio fingerprinting
- Requires user intervention (holding device up to see the first screen)
- Requires integrated first screen hardware to enable synchronisation
- Lighting conditions and aspect ratio interpretation can affect fingerprint decoding accuracy

**J.7 Linked devices**

Content identification and synchronisation is enabled by transmitting metadata and time codes over a connection between the main screen and second screen device (enabled by the home network or a cloud service)

If the two devices are paired through the home network, the main device can transmit status information and content metadata to the second screen application, including now and next programmes, the seven day EPG and broadcast content identifiers. Synchronisation is enabled by sharing playtime information and broadcast time codes to the second screen application. Broadcast time codes include the Time and Date Table (TDT) and Program Clock Reference (PCR). TDT transmits the actual UTC time (Coordinated Universal Time) every 30 seconds. The program Clock Reference is transmitted every 100 ms and enables the TV receiver’s decoder to synchronise audio tracks with matching the associated video. The BBC UC protocol is an example of such approach.

In a similar manner, devices paired through a cloud server can exchange control and status information. This was observed amongst integrated platforms such as Virgin’s TiVo, Sky+ and Youview. The main screen is able to transmit sync information between the set top box and a second screen application; at the same
time the second screen application can send control signals (remote record signals) and query the status of the TV.

“With Virgin’s TV Anywhere app, TiVo and iPads are synchronised to the split second” 151

Advantages
• Ability to provide frame accurate synchronisation
• Ability for second screen to access and interrogate first screen for additional information
• Uses standard web protocols for to enable communication between devices

Disadvantages
• Typically a closed technique only available to vertical platforms.

151 Virgin interview
Appendix K Survey of second screen apps

K.1 Introduction
This chapter describes the available second screen apps and illustrates their respective functionalities through the use of screenshots. The apps are grouped and described according to their ‘cluster’ (see section 3.4).

K.2 (M) Consumer Electronics manufacturer produced remote control apps
Many TV manufacturers produce second screen apps that are compatible with their TVs and which can be run on iOS or Android smartphones and tablets. They typically provide channel change and a full remote control capability when connected on the same home network. Additional functionalities may be provided, especially when the same brand of device and screen are used. Currently all the CE manufacturer apps sit firmly within the ‘control and access’ domain.

These second screen applications create a logical link between the first and second screens so that, in the simplest case, the second screen can act as a remote control, and in more advanced manifestations, content can be shared between the screens. While all of these applications appear to the user to link the first and second screens, the realisation of the link may be via the service cloud (e.g. YouView, YouTube), as described in chapter 7.

The manufacturer apps are starting to acquire additional features. For example:

- the Panasonic Viera remote app allows web pages from an iPhone/iPod touch/iPad device to be sent to the VIERA TV screen and watched from there
- the Sony TV SideView app has a range of additional functionalities made possible by Sony’s ownership of Gracenote, ‘the largest source of music and video metadata on the planet’152
- Samsung has an iOS app which works on the iPhone, iPod and iPad and which enables users to control a Samsung Smart TV (models from 2011 onwards) when the devices are on the same home network. The screen shots in Figure 19 show first how a device would be installed and configured on a network.

“As informitv has long suggested, users want choice, convenience and control. An open standard to facilitate the interaction between personal devices and a large shared screen goes some way to addressing this. It means that third-party apps can take control of the screen and interact directly with an app running on the connected device or display. Of course, it is deeply disruptive to those that may seek to control the television experience, including pay-television platform operators and consumer electronics manufacturers. For anyone else interested in delivering media to the television screen, this is one to watch.” 153

152 http://www.gracenote.com/company/
153 “YouTube app brings remote control to Apple devices” http://informitv.com/news/2013/02/27/youtubeappbrings/
Assessing the impact of second screen

"More than 99% of those that use it [gesture or voice capability in their new TV] may in the medium term revert to a standard remote control." 154

The way in which the remote control functions are used is shown in the screenshots of Figure 20.

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155 This app is produced by Samsung Electronics Co. Ltd
Assessing the impact of second screen

Access to remote control app enabled (‘full’ view – see highlighted tab at bottom)

Access to remote control app enabled (‘full’ view – see highlighted tab at bottom)

Access to remote control app enabled (‘simple view’ – see highlighted tab at bottom). Here, gesture control is enabled.

