DELIVERABLE

Project Acronym:	**TV-RING**
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D2.3.1 List of Professional Requirements (second iteration)

Revision: 2.5

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Abstract: set of user requirements gathered through two iterations of interviews and workshops with professional users of HbbTV applications.

Revision History

Revision	Date	Author	Organisation	Description
0.1	03-10-2013	David Geerts & Rinze Leenheer	iMinds/KU Leuven	Added Table of Contents
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1.2	16-01-2014	Sven Glaser	RBB	Updates and adaptations to sections 7.1, 7.2, 7.3 and adding interview guides
1.2	22-01-2014	Sven Glaser	RBB	Added quotes and requirements to the results sections. Creation of use cases and conclusion.
1.2	22-01-2014	Daniel Giribet	TVC	Revision and updates to section 8

1.3	23-01-2014	Susanne Heijstraten	NPO	Integrate en structure section 6, 7 and 8 and adjust revisions
1.4	23-01-2014	Rinze Leenheer	KUL	Completely reworked section 9 and added Dutch use cases
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1.7	28-01-2014	Marc Aguilar & Sergi Fernández	I2CAT	Final formatting and review
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2.1	15-01-2015	Sven Glaser & Aylin Vogl	RBB	Added chapter 11 German pilot redefined
2.2	15-01-2015	Marc Aguilar	I2CAT	Added chapter 12 Spanish pilot redefined
2.3	20-01-2015	Susanne Heijstraten & Joost Negenman	NPO	Integrated different versions second phase Adjusted conclusion Adjusted summary and introduction
2.4	11-03-2015	Marc Aguilar & David Geerts	I2CAT & KUL	Small editorial change in abstract
2.5	28.4.2016	David Geerts	KUL	Minor modifications to facilitate the identification of iterations

1. Executive Summary

This deliverable presents the results two iterations of requirements gathering in task 2.3 (" Professional user requirements") of the TV-RING project. The goal of this task is to understand the professional users developing and distributing services for HbbTV. And provide an overview of professional user requirements related to interface, back-end, business, distribution and customer relations & engagement.

The Netherlands (NPO and KUL), Germany (RBB) and Spain (TVC and i2CAT) all gathered professional user requirements in each iteration by various types of research like surveys, semi-structured interviews and workshops. Due to the different focus of each pilot and the different type of professional users who were interviewed, a varied results with some overlap emerged.

The professional user requirements were gathered in two iterations. The first round took place from M1-M4 and was first documented in Deliverable D 2.3.v 1.7. The second iteration has taken place from M13-M16 and is documented in this final Deliverable D 2.3. v.2.3, which includes the results from the first iteration (chapters 5-9) as well as the second iteration (chapters 10-12).

For each country we listed the main professional user requirements. During a plenary meeting a workshop was held to combine all the different results. In the second iteration each country deepened or adjusted some requirements and discovered some new requirements. We merged these new findings with the combined professional user requirements we defined in the first deliverable. The result is a final list of combined professional user requirements we can (partial) use in the execution of our pilots.

The main conclusions are clustered in three areas: Business, User Experience and Engineering. Business involves all the internal processes for the broadcasters, app developers and possible paid business models. On the one hand they are concerned with the end-user of interactive TV through marketing and audience analyses. On the other hand it is also important to have a high level of internal engagement and good internal communication. Communication between different parties is clearly a very important issues and something that should get a lot of attention in the development process. Key Business points are the high production costs in comparison to a relatively small audience, internal engagement and the need for promotion and market research.

User experience includes everything that has an influence on the end users' experience with using the interactive TV app. With the rise of multiple screen use when watching television, keeping users engaged is no simple feature. Design, features and content for interactive TV apps have to be very good and well balanced to keep the viewers' attention. For User Experience the key points are interaction, usability and accessibility of the services and applications developed for end users. Rich media and high video quality are very important ingredients for successful HbbTV applications.

Engineering is about the technical issues and challenges when creating interactive TV apps. It includes concerns for the backend and the front end as well as protocols and standards that are important issues in both. One major hurdle is the heterogeneous implementation of HbbTV standards in the TV-sets. The key points addressed in this area are standardization, scalability and the access to a wide range of devices and tools for developing.

2. Contributors

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3. Introduction

This deliverable presents the results of the first and second iteration of task 2.3 ("Professional user requirements") of the TV-RING project. The goal of this task is to understand the professional users that will develop and distribute applications and services for HbbTV and provide a list of professional user requirements related to interface, back-end, business, distribution and customer relations.

"Professional users" are content providers, content aggregators, content distributors, app developers, service integrators, interface developers, CE manufacturers, ISP's and others who are involved in communication via content with audience and or distribution of that content. Additionally, the people who will use the applications consist of a broad range of TV-viewers and are called "End-users". This deliverable will focus specifically on professional user requirements. The end user requirements are gathered and documented in the deliverable 2.2.

As the TV-RING project consists of three pilots, the professional user requirements are gathered separately for each pilot. In the first round the Dutch pilot used semi-structured interviews, the German pilot contextual interviews and the Spanish pilot also used contextual interviews, followed by a requirement workshop. In the second round of gathering professional user requirements each country deepened the existing requirements or found new requirements through a new round of interviews and workshops about specific pilot parts with professional users.

The specific approach of each pilot and its results is explained in the respective pilot sections. In the final section the professional user requirements from each pilot are aggregated and a joint list of professional user requirements is presented.

4. Action Log

[04/10/2013] – Gent, Belgium – iMinds|KU Leuven – First professional user interview

[08/10/2013] – Hilversum, The Netherlands – iMinds|KU Leuven 4 professional user interviews

[17/10/2013] – Barcelona, Spain – i2CAT, TVC – Online meeting to coordinate task

[17/10/2013] – Leuven, Belgium – iMinds|KU Leuven, NPO – Internal Workshop professional user requirements

[18/10/2013] – Barcelona, Spain – TVC, RTV – Online meeting to coordinate task

[31/10/2013] – Barcelona, Spain – i2CAT – 3 professional interviews carried out

[04/11/2013] – Barcelona, Spain – i2CAT – 2 professional interviews carried out

[08/11/2013] – Potsdam, Germany – RBB – Team meeting to coordinate task

[13/11/2013] – Barcelona, Spain – i2CAT, TVC – Professional requirements workshop carried out

 [13/11/2013] – Potsdam, Germany – RBB – 2 professional user interviews carried out

[15/11/2013] – Potsdam, Germany – RBB – 2 professional user interviews carried out

[18/11/2013] – Potsdam, Germany – RBB – 1 professional user interview carried out

[18/12/2013] – Munich, Germany – All – workshop with representatives from all pilots to aggregate the results.