Access to basic control enabled (‘ch/vol’ view – see highlighted tab at bottom)

Samsung app on iOS device operates as a remote control on a Samsung TV on the same home network.

Figure 20: Screen shots of the Samsung SmartView app (remote control)

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156 This app is produced by Samsung Electronics Co. Ltd
The LG TV Remote iPad app allows users to connect to and control their TV. Figure 21 shows that it has functionality ‘beyond’ replicating the remote control and allows the user to watch the first screen content on the second screen. It also allows the user to employ the touchscreen capability of the iPad which acts as a trackpad to direct the mouse cursor on the first screen, an interface that could be much more intuitive than making selections through buttons on an infra-red remote control.
The iPad is connected to the TV and showing the same content on the second screen.

The Screen of the iPad, showing the TV content overlaid with control options

The iPad acting as a trackpad with a mouse cursor on the main set

Figure 21: Screenshots of LG TV Remote app controlling an LG Smart TV

157 This app is produced by LG Electronics, Inc.
There are indications that some CE manufacturers are seeking to expand their offer beyond control and access. For example, Samsung has announced ‘TV Discovery’, a service that is claimed to offer a faster and easier way for viewers to find and enjoy video and live TV content. According to Samsung’s press release, TV Discovery’s features include:

- “Universal Remote Control: Connects to all major media devices including cable, satellite, home stereos, DVD and Blu-Ray players, so you no longer need multiple remote controls to manage your content choices
- Personalised Recommendations: Allows you to discover the most relevant content to you through personal recommendations
- Comprehensive Search: Means you can find films, TV shows and on-demand video from popular sources in a single search
- Cross-Device Experience: Allows you to project content from a smartphone or tablet, to a TV, or vice-versa
- Social Sharing: You can share what you’re watching with your friends and family, plus see what they have watched themselves”.

For CE manufacturers such as Samsung, a move towards services would appear to lead to a broader product proposition which is less based on manufacturing. It is unlikely that Samsung will be alone in this move, suggesting that though these apps are currently confined to control and access, they will gradually add additional services in an attempt to keep viewers’ attention. This would allow first screen manufacturers to move from producing a screen which displays other entities’ content to being a distributor/service provider with an expanded relationship with the viewer. This may explain the tendency for first screen CE manufacturers to want to limit some of the functionality available within control and access (e.g. screen casting, full control over first screen settings) to their own devices.

### K.3 (P) Platform produced apps to provide access to EPG (rich, socially enhanced, or regular schedule) and hard drive to manage recordings

The vertically integrated platforms – i.e. the ones that have their own set top boxes (Virgin, Sky and YouView) provide apps which offer full remote control functionality for the set top box only and a rich EPG. These functionalities are relatively easy for platform operators to provide given that they control the entire communications system from broadcast feed through to the set top boxes and already have metadata to enable EPGs to be constructed.

Initially, pairing a second screen device to the set top box via the user id/login/password is needed on a shared home network. But once associated, control signals can be sent from anywhere (i.e. not just on a shared network) – enabling nomadic control.

Figure 22 and Figure 23 show a series of screen shots of the Youview app for iOS (iPhone, iPad) which is paired with a YouView set top box on a shared network and then enables users to send record instructions to the set top box from anywhere.

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Pair devices on same home network (iOS device and connected TV), and confirm pairing via a server based login

View of YouView EPG on iOS app

Selected programme information on iOS app

Press ‘R’ (top right) to record – feedback confirms that recording has been sent to the box

A second programme is selected for recording

Figure 22: Screen shots of the YouView app

This app is produced by YouView TV Ltd.
Similar screen shots for the Sky+ app are shown in Figure 24. In addition to rich EPG functionality and nomadic control, the Sky+ screen shots show how Sky is starting to incorporate elements of Zeebox. Sky has an ownership stake in Zeebox.