[14/10/2014] – Hilversum, The Netherlands – iMinds|KU Leuven – three professional-user interviews

[27/10/2014] – Leuven, Belgium – iMinds|KU Leuven – professional-user interview

[21/11/2014] – Leuven, Belgium – iMinds|KU Leuven – professional-user interview

[01/12/2014] – Munich, Germany – IRT, RBB – Telephone conference on coordination and set-up of requirements gathering activities

[09/12/2014] – Munich, Germany – IRT, RBB – development of questionnaire for interviews

[11/12/2014] – Munich, Germany – IRT – 14 professional-user interviews carried out

[15/12/2014] – Berlin, Germany – RBB – 3 professional-user interviews carried out

5. Objectives

The objective of *Task 2.3 - Professional User Requirements* is to understand the professional users that will develop and distribute applications and services for HbbTV and gather a list of professional user requirements related to interface, back-end, business, distribution and customer relations.

The aim of the several interviews and the requirement workshop was to learn about habits, expectations and possible difficulties during the work of professional users on providing HbbTV services. We wanted to find out how the professional users use their tools, their job and tasks and all the inherent implications for the editorial and HbbTV production. Next to that we focused on the professional users' wishes and their goals and demands for a future production of new and better HbbTV services and applications.

Each pilot serves a different region, with local variations such as broadcasting history, technical capabilities and cultural background. Therefore, each pilot has different focus points that are used as a starting point for gathering user requirements. The focus points for each pilot were gathered by sending out a request to each partner to provide the focus points of their pilot.

The German Pilot and Dutch pilot used consisted of a number of contextual interviews of according stakeholders. The aim was to learn about habits, expectations and possible difficulties during their work on providing HbbTV services. The interviews were structured in three sets of questions. The first set was intended to find out who the users are and where they are working in the editorial and HbbTV production chain. The second set of questions aimed directly at how the users use their tools, their job and tasks and all the inherent implications for the editorial and HbbTV production. The final and last set concentrated on the user's wishes and their goals and demands for a future production of new and better HbbTV services and applications.

For the Spanish pilot two main actions were performed to elicit the requirements of the relevant stakeholders. Professional user research actions started with a round of five contextual interviews with different stakeholder profiles. This was followed by a requirements workshop, in which interview transcripts were analysed, processed and structured by a group of five (other) stakeholders involved with the project. A main goal of the Spanish pilot was to identify the key tasks performed by each professional user profile, to understand the specific technologies, and to elicit a first set of functional and non-functional requirements that each of these profiles had in regards to HbbTV.

Although the focus points of the three pilots are formulated differently, they are not mutually exclusive, and share many aspects that allowed their aggregation to create joint requirements.

6. German Pilot Requirements

The current section describes the specific approach of gathering professional user requirements for the German pilot. At first it will be described which specific methods were being used, and how this approach works towards the general plan and methodology, as well as the chosen participants that took part in this process. At the end the results will be presented.

6.1.Methods Used

The first iteration of task T2.3 for the German pilot activities and its requirements started with a number of contextual interviews of according stakeholders. This group consisted of five people from within the HbbTV production chain inside both, Rundfunk Berlin-Brandenburg and ARD (Arbeitsgemeinschaft der öffentlich-rechtlichen Rundfunkanstalten der Bundesrepublik Deutschland – Consortium of public broadcasters in Germany). The aim was to learn about habits, expectations and possible difficulties during their work on providing HbbTV services.

The interviews were structured in three set of questions. The first set was intended to find out who the users are and where they are working in the editorial and HbbTV production chain. The second set of questions aimed directly at how the users use their tools, their job and tasks and all the inherent implications for the editorial and HbbTV production. The final and last set concentrated on the user's wishes and their goals and demands for a future production of new and better HbbTV services and applications. The according interview guideline was provided by KUL. The questions that formed the basis of the semi-structured interview are listed below:

• What does your job entail?

• How long have you been doing it?

• How much time do you spend on interactive TV/HbbTV related activities?

• What are the specifics of these activities?

• How challenging or easy is this interactive TV/HbbTV related work?

• Which tools do you use for the HbbTV related work?

• What are the difficulties you run into while performing interactive TV/HbbTV related tasks? What could be improved?

• Is there anything we haven't discussed yet that you think is important in (future) interactive TV/HbbTV development?

The interviews were conducted directly at the user's daily workplace and structured along the guidelines provided by TV Ring partner KU Leuven. The answers and accompanying comments were originally written down on paper during the interviews and later transferred into paragraphs of digital form. Scans of the notes and the transferred data are available on request.

6.2.Participants

The number of stakeholders working within the HbbTV production chain is relatively small. Despite that fact we managed to interview five professional users from different parts of the chain. They are responsible for different HbbTV services and thus different departments and responsibilities (two women and three man, ages 30 - 50). During the interview preparation we identified the following stakeholder roles based on the already chosen interviewees:

Participant	Job description	Years of Experience Interactive TV
A	Senior Manager Program Data and Interactive Services	7 years
B	Editor Program Data and Interactive Services	3 years
C	Senior Editor TV and Accompanying Services	4 years
D	Engineer Program Data and Interactive Services	2 years
E	Editor Teletext Department	0.5 years

Table 1. Participants German Pilot

6.3. Data analysis

After having processed all the interviews, the documented answers and comments of the interviewees were transferred into digital form (MS Word) and mixed up. This raw data (available in the annex) was handed over to a person not familiar with the requirements gathering, and he re-grouped and allocated the data according to the topics / set of questions mentioned in section 7.1. Now this input was summarized and thus prepared for deducting requirements.

6.4. Results

The results of the all the pilot's professional user interviews have been gathered and discussed in a project-internal workshop in December in Munich. These results are documented in section 9. Whereas the preliminary results from the German pilot will be summarized in the following. Quotes have an exemplifying character.

6.4.1. Main tasks

All of the interviewees stated that two of the main tasks they perform are to communicate with other people of the production chain and to interface between involved departments. One of the interviewees is only involved in management duties, in supervising and guiding the production people and their tasks in order to keep as well as get HbbTV services running.

> *"There is a lot of reading and writing emails and check results in order to manage and route tasks between the departments here."(A)*

> *"I have always sit together with the development contractor people if I have to integrate a change within the app code."(C)*

"Of course we have to ask the tech people first and then go to the interface designers."(B)

> **Req.01** For seamless task processing tools and technical environment must be easy to use.
> **Req.02** For easy input/output operations tools must integrate standardised and consistent user interfaces.

Figure 1. Set of tools for working on singular data sets going to different services (web, teletext and HbbTV)

Three of the group of people are taking care of dedicated HbbTV applications that are on-air. They have to add data to databases that provide input for these applications, to monitor and check the representation of these data within the HbbTV applications, and if they recognise problems to update or correct the according data sets. Another interviewee is busy collecting, streamlining and adapting data for inserting and signalling HbbTV widgets into a common launcher application for Smart TVs.

> *"Mainly, I randomly choose any of the data-sets in the HbbTV app and check its integrity and representation in the application." (D)*

> *"If I have found an inconsistency I have to crawl through the CMS, to find the source of the problem with the data-set for one of the provision services." (E)*

Req.03	CMS and use of metadata must be integrated in a way that essence data sets can be maintained easily.
Req.04	Monitoring of the quality of service must be as easy as possible.