Figure 23: Screen shots of the YouView app

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160 This app is produced by YouView TV Ltd.
Assessing the impact of second screen

EPGs on some platform produced apps also have the possibility to recommend or pre-download content matched to assumed or stated preferences. This is a functionality of the Virgin TiVo service, and is also

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161 This app is produced by BSkyB.
supported using second screen app Virgin TV Anywhere as shown in Figure 25. The app has access to the TiVo recording functionality from a remote location (‘nomadic’ use).

![Screen shots of the Virgin TV Anywhere app](http://my.virginmedia.com/discover/tv/tvanywhere/app/intro.html)

The platform operator apps, Sky Go and Virgin TV Anywhere, also include content streaming. Both Sky and Virgin indicated that consumers like this functionality. It allows people to be in the same room but

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163 This app is produced by Virgin Media Limited

164 Sky Go is not a second screen app according to the definition in this report
Assessing the impact of second screen

watching different channels, and it allows people to start off watching on the main TV and then continue watching on a handheld device. Virgin sees a peak in usage of TV Anywhere in the late evening when people take their tablets to bed.

Commentators argue that live sports and events are critical to linear engagement and consumer proposition – as evidenced by BT’s recent acquisition of football and rugby rights; in theory platform operators are in a good position to drive the evolution of second screen with a holistic offering that stays with consumers as they migrate around their entertainment schedule.

YouTube is not able to stream linear TV and is not strictly a candidate to be included in second screen. However the YouTube Remote165 (Figure 26) allows users to “control the YouTube experience from the comfort of your couch!”. Yet again, second screen devices are being used both to provide remote control functionality and to stream content.

Visit YouTube.com/leanback on your PC or IPTV – select “Pair Device” from Settings

Enter the number (using the app) on your second screen and build a playlist of videos to watch on your first screen

‘Leanback’ and enjoy! You can play/pause, skip and go backwards from your second screen

Figure 26: Screen shots of the YouTube app166

K.4 (B) Broadcaster produced apps to enrich viewers’ experience of TV content

The broadcaster apps provide social viewing and/or programme enhancement though extra content. Social viewing enables viewers to register their viewing of a programme and share comments with other viewers, and is not by any means confined to broadcaster apps. Indeed, services like Twitter have become ubiquitous and allow viewers to turn TV watching into a social activity - almost like a ‘virtual’ water-cooler conversation167. This is facilitated by the use of hashtags (‘#’) which make it easy locate conversations of relevance to a particular programme or event. Popular programmes may give rise to hundreds of tweets per minute.


166 This app is produced by Google Inc.

167 40 percent of all Tweets between 6.30pm – 10pm are about TV. TV Licencing, March 2013 (http://www.tvlicensing.co.uk/about/media-centre/news/tv-licensing-reveals-tv-elation-across-the-nation-NEWS65/?WT.ac=home_pop_tele2013) Accessed 19-03-2013
“Twitter is a giant watercooler for TV, where little birds and @handles outnumber Facebook’s "like button"”

Twitter is also utilised on occasions as a communications path back to the programme. As an example, the screen shot in Figure 27 illustrates how Twitter is appropriated into the BBC’s Question Time show. The invitation on screen is known as a ‘call to action’. Two Twitter elements are visible on screen: the hashtag #BBCQT and the Twitter name @bbcquestiontime. Hashtags are, in general, user-generated; they allow users to locate a conversation based on its content. The Twitter name or ‘handle’ allows users to send messages specifically back to the show; it is therefore a more ‘official’ communications channel. The ‘call to action’ allows viewers to ‘follow’ Question time, so that their tweets are visible to other viewers. The resultant Twitter activity is shown in Figure 28.

Example of Twitter call to action appearing on television through - #bbcqt and @bbcquestiontime for BBC Question Time

Figure 27: Screen shots of BBC Question Time

168 "Facebook: Twitter Isn’t TV’s Only Second Screen" http://adage.com/article/digital/facebook-twitter-tv-s-screen/239762/


170 This screen shot was of a programme broadcast by the BBC
Main feed with assorted conversations. Note the serendipitous discovery about Newsround (second tweet from top)

Feed that has been found following the #bbcqt hashtag

Trending topics on Twitter – either popular words or hashtags. Promoted tags are paid for and appear at the top

Figure 28: Twitter activity arising out of BBC Question Time

The BBC’s Antiques Roadshow app is a good example of a purpose-made broadcaster app. It is designed for use whilst watching the BBC Antiques Roadshow programme (linear, on-demand or recorded) and only requires the user to start the app – as per the instructions in Figure 29. The app then ‘listens’ to the TV show which contains inaudible audio watermarking technology within the programme dialogue that only the device can hear. The device then aligns the second screen display to coincide with the content on the first screen.