6.4.2. Timing aspects

All interviewees mentioned that although HbbTV related tasks are often more time consuming than others, there is less time available for doing their HbbTV work. A lot of work is still connected to services other than this.

"Most of time I work on tasks other than HbbTV." (C)

"I have to take care of the articles on the website also. And in the 'old' teletext." (E)

"Web and teletext and HbbTV – for the latter it's less than a third of the overall efforts." (B)

Req.05	Tools for maintaining HbbTV services must support quick and easy task performance.

6.4.3. Tools in use

All of the professionals interviewed are using HbbTV enabled TV sets for monitoring their own tasks as well as checking the dedicated HbbTV services. Four of them are working with content management systems for the realisation of their HbbTV and also non-HbbTV services and accessing these systems via web-based interfaces on their PC workstations. For exchanging raw data XML-based file formats are used by all of the interviewees.

"I am monitoring by checking the service on that TV set. Although it slows down sometimes." (E)

"Here are the two monitors for the website, the CMS and XML files, and over there is the TV set for having a look on the teletext and HbbTV teletext." (B)

"When I have to correct the data-set or its metadata I am using that editor. It's a web-based application." (B)

"I create the new widget with the help of that web-based tool, which was particularly built for this task." (D)

"For exchange of files we use an XML-based file format. If necessary I can edit things easily by hand." (C)

Req.06 HbbTV-enabled devices must offer increased performance.
Req.07 Tools for content creation must, apart from HbbTV, support different provision formats in parallel.
Req.08 CMS for providing data also to HbbTV applications must be failsafe and run reliable.
Req.09 As exchange format XML-based structures are needed.
Req.10 Preview functionalities.

6.4.4. Expectations for future HbbTV provision

Expectations for future HbbTV-related tasks are high. They clearly reflect the issues of the present work, as can be seen in the following answers to the last set of questions. During the

interview about their tasks four out of five interviewees expressed their demand for fail-safe HbbTV and database servers as well as extremely reliable and most up-to-date content management systems. Standard compliance is another important issue for all of the respondents, they stated. This must be maintained in authoring and production tools as well as in the end devices expected to have enormous performance and computing power and memory resources. Two of the professionals interviewed want to have direct access to DVB parameters in order to directly influence the application-broadcast interconnection and synchronisation. All of the interviewees expect to have proper test environment in the future in order to check integrity, performance and other aspects of HbbTV applications before "airing" them. Overall, a greater general awareness for HbbTV services, their implications, their editorial and technical production and needed efforts is seen to be necessary within their departments.

> *"That would be the worst case – when the HbbTV web server brakes down. It seems to be very stable. But in case – there will be no redundancy." (C)*

> *"That is one of our major problems: non-compliant end devices at users' homes. And HbbTV second screen applications are even worse. Because there are too many manufacturers, operating systems and browsers on the market. We are simply not able to cover all these variances." (A)*

> *"This (that certain page in the application) can look fine here, but it is possible that on another manufacturer's device it looks messy." (B)*

> *"Line breaks are still a problem. But they also are in 'old' teletext." (E)*

> *"If we go for better and more advanced HbbTV services we definitely need end devices with higher performance. And more memory there, as well." (A)*

> *"That would be nice: being able to control directly the DVB AIT! Or a dedicated test play-out environment, where I can deploy the latest changes before putting the updated service on-air." (C)*

> *"It is still difficult to get agreements from editorial teams and their managements, because they do not have HbbTV in mind at all. Sometimes it is completely unknown to some people." (D)*

Req.11 Servers for providing HbbTV applications must be failsafe and run reliable.
Req.12 HbbTV end devices must be standard compliant and offer high computing power and performance memory.
Req.13 Tools for maintaining HbbTV applications must offer functionality to influence DVB signalling if needed.
Req.14 A dedicated test environment for monitoring results before on-air deployment.
Req.15 The general HbbTV awareness must be increased within the complete staff of the service provider.

6.5. Use cases

From the gathered results and their fields of focus a number of concrete use cases can be deducted and formalized. They can be grouped according to the method and the sets of questions used above in section 7.1.

6.5.1. Main tasks

User story	**As a professional I need to perform generic HbbTV-related tasks in which all the applied tools and the technical environment are easy to use.**
Category/topic/context	*Software, Application, Development*
Owner(s)/contacts	*Software developers, UX designers, technical integrators, engineers.*
Abstract	*By offering easy to use tools and environment professionals can add, adapt and correct content and applications quickly and easily and thereby maintain the necessary overall load of communication, interacting and documentation.*
Detailed description	*From the interviews with the HbbTV-related professionals it becomes clear, that HbbTV-related tasks are highly dependent on other fields of business, like editorial decisions, TV program makers, technical infrastructure, graphic design and software development. This makes it necessary and very important to maintain a huge amount of communication, coordination and knowledge transfer with other departments and people.* *By running tools and using environment very easy to use for HbbTV-related tasks, the aforementioned additional efforts can be better integrated and thus guarantee effective work and a better quality of the results*
Justification for inclusion	*Higher efficiency and cost reduction because performing HbbTV-related tasks can be completed quicker and easier by maintaining all necessary additional efforts.*

User story	**As a professional I need to perform input/output operations of HbbTV-based services in which all tools are standardised and have consistent user interfaces.**
Category/topic/context	*Software, Application, Development*
Owner(s)/contacts	*Software developers, UX designers, technical integrators, engineers.*
Abstract	*When HbbTV-related professionals are performing data input/output operations with the help of their dedicated tools, they must be able to find all the desired functionalities quickly and for communication and documentation easily describe tasks and steps. Thus it is necessary to have consistent user interfaces, to keep overview and transparency.*
Detailed description	*When a professional user has to perform certain tasks for maintaining HbbTV services, he would probably have to check the integrity of data he put in, as well as correct possible*

	inconsistencies of data or its graphical representation in the HbbTV application.
	The tools that are required to perform these tasks have to display the data sets and at the same time offer all functionalities for any necessary editing, processing, adaptation and annotation.
	The range of here needed user interaction is determined by the space of the workstation's monitor and the used peripherals. In order to ease this complex setting and the inherent tasks to be performed the user interfaces (incl. localisation of functions, labelling and terminology) of all the used tools have to be designed as easy as possible; they have to be consistent within the range of the workflow chain and to match the users' expectations and knowledge.
Justification for inclusion	Higher efficiency and cost reduction because performing HbbTV-related tasks can be completed quicker and easier by being able to perform quicker and to document accomplished tasks.

6.5.2. Time pressure

User story	As a professional I need to perform HbbTV-related tasks under time pressure
Category/topic/context	Efficiency
Owner(s)/contacts	Management, software developers, engineers
Abstract	Although HbbTV-related tasks are often more time consuming than others, there is actually less time available for doing their HbbTV work.
Detailed description	HbbTV is a standard that is quite new to the broadcast and media business - it is only five years old. In sum accompanying TV services are still focused on classic teletext and web-based services. When it comes to editorial work HbbTV-based content is created, maintained and deployed only within the complete bundle of services, as it is the case for RBB. The focus of the work to be done is still on the "classic" services, as their number and user demand is much more higher and their priority is superior compared to the new HbbTV services. Accomplishing tasks in that said setting means that most efforts are dedicated to tasks other than HbbTV-related ones.
Justification for inclusion	The justification for including this use case is again efficiency. Especially for tasks related to evolving, richer HbbTV services it is crucial to gain content and services of high quality in still short time.