171 These screenshots are of Twitter, an app produced by Twitter Inc.
Apart from the BBC experimental second screen app concerned with Autumn Watch, most other broadcaster apps give viewers the opportunity to play along with the programme. The most popular genres for broadcaster apps are quiz shows, competition, or indeed anything where viewers can ‘take a punt’ on what’s happening on screen.

172 This app is produced by the BBC
Assessing the impact of second screen

X-Factor is an example of a second screen app providing extra content, see Figure 30 below, which includes extras like audition videos, backstage gossip and information about hair and makeup. It also directs the user to Twitter as a way of locating the conversation and offers custom feeds from ‘all’, your own friends using the x-factor hashtag, judges on the show and celebs who are watching or are paid to tweet.

The app presents the user with a Twitter feed at the bottom which can be filtered by All/Following (your own account; X-Factor tweets)/Judges/Celebs.

The options at the top allow one to select content according to All/Videos/Songs/Photos/Live Performance/Backstage/Auditions/Insider/Hair/Make Up/Fashion/Diaries/Live Tour.

Users can even tweet from within the app itself – note the dialogue box already contains the ‘#’ (hashtag) #xfactor.

Figure 30: Screen shots of the X-Factor app

“The problem all commercial broadcasters have with downloads is less one of negotiating different rights from the content owners and more to do with the danger of severing their links to viewers”

K.5 (3RD) Third party produced apps to provide access to contextually enhanced experience (social activity, betting, shopping)

Another type of contextual enhancement is designed to make use of the first screen content but not as part of a designed enhancement by the programme makers. Currently such apps have sports and betting as a key focus.

In the dynamic betting situation, the second screen app offers odds that change to reflect the changing circumstances of live events. For example, users can bet on potentially limitless scenarios such as the

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173 This app is produced by FreemantleMedia Ltd

number of corner kicks, throw-ins or fouls in a football game. While the user is not necessarily required to be watching the show it is expected that they will be.

“End users are adopting companion services that tend to be third party services like Facebook, Twitter, IMDB, Wikipedia – all of which are not “dedicated companion services”” 175

The William Hill example below exploits live events to encourage betting in ‘real-time’ and even includes ‘TV Specials’, a proposition based entirely on popular linear television events e.g. The Oscars. It enables the user to bet on live events and features ‘specials’ related to TV and Film events such as The Oscars, Dancing on Ice and BBC Sports Personality of the Year.

The app allows one to bet ‘In Play’ on live events with dynamic odds that change according to circumstance.

The app has three tabs along the top: ‘Top Bets’, ‘In Play’ and ‘Highlights’.

The ‘TV Specials’ section features betting on events like The Oscars, Dancing on Ice and BBC Sports Personality of the Year.

Figure 31: Screen shots of the William Hill app

176 This app is produced by William Hill
Second screen apps which enhance programme content as the programme is playing often need a means of synchronising with the content playback. Synchronisation often relies on audio fingerprinting or watermarking. Such apps are sometimes called Companion Apps and are inherently linked to particular content.

X-Factor Bingo (Figure 32) is a gambling proposition from Mecca Bingo based on the popular TV show, X-Factor. Users buy tickets, chat to other users and potentially share the winnings. If they are unsuccessful at bingo, they get another chance to win a prize through an X-Factor themed scratch card at no extra cost.

![Figure 32: Screen shots of the X-Factor Bingo app](image)

177 This app is produced by MeccaBingo
“It’s the extensive audience, immediacy and simplicity that is really helping Twitter to dominate the second screen mobile era.” [...] “For many shows and advertisers during these shows, Twitter hashtags are married to the success of interaction with them.” 178

**K.6 (R-EPG) Third party produced apps to provide access to rich EPG, with or without capacity to change channel**

Third party EPG apps provide a range of facilities for selecting content, ranging from a well-presented EPG through to previews, reminders, recommendations, popularity indicators and social media ratings.

The simplest form of content search and discovery on the second screen is an Electronic Programme Guide (EPG). Typically, such EPGs take advantage of the generally superior interface and usability of a second screen compared with a TV. It has also been noticed that by locating the EPG on the second screen, there is less disruption to the content on the first screen.

This affords users the ability to reorder channels, set reminders and filter content by genre. These EPGs are often extensions of popular websites, and form something of a consumer proposition involving full use of the device’s inherent screen resolution and convenience.

Consumers are increasingly using mobile devices and second-screen apps as alternatives to traditional remote controllers and EPGs: “Over one-third regularly use apps to search for show-related information or check listings while in front of the TV” 179

TV24 is a rich EPG without any remote control functionality. It makes use of the touchscreen to offer an intuitive and expansive electronic programme guide. Users can customise order and appearance of channels through filters and/or manual selection, view highlights (popular programmes) and set alerts. The screen shots in Figure 15 illustrate some of the functionalities on offer.


Assessing the impact of second screen

The TV24 app on a second screen does not currently control the first screen, it is an entirely standalone service. It is instructive to compare this type of EPG with a ‘standard’ Freeview EPG such as the one in Figure 34.

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180 This app is produced by tv24.co.uk
Compared to the Freeview EPG, an advantage of moving the EPG to the second screen is the ability to keep watching the first screen whilst searching for content. Currently EPGs on the first screen are ‘laid over’ content completely or offer a ‘picture in picture’ view of content (a small window inside the EPG).

“It is no coincidence that a lot of second screen apps now include navigation and some form of advanced search and discovery. Traditional navigation can be brutally unwieldy. From the service provider side, there’s an argument to be made that the second screen phenomenon is all about the interface.”

The screen shots in Figure 35 illustrate some of the other functionalities on offer from TV24. Even where similar functionalities are provided through the TV or set top box they tend to be less convenient and less visually appealing.

The other R-EPGs apps we have identified include Livesport.co.uk and Sidereel. Neither of these includes a remote control or channel change capability.

Several interviewees mentioned another advantage of running EPGs on a second screen – that it avoids disrupting the programme for other viewers. Another advantage is speed; first screen EPGs can be slow to load and navigate.

181 This image is of a Toshiba TV as published on the EPG gallery of Nigel Whitfield’s digital TV & technology blog http://gonedigital.net/2010/06/23/epg-gallery-freeviewhd/

Assessing the impact of second screen

© Technologia 2014

‘Highlights’ option showcasing popular shows

Set alerts/reminders for individual shows. The device will then show a notification and make a sound when your show is about to start

Search for content by show, movie title or actors name.

Figure 35: Showcasing and other functionalities in the TV24 app

K.7 (S-EPG) Third party produced apps to provide access to socially enhanced EPGs, with or without capacity to change channel

A number of apps combine social media with rich EPG functionality. The social media statistics such as popularity and ‘buzz’ are displayed along with programme information, and typically, it is also possible to send and read tweets related to the content. These apps act as aggregators for social media content, and also in some cases provide other relevant content and links e.g. to Google News, Wikipedia (Zeebox calls these ‘Zeetags’), or IMDB.

For some of these apps to work it is necessary for them to know what programme is being watched. This is achieved in different ways. TV Check asks users to ‘check in’, either by manually selecting a channel or by using a visual fingerprinting-based programme recognition capability, see Figure 36 and Figure 37. Points and rewards are given as incentives to check in.