6.5.3. Usage of tools

User story	As a professional I need to monitor a service
Category/topic/context	*Editorial, monitoring, production*
Owner(s)/contacts	*Engineers, editors, software developers, hardware developers*
Abstract	*After having added or updated content for an HbbTV service, the editor need to check if all his input is integrated correctly and displayed consistently. On the other side the end user must get the exact representation and user experience the editor aimed for.*
Detailed description	*Using a service is happening at both ends of the HbbTV chain: at the production side and at the end user side.*
	The editor or producer has the duty to monitor the state, integrity and performance of the HbbTV service and he checks if all content is presented and running in the desired way. The conventional HbbTV content can be checked and monitored easily with the help of simple preview features throughout the HbbTV content production chain. Especially the possibilities for new and rich services and thus the integration of high quality video or third-party resources are a challenge for the creation of the new generation of services, which the producer can monitor by playing the service at his high-performance end device and therefor can have the same look at the application as the end user will. Maybe via a dedicated, internal and test-wise play-out through a real provision chain, before actually delivering the service to the users.
Justification for inclusion	*This use case is included because it is very important to have the possibility to monitor the work done as early as possible. Extra efforts through aftereffects can be reduced.*
	By monitoring the service on end devices a producer can satisfy the end user's expectations of and seamlessly running service and thus strengthen the impact of the service and the broadcaster itself.

User story	As a professional I need to edit data-sets
Category/topic/context	*Editorial, monitoring, production*
Owner(s)/contacts	*Engineers, software developers, hardware developers*
Abstract	*While editing data-sets for HbbTV services a number of editors and data formats are used.*
Detailed description	*Editors work on data-sets with the help of dedicated editors, that can import and export data in ARD specific XML formats. For RBB's TV accompanying services the data-sets are*

sometimes produced once but for all the different services. With the help of XML formats these different forms of service provision including all their technical implications can be managed and annotated easily.

The usage of XML-based structures has another main advantage: during production an editor can easily monitor small changes within that structure, while working with convenient (web-based) user interfaces.

Justification for inclusion	The use of a produce-once-deliver-all approach clearly reduces costs and enhances efficiency because the creating of data-sets can be reduced to the number one.
	The possibility of monitoring non-binary data before the provision to the user enhances the quality of service.
	Also import/export procedures are running fast with XML structures, storage and if necessary compression algorithms can be used at a maximum efficiency.

6.5.4. Production of future services

User story	As a professional I need to maintain technically demanding services
Category/topic/context	Editorial, software, hardware, reliability
Owner(s)/contacts	Engineers, editors, software developers, hardware developers
Abstract	When creating new and rich HbbTV services the producer can perform his tasks on maximum fail-safe and reliable tools and hardware.
Detailed description	When creating new and rich HbbTV services the producer must rely on higher connectivity, storage and processing power of the needed technical environment. Future services will integrate high capacity data and complex scripts for interacting and control of the applications. Due to the utilisation of further resources and far more connectivity and communication features maintaining these new applications will increase the demand of resources on the production side already, where all the data items and all the interaction features must be accessible for the producer as well as for the actual service provision.
Justification for inclusion	TV-RING is indeed heading towards the creation and deployment of new and rich, even transmedia services, which implies tasks to be performed on a capable and reliable production environment.

User story	As a professional I need to use tools for creating applications

	running on every device
Category/topic/context	*Standardisation*
Owner(s)/contacts	*Engineers, editors, software developers, hardware developers*
Abstract	*When developing and creating HbbTV applications editors and producers must be sure they will run flawlessly on every targeted end device.*
Detailed description	*When developing and creating not only new and rich HbbTV applications editors and producers must be sure they will run flawlessly on every targeted end device. All the program and script code generated manually or within the CMS or development kits for the realisation of HbbTV applications must be standard-compliant. This counts also for the implementation of soft- and middleware stacks as well as the hardware of end devices. They are also needed for the monitoring of the provided services at the production side.*
Justification for inclusion	*Standard-compliance means all code generated in that way is able to be processed on the end device side as intended by the creator. This is essential for the quality of service and the strength of the brand that service does support.*

User story	As a professional I need to control DVB signalling
Category/topic/context	*Application signalling, DVB*
Owner(s)/contacts	*Engineers, software developers, editors*
Abstract	*An editor can control the signalling of the HbbTV application and its synchronisation*
Detailed description	*If necessary an editor has to be able to influence the signalling of an HbbTV application (as agreed on internally with his DVB engineers) or maybe the synchronisation of dedicated functionalities with the broadcast signal.* *When creating new formats and HbbTV-supported storytelling most likely elements from the HbbTV application must be synchronised with the main video coming via DVB signal. That means that hooks in the transport stream have to be created and to be delivered via DVB so that the HbbTV application running locally on the end device can be manipulated accordingly. When an editor or a producer maintains such a complex service he must have the ability to create, adapt, remove or schedule such hooks.*
Justification for inclusion	*This use case is essential for creating new, rich and complex services to be created for new forms of interaction and*

6.6. Conclusion

As a conclusion it becomes very clear that in general HbbTV-related work and all its implications are still, after less than five years' time on the market, managed with a lower priority than fully established services, like teletext or websites. This influences the tools and the technical environment to be used, as there are a number of improvements needed. Also the planning of efforts is done in a way that prioritizes other services. So, professional users are aiming at increasing that "wrong" level of priority in order to ease the aspects and these effects that were mentioned above. This has to go hand in hand with an overall boost of the awareness for the new technological possibilities and chances that HbbTV development can achieve but must be supported throughout the complete production chain and also in the neighbouring areas and departments, like management, administration regulation and technical support.

What is also evident is that work on HbbTV services brings along additional communication and supervision activities, which are needed to browse through the whole HbbTV production chain, to harmonise and adjust, from management, editorial work, production and graphic design to software development.

HbbTV-related efforts must be performed along the production on other TV accompanying services as well. So, all needed tools and technical environment must enable the professional user to achieve his results both, in addition to teletext and websites or even working on content to be provided to all the services in parallel.

6.6.1. List of User Requirements

Req.01 For seamless task processing tools and technical environment must be easy to use.

Req.02 For easy input/output operations tools must integrate standardised and consistent user interfaces.

Req.03 CMS and use of metadata must be integrated in a way that essence data sets can be maintained easily.

Req.04 Monitoring of the quality of service must be as easy as possible.

Req.05 Tools for maintaining HbbTV services must support quick and easy task performance.

Req.06 HbbTV-enabled devices must offer increased performance.

Req.07 Tools for content creation must, apart from HbbTV, support different provision formats in parallel.

Req.08 CMS for providing data also to HbbTV applications must be failsafe and run reliable.

Req.09 As exchange format XML-based structures are needed.

Req.10 Preview functionalities.

Req.11 Servers for providing HbbTV applications must be failsafe and run reliable.

Req.12 HbbTV end devices must be standard compliant and offer high computing power and

performance memory.

Req.13 Tools for maintaining HbbTV applications must offer functionality to influence DVB signalling if needed.

Req.14 A dedicated test environment for monitoring results before on-air deployment.

Req.15 The general HbbTV awareness must be increased within the complete staff of the service provider.

6.6.2. List of User Stories

Main tasks

- As a professional I need to perform generic HbbTV-related tasks in which all the applied tools and the technical environment are easy to use.

- As a professional I need to perform input/output operations of HbbTV-based services in which all tools are standardised and have consistent user interfaces.

Time pressure

- As a professional I need to perform HbbTV-related tasks under time pressure

Usage of tools

- As a professional I need to monitor a service

- As a professional I need to edit data-sets

- As a professional I need to maintain technically demanding services

Production of future services

- As a professional I need to control DVB signalling.

- As a professional I need to use tools for creating applications running on every device

- As a professional I need to control DVB signaling.

7. Dutch Pilot Requirements

This section describes the specific approach of gathering professional user requirements for the Dutch pilot. We will first describe which specific methods were being used, and how this fits in the general plan and methodology, as well as the participants that took part in this process. We will then present our results. The aim of the pilots to promote the use and general knowledge about HbbTV has been explained to all participants and we have briefly mentioned the particular Dutch pilots as planned in the context of the TV-RING project.

7.1. Methods Used

The method that was used is semi-structured interviews. At first the goal was to use contextual inquiry to see the user at work and ask him/her questions while they are performing their job. However, due to the nature of the people interviewed (more management level) this was not possible. Therefore we opted for semi-structured interviews at their location of work. Audio recordings were made of all the interviews (a transcription of these interviews, in Dutch, can be found on the annex). The set of questions that formed the basis of the semi-structured interview are listed below:

- What does your job entail?
- How long have you been doing it?
- How much time do you spend on interactive TV/HbbTV related activities?
- What are the specifics of these activities?
- How challenging or easy is this interactive TV/HbbTV related work?
- Which tools do you use for the HbbTV related work?
- What are the difficulties you run into while performing interactive TV/HbbTV related tasks? What could be improved?
- Is there anything we haven't discussed yet that you think is important in (future) interactive TV/HbbTV development?

7.2. Participants

The first round of professional users consisted of six people. Four of them work as head of new media at different broadcasters within the Dutch NPO (three from TV and one from Radio which also has an online video stream and is sometimes featured on the main broadcast channels). Two were heads of technology companies that are dedicated to developing second screen applications for broadcasters (see Table 1 for an overview). The second interview was done with two persons at once who are therefore referred to as B1 and B2.

Participant	Job description	Years of Experience Interactive TV
A	Head Interactive TV Development Company	10 years

B1	Manager New Media, Public Broadcaster	3 years
B2	Manager New Media, Public Broadcaster	2 years
C	Manager New Media, Public News Broadcaster	2 years
D	Manager Online, Public Radio Broadcaster	5 years
E	Head Interactive TV Development, Webbureau	3 years

Table 2. Participants Dutch Pilot

7.3. Data analysis

The first step was to write out all the interviews. Everything that was relevant was written out verbatim. A workshop was organized with two members from KU Leuven and one from NPO. The interviews were divided among the workshop participants and each participant picked out snippets with interesting quotes from their interviews. The documents containing these snippets were printed and cut into individual pieces. The participants then started grouping these snippets into categories (every participant picked snippets and placed them in a category, when there was no fitting category a new one was created). See Figure 2 for an illustration. During this process, categories were renamed, merged or split when this was appropriate.
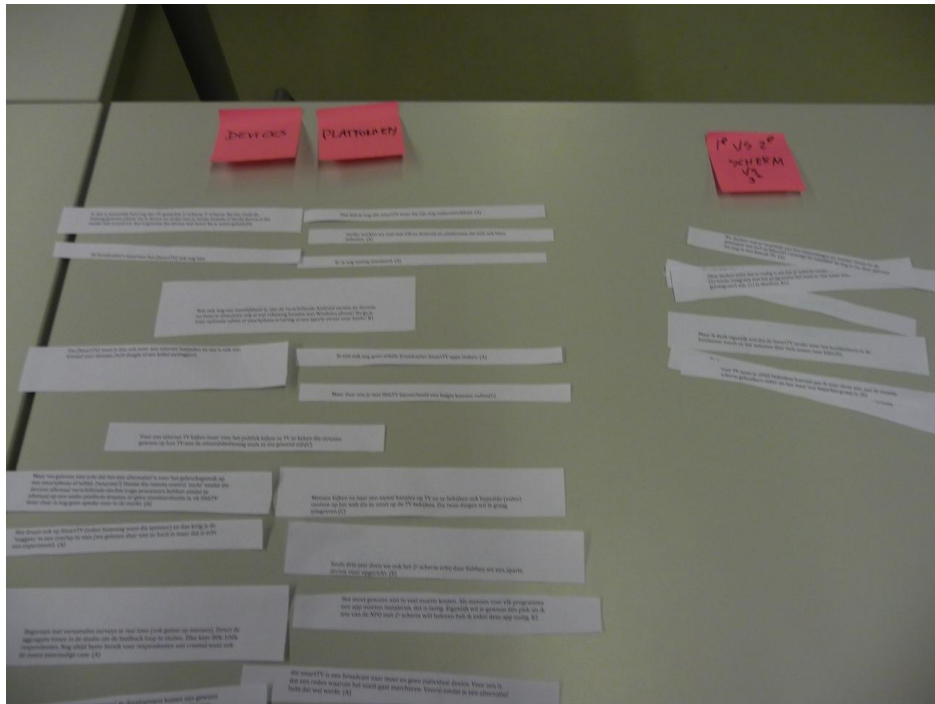
Figure 2. Grouping the snippets into categories