183 This app was produced by TV24.co.uk
Assessing the impact of second screen

Figure 36: Screen shots of the TV Check app

184 This app was produced by Orange France Telecom
Leaderboard showing who has the most points on the app through check ins, quizzes and sharing

Area for TVCheck specific competitions

User ‘Wall’ detailing their TVCheck activity

Users activity showing rewards, badges and alerts

As an alternative, the app includes a programme recognition facility

The facility works on live TV

Figure 37: Screen shots of the TV Check app

185 This app was produced by Orange France Telecom
Some second screen EPGs can directly control TVs and platform provided set top boxes and Digital Video Recorders (DVR). An example shown in Figure 38 is TV Guide (TVguide.co.uk). This is a third party EPG which offers remote control of Samsung TVs, Virgin TiVo boxes and nomadic control of Virgin TiVo and Sky recorders.
Assessing the impact of second screen

| Initial screen explaining functions | Shows have ratings as per the main picture (yellow circle) and you can filter by favourites or genre |
| Search for content using the keyboard (easier to use than a remote control) | This example shows Top Gear and the result shows when it is on and on what channel |
| Notification explaining a Virgin TiVo set-top box has been found, it reads: “Click channel logo to change channel on your TiVo. Edit this feature in your Settings” | Settings with options to turn on/off Sky and Virgin Media recordings |

Figure 38: Screen shots of the TV Guide app

186 This app was produced by TVGuide.co.uk Ltd.
These use similar processes of discovery and pairing to offer a reduced level of control (Channel change, as described in Table 2). A process of authorisation is still always required, as shown in Figure 39.

A screenshot of a Samsung TV requesting viewer to authorise a third party app (TV Guide) to control the TV.

Figure 39: Screen shots of the TV Guide app

Once second screen apps are paired with a connected TV first screen on the home network, they can control the first screen to whatever level of control they are able from anywhere on the home network.

Fanatix is an iPad app that is targeted at sports fans, see Figure 40. Fanatix can be seen as creating a sports orientated social network dictated by the TV schedule. Users can see what’s coming up and the app makes good use of users’ knowledge by displaying an EPG with features that appeal to them and are instantly recognisable. For example, their favourite team can be learnt, or selected manually. Typically, consumers are encouraged to share their activity as a way of extending the app’s functionality to include interaction from their social network and also as a viral distribution for marketing of the app. The capacity to connect to Facebook is promoted for five reasons, listed as importing: (i) sports preferences, (ii) friends’ preferences, (iii) group chat (iv) post on wall, (v) display friends on Fanatix. In EPG terms, Fanatix is ‘curated’ in that it covers sports content only.
Assessing the impact of second screen

Home screen featuring a sports-orientated EPG

Capacity to connect to Facebook

Capacity to connect to Twitter

You are then presented with your own Twitter feed within the Fanatix app

As well as their own ‘recommended’ feed. This example shows Arsenal

You can predict the score of the game and change it at any time

Figure 40: Screen shots of the Fanatix app

187 This app was produced by Tixdaq Limited
K.8 (COMP) Comprehensive third party apps

The only app currently in this category is Zeebox. Zeebox has received quite a lot of publicity and is acknowledged as a high profile second screen application. We denote it as a comprehensive app in that it covers all three major functions – control, content search and discovery and contextual enhancement.

Its major functionalities arise out of social networking, however. It calculates and displays alongside its EPG the amount of social media activity (‘buzz’) generated by programmes, and also displays what friends are viewing. In addition, Zeebox provides enough relevant content to keep the application open during viewing.

Zeebox allows people to change channel on the first screen if it is compatible and on the same home network. Virgin TiVo, Sky+ and several manufacturers’ connected TVs are compatible with Zeebox.

“Zeebox is basically a platform to chat about live TV shows and follow celebrities’ TV-watching habits, though it’s most skilful at showing where ‘the buzz’ is.”

Zeebox discovers what is being watched either with reference to the channel chosen when the app is used to change channel, or by inferring from the page selected in the Zeebox app. If a particular programme page is selected on Zeebox and not navigated away, then after a few minutes Zeebox assumes that the viewer is watching the corresponding programme. Equally, if the app is set to display tweets about a programme, then Zeebox concludes after a few minutes that that programme is being watched. This, of course, is not 100% reliable.

The types of information and interaction that Zeebox provides is illustrated in Figure 41, Figure 42 and Figure 43.