When all the snippets were divided into categories the groups were reviewed to create meaningful head and subgroups. See Figure 3 for an illustration. At the end individual snippets were reviewed to see if they still fitted their (new) head and subgroups.
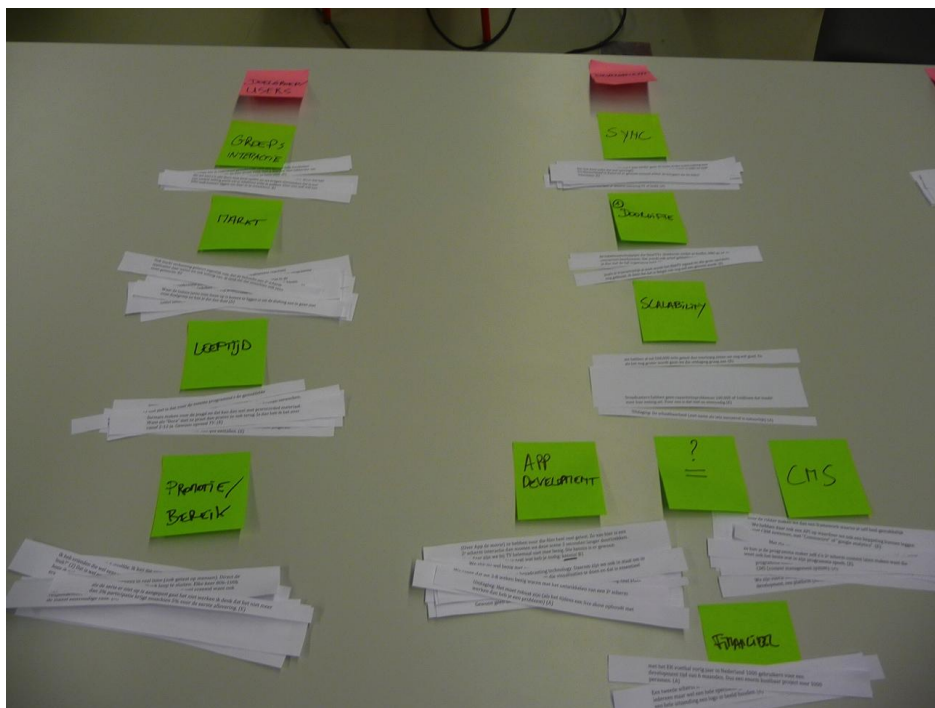
Figure 3. Creating head and subgroups

7.4. Results

The final clustering from the internal workshop resulted in the following structure. The headings and sub headings represent the categories and sub categories. Each sub category has an explanation and some translated (from Dutch to English) example quotes to support the explanation.

7.4.1. (Software) Development

The category (software) development includes everything that has to do with the development of interactive TV experiences. This includes software but also hardware and financial aspects.

7.4.1.1. Financial

This category refers to the financial costs and opportunities that can arise from the implementation of interactive/HbbTV. From the interviews it became clear that financial issues are mainly about the non trivial development time combined with the low amount of people using interactive TV.

> *"We created an app for the European Cup last year in the Netherlands. It had 1000 users and cost 6 months to develop. So a really costly project for so few users." (A)*

> *"A problem is the cost aspect related to the number of users. At the moment that balance is still skewed." (B1)*

However, it also becomes clear that the people working in new media departments of broadcasters see opportunities for financial gain for interactive TV apps

> *"Second screen can be interesting for advertisers. You won't reach everyone but it's quite a specific group and you could have your logo in the screen quite cheaply for the whole of the show's running time." (E)*

In conclusion: the cost of creating HbbTV applications should not be too high, and should include opportunities for advertisers.

Because of the relatively small number of interactive TV users, applications should be cost effective.

Req.01 When creating Interactive TV applications, try to look for opportunities for advertisers.

7.4.1.2. CMS (Content management systems)

From the interviews with the app developers it becomes clear, that having a well designed content management system allows for easy addition of content to any app framework.

> *"We work with our own platform that we created ourselves that lets program makers add content themselves. Its basically a real time CMS" (A)*

> *"With our self developed CMS system you can make your own design to go with your show. You can set many different options and the end result is responsive so you can immediately deploy it on any platform." (E)*

This is seen as a great advantage because program makers can add the content themselves and they are the best judges of what content is appropriate for their show.

*"This would make it possible for program makers to create their own second
screen content. In the end they know what fits their show the best." (E)*

Having a CMS based development system seems a must. It allows program makers to add their own content to an interactive TV app framework, making development cheaper and giving the program maker more control.

Req.02	It is essential to have an easy to use CMS system so program makers can add content to the apps themselves thereby reducing the cost and enhancing the quality.

7.4.1.3. App Development

App development is about the development (creation) of interactive TV applications. The app developers make a distinction between technical requirements that an app should have (like robustness) and requirements or features that come from user tests.

*"A challenge is robustness of the app (if it fails during a live show you have a
big problem)" (A)*

*"We have done some testing and what we found was that info on
background music was really popular." (A)*

They also emphasise the importance of good user testing and knowledge building, especially because interactive TV is still a relatively new development field. Participant B1 e.g. talks about 'App the movie' (a theatre film specifically designed to be accompanied by a second screen app):

*"They tested a lot for that movie. For example, at this moment there is a
second screen interaction, so then we have to stretch this scene 3 seconds
more. Us TV makers are not doing that at all. That kind of knowledge does
not exist. So if you ask me what we need, Knowledge!" (B1)*

The lesson to take away here is that when it comes to app development there are several aspects to take into account. An app has to be technically sound but it is also very important to have the knowledge about what kind of features users want and how to make sure these features have a good user experience. The TV Ring project could specifically contribute here, and create a knowledge base with best practices based from the Pilots.

Req.03	Make sure apps are technically sound.
Req.04	Do user research to broaden the knowledge base
Req.05	Create a way to share and spread knowledge.

7.4.1.4. Scalability

Scalibility deals with the adaptation to the number of interactive TV users. For app developers the main issue is bandwith when confronted with an increasing amount of users.

*"Broadcasters don't have a capacity problem. 100.000 or 1 million viewers
makes no difference for them. For us that isn't as simple" (E)*

"Scalability is a challenge, especially if something is successful." (A)

Bandwidth limitations and app stability is therefore something that definitely has to be taken into account when developing for large groups of users.

Req.06	Be aware of scaling issues for bandwidth when developing for large groups of users.

7.4.1.5. Synchronisation

This category is about synchronisation between first and second screen. From the interviews it is apparent that easy, well working synchronisation is an important issue for app developers and that the options they have available now are not yet sufficient.

> *"Better synchronisation would make our life easier. What is available now is insufficient." (A)*

> *"For instance we believe watermarking is still in its infant stage. Especially considering the UX. If you have to sync for 6-10 seconds that is really too long and it also drops out often, so that technology just isn't good enough yet according to us." (A)*

Synchronising first and second screen is still done by hand by some broadcasters. For live shows this might always be necessary and the best option.

> *"Synchronisation-wise everything is still done by hand and that is ok for putting a text message on screen but to start a video to accompany a song you have to be more precise" (D)*

> *"For 'Kassa'[1] there is simply someone at the controls who 'takes the viewers along'." (B2)*

For smooth operation of any interactive TV app that is used on more than one device synchronisation is crucial. In some cases this can only be done by hand but for others well working technological solutions are necessary.

> **Req.07** When using multiple screens, smooth synchronisation between these screens is essential.

7.4.2. Target group/Users

Target group and users contains everything to do with the viewers of interactive TV as well as the potential market for interactive TV.

7.4.2.1. Group Interaction

For interaction between the people who are watching a show together in the same room, new media management sees the most opportunity in quiz shows where people can interact with eachother.

> *"If we can all play along at home and we get statistics about our scores, that would be a unique selling point and make you take out your phone." (B1)*

The challenge here is to have scores visible for everybody and have a way of interaction for everybody as well. App developers seem to think this might require a central screen.

> *"What you would miss with just a first screen is the interaction together. But you could solve this by using your phone as a sort of interactive remote with four buttons and everybody can join in on the main screen" (B1)*

> *"With [HbbTV] you could easily take a whole household or even a street together for a quiz. But then it would be nicer to get aggregated information to display on a first screen." (E)*

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[1] A consumer television show that is broadcasted live (vara.kassa.nl)

However, the combination with a second screen also offers some benefits according to the app developers.

> *"As far as UX is concerned it is a personal device: you answer to polls as a person, not as a family. Interaction is what you do as a person. You also don't Facebook or Twitter as a family." (A)*

In conclusion, the challenge for successful group interaction seems to lie in the way the different devices (first and second screen) are used to accommodate this interaction. The first screen is mainly an aggregator, showing joint results from either the household or the public as a whole. The second screen is being used for personal interaction with the content (e.g. polls), and allows individual activity such as voting or social interaction with the outside world.

> **Req.08** To stimulate group interaction it is important to allow all participants to interact on an individual level while showing scores on a 'shared' screen.

7.4.2.2. Market

Market research for interactive TV demand is not done yet by new media management, but they do however see the value in this.

> *"Market research is not something we really do, so we do not know a lot about the demand for second screen apps. I believe we should start doing this." (B2)*

User research is not something they perform now, mostly due the combination of high costs and the fact interactive TV is still a small market. However, there is awareness that focus should be more on what the user wants.

> *"What is the motivation for the user to use the second screen? I believe we are still thinking too much from our viewpoint of program makers and not enough from the viewers' point. What does the viewer really need?" (B1)*

Even though the importance of user research is acknowledged, it does not seem to be carried out much. Here lies a definitive opportunity to reach out to the interactive TV end user and find out what they require from interactive TV.

> **Req.09** To get a good understanding of what users expect from interactive TV more user research is needed.

7.4.2.3. Age

How does age play a role in the domain of interactive TV? The average age of the viewing audience is quite high. This can be seen as a reason why the number of interactive TV users is still quite low as older people are less prone to use it for now.

> *"What we see now is that for most TV shows the average age is around 55 years (these are not really second screen adepts)" (E)*

The challenge is to make HbbTV applications easy to use and accessible for these target users. At the same time, it is necessary to reach out to the younger generations. To do this, it is important to know what kind of devices they use and how they communicate, and give this a place in interactive TV.

> *"Where are all the young people, how do they communicate, which devices do they use and how can we give those a place in our strategy?" (D)*

> *"Young people consume video in a different way: a lot more on demand on their laptop for instance. So very different from the linear TV from before." (E)*

The challenge in catering to the different age groups seems to lie in getting young viewers involved and back to TV, without alienating the core TV audience that is mostly comprised of older viewers.

> **Req.10** Get younger viewers more involved by offering interactive extras without alienating older viewers.

7.4.2.4. Promotion/Reach

According to new media management and app developers it is crucial to promote the existence of Interactive TV components in the show itself or at least just before the show starts.

> *"What is absolutely necessary is to promote the second screen app in the show itself. If that doesn't happen you might as well forget it" (B2)*

The main challenge is still to convince the viewers to participate because percentage wise the amount of viewers who actively participate in Interactive TV is very low.

> *"Now you have a maximum of maybe 10-15% of the viewers on the second screen. I don't see it going higher than 25-30% in the coming years." (E)*

> *"The challenge is to convince the people at home to participate" (A)*

A related issue is the still low market reach, despite these promotions. All professional users are convinced that promotion is crucial for the success of any interactive TV app.

> **Req.11** Promotion is critical for the success of any interactive TV app.

7.4.3. Delivery (getting the interactive TV experience to the users)

7.4.3.1. On demand vs Live

What is made clear from the interviews is that some of the people responsible for new media think that the line between on demand (internet) and live (tv) is something that should become integrated seamlessly. The reason for people to keep viewing live TV would lie in providing them with enticing interactive components.

> *"People watch a number of channels on TV and they also watch certain (video) content on the web that they never watch on TV. I would like to integrate these." (C)*

> *"How are we going to get more people watching live TV and TV events? By making them far more interactive" (A)*

This also offers opportunity to personalize broadcasts for users. The challenge however lies in convincing broadcasters that one broadcast for everyone is not the future.

> *"That is something broadcasters have to get used to. They still think of one broadcast that goes to everyone. The personalisation of that experience through second screen or HbbTV is not something they usually consider." (E)*

The challenge is to offer people all that you as a broadcaster have to offer and in such a way that for them on demand feels no different as live. Enticing people to watch live TV (which can be attractive for commercial purposes) could come from adding attractive interactive components to these live broadcasts.

> **Req.12** Whether content is live or on demand, this should not make a difference for the user's experience.
>
> **Req.13** If you want people to watch your programs live, entice them with an interactive experience.

7.4.3.2. Smart TV

Smart TVs are TVs that can run apps on their own. One app developer believed in Smart TVs but the main issue for them is that they are not widespread enough yet, and most that are out there are not powerful enough to run advanced apps.

> *"The problem with Smart TVs is that there are not that many in homes yet and the ones that are there don't always have a powerful graphics chip" (E)*

The other app developer was less enthusiastic about smart TVs. Their main problem was the lack of standards and the limited interaction that a remote control offers compared to smartphones and tablets. HbbTV could play a role in solving the standardisation problems.

> *"We don't really believe Smart TVs are an alternative for smartphones and tablets because the remote sucks. They all have different kinds of slow processors and all run on different platforms. There is no standardisation. OK, maybe HbbTV, but there is no uptake for that in the market yet" (A)*

> **Req.14** If Smart TVs are to succeed they need to be powerful enough and find a single standard.

7.4.3.3. Passthrough

Passthrough deals with the way the cable companies allow the broadcasters to deliver their signal to the users. The main problem here is that all the major cable companies in The Netherlands and Belgium actively block the HbbTV signal, mainly because they want to protect their own interactive TV activities. There might be a change in this in the near future as negotiations and legal procedures are in progress.

> *"As you probably know, the HbbTV signal is still blocked by most major cable companies (both in The Netherlands and Belgium)" (E)*

> *"The cable companies see Netflix and HBO go etc. as competition. That's why it's actively blocked in Belgium, which prevents you from getting the full experience." (A)*

> **Req.15** For HbbTV to succeed it is important for the HbbTV signal to be freely distributed by all cable companies.

7.4.3.4. Standards

In general the interviewees are disappointed about the lack of standards, for both devices and software, and the way this complicates their work.

> *"What is a problem is that you can't take something directly from a Samsung to a Philips SmartTV for instance. There are initiatives to solve this like HbbTV but we don't see enough push in the market yet." (A)*

> *"It's difficult to decide which devices you cater for: different versions of Android and do you take Windows phone into account? And do you go for an*

optimal tablet or smartphone experience or create different versions for both." (B1)

Standards are an important issue on the 'client side', the devices on which end users view the content. There are both a large number of different type of devices like tablets, smartphones, computers, and Smart TVs and different operating systems on these devices like Android, iOS, and windows mobile. Standards like HbbTV are necessary to overcome these issues.