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Assessing the impact of second screen

<table>
<thead>
<tr>
<th>Find out what has the ‘biggest buzz’ and control your TV</th>
<th>Example of EPG with buzz and audience measures: increasing, declining or staying the same</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filter by channel; what has the biggest audience; what has the biggest buzz; what friends are watching; or actor.</td>
<td>See other Zeebox users activity as well as the ‘Top 10 Booked Shows’</td>
</tr>
<tr>
<td>See friends activity and their bookings</td>
<td>Review your own activity and bookings</td>
</tr>
</tbody>
</table>

Figure 41: Screen shots of the Zeebox app

---

189 This app is produced by Zeebox Limited
Assessing the impact of second screen

<table>
<thead>
<tr>
<th>Start a chat with friends from your social networks (Facebook/Twitter) within the app</th>
<th>Zeetags provide contextual information: they are sponsored, geo-located (relevant to content i.e. Northampton for Escape to the Country) or provide more information</th>
</tr>
</thead>
<tbody>
<tr>
<td>You can chat even if friends are offline – N.B. they must have the app</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Find out who else is watching the show – what the audience is and what the ‘buzz’ is</th>
<th>See what’s happening on Twitter and access Information and credits</th>
</tr>
</thead>
</table>

Figure 42: Screen shots of the Zeebox app

---

This app is produced by Zeebox Limited
Assessing the impact of second screen

<table>
<thead>
<tr>
<th>NEWS</th>
<th>APPS &amp; DOWNLOADS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Related news about the show pulls in stories using Google News</td>
<td>Find related apps – TV series of other. This example includes The National Trust for ‘Escape to the Country’</td>
</tr>
<tr>
<td>See the top downloads related to the show</td>
<td>See audience trends – the number of people watching the show in two minute increments</td>
</tr>
</tbody>
</table>

Figure 43: Screen shots of the Zeebox app

“A second-screen initiative thoughtfully integrated into a TV show can help raise viewers’ interest level throughout an entire episode, between episodes or even over the course of a full run and/or subsequent seasons”

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191 This app is produced by Zeebox Limited
Zeebox also provides from some novel usage scenarios. As shown in Figure 44, it can be used for channel control on the first screen by a parent to control children’s viewing from another room in a house.

![Zeebox interface on iPad providing feedback that it has sent a change Channel command to the Samsung TV it is paired with on the same home network.](figure44.png)

**Figure 44: Zeebox pairing with a TV on the same network**

K.9 (APPR) Apps which have been appropriated to second screen, mainly in the field of social activity around TV content

These are assumed to be familiar outside TV and do not require screenshots.

“One out of every seven people in the world has a Facebook page”

K.10 (A) Accessibility related functions, either via native capabilities of smart devices (e.g. iOS’s VoiceOver) or as third party apps

Accessibility-related functions can be provided either via:

1. native capabilities (e.g. iOS’s VoiceOver or Android’s Voice output) of the smart devices on which second screen apps run, designed to enhance access to any information presented on the device, or

2. third party apps explicitly designed to improve accessibility to TV, although none was found during this project.

Figure 45 shows how VoiceOver can be set up.

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193 This app is produced by Zeebox Limited
The iPad (iOS) has a native accessibility capacity that can be found in: Settings > General >> Accessibility

Turn on “VoiceOver” – any text on the screen can then be read if you touch it once. Touch twice to select. This can be employed to ‘read out’ EPGs and other TV related content, making it more accessible.

Figure 45: iOS VoiceOver

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195 This screenshot is of software produced by Apple Inc.
Since its spin-out from a product development consultancy, Technologia has developed its own skill base in policy consulting, innovation support, business case development, appraisal and analysis of R&D propositions and technology, and due diligence. While we have the capacity and capabilities to undertake even the most challenging projects, we are small enough to care passionately about the quality and value of the results we deliver.

We have access to a broad range of specialist knowledge through our network of associates, whose expertise ranges from medical devices to domestic showers, and from drug delivery to free-space optics.

We believe our distinctive name brings clarity to our market position and our market proposition. But while the name is different, the underlying principle that we inherited from past work remains unaltered. We continue to help clients achieve their objectives through an intelligent engagement with technological change.