Req.16 Standards like HbbTV are necessary to further interactive TV development.

7.4.3.5. Multiscreen

On the one hand there is talk about the merging of the different screens and the way people experience them.

"Considering apps, you use devices for the interaction and if all goes well you see the result back in the show. And it doesn't really matter to me if you are watching that show online or on TV." (D)

But there is also the idea that there is still a battle between attention for first and second screen in which a balance has to be found.

"For TV you always have to consider how much you adjust your show to the second screen especially if the second screen users are just a small percentage of total viewers." (E)

"Program makers have to learn how to adapt a show to the second screen" (B1)

It is important to let viewers experience interactive TV on the device(s) they want, but because the percentage of viewers who use interactive TV is still relatively small, the 'regular' TV viewer should not be forgotten.

Req.17 When developing interactive TV apps, it is important not to intrude (too much) on the experience of the 'regular' TV viewer.

7.4.4. Content Production

7.4.4.1. Program Makers

There is an issue between the people working on interactive TV experiences and program makers. Because the percentage of people that use the second screen is still quite small, it is difficult to convince program makers to adapt their show to enhance the second screen experience.

"The problem is that many program makers say the group of second screen users is only a small percentage of our viewers. We won't change our show just for them. But if they don't adapt the show for second screen, the second screen will not get more users etc. How will you solve that?" (B1)

"A challenge is to convince program makers that the second screen won't distract from the first screen experience." (E)

At least in part this seems to come from a lack of communication between program makers and app developers.

"From the second screen developers, there are very few who talk to the program makers." (A)

7.4.4.2. Fiction

Fiction seems to be a difficult genre to create a good second screen experience for. You can't really change the show depending on the input from the viewers without spending a lot of money on different story lines of which only one will actually be seen. Fiction shows also tend to require more attention from viewers than for instance a game show, so it is a challenge to find the right amount of content for the second screen.

"I think TV viewers won't let themselves be tricked by pre-recorded shows (fiction). If they have no influence, they won't participate. (about story direction choice by viewers in fiction shows)." (E)

"We tried with "Case Sensitive" an acquired English detective that we added a second screen experience to. But we found that it simply distracted too much from the actual show." (E)

"What we have learned is that second screen can work for drama as long as it is 'optional', i.e. it enriches the viewing experience but you won't miss anything if you don't follow the updates, like we did for "De Ridder". (A)

7.4.4.3. Non-Fiction

The opposite can be seen for non fiction shows. Here viewer participation is easier to create, for instance by giving opinions that can be discussed on live shows.

"For live shows it is possible to participate by giving your opinion on a topic. That's something Dutch people are fond off so that works quite well" (E)

The amount of attention required for this type of programs is usually also less, which gives more room for content-heavy second screen experiences.

"Background information could be even cooler for non-fiction shows like current events shows or documentaries, because those are also shows you don't have to meticulously follow all the time so you have more time to read up on background info." (A)

7.4.4.4. Game show/Competition

Gameshows are a form of non fiction that gets discussed a lot, mainly because of the element of competition they can provide. Viewers can participate and see their own scores which they usually enjoy.

"Something like the national IQ test (a sort of televised version of the IQ test) works really well. It's just really simple the interaction is direct (question on TV answer on your device)." (B1)

"Live shows and competitions those are the shows we have noticed they work with a second screen." (E)

Still care has to be given to the balance between the game on TV and the game the viewer is playing himself through the interactive TV experience.

"For "Wie is de Mol"[2] we tried it, but we found it didn't work so well because people want to focus on the show." (A)

Req.21	Let viewers join in on the competition of a game show.

7.4.5. Consumption

7.4.5.1.   Usability

The main requirement for usability seems to be ease of use. It has to be simple on a discovery and accessibility level so the user does not have to put in an effort to start his interactive TV experience.

"It just shouldn't cost too much effort, if people need to install a different app for each program, that is a hassle. What you would really want, is a single app with which you could follow all the second screen shows of a broadcast network." (B2)

It is also noted that TV is traditionally a lean back medium and viewers might expect the same from the interactive TV experience.

"It also has to be simple for the regular TV user. TV is still a lean back medium. It has to be simple on app level as well as for discovery." (A)

"We have also talked about overlays on the first screen where you would get extra information on these overlays like maps. That way you would not have to be active yourself like usually on second screen, but the information is handed to you." (B1)

According to the professional users that were interviewed, the main requirements for usability are a very low threshold and very simple interaction once viewers start using the application.

Req.22	Ease of use in both discovery and accessibility is crucial for any second screen app

7.4.5.2.   Design

On the design front the discussion is mostly about how to present information to the user. When using the first screen for instance do you use overlays or picture in picture or do you give the user a choice?

"The question is how do you display the video clip (talking about 'radio on TV'). Do you do it full screen, or do you display it next to the DJ in split-screen or picture-in-picture, or do you just give people the option to turn it on and off. That is a nice challenge and one in which HbbTV might play a role." (D).

"We have also talked about overlays on the first screen where you have the option to receive extra information like for instance a Google map. In this way the extras are just handed to you and you don't have to be active like you usually have to be with a second screen." (B1)

The comments in the design category where interesting, but not detailed enough to draw any conclusions from or to specify any requirements from. This is a category that would be well

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[2] An intense multi episode game show in which one person of secretly the groups tries to prevent the others from completing tasks and they have to find out who it is

suited for extra research in the second iteration once there is a clear direction for the prototypes.

7.4.5.3. Social

For some of our interviewees, social media is very important to stay in touch with the users of interactive TV and it is used as a way to display the viewers' comments on the screen or in the app. It also happens that the app offers the posibility to share updates through Twitter or Facebook but these updates won't show in the app.

"We don't do communication within our own app, we use Twitter and Facebook for that." (A)

The last few years my focus has been on the dialogue with our target group and how to do this (live interaction). (D)

"What is tricky about social media communication is the moderation. You really need a moderator to check all the messages." (D)

It depends on the type of app if it should display the communication in the app itself or even have its own social communication platform, or just offer a way to share updates through existing platforms like Twitter or Facebook. Having at least a possibility for social communication seems necessary for most apps however.

Req.23 A way for users to interact with others watching the show is necessary for most apps.

7.4.5.4. Engagement (short and long term)

All television makers want to hold the attention of their viewers both during the show and over the span of multiple shows. For some, interactive TV can be a way to make it easier to retain users when a show they watched just ended and the next show might not immediately appeal to them.

"What all television makers try, is when people have a show that they regularly watch, to keep that person watching their channel after that show ends." (C)

There is also the belief that a good second screen experience can actually increase the attention of viewers for the show on TV, because the second screen is relevant to the content of the show and viewers will be less prone to watch unrelated content on their second screen device. Not all program makers share this vision though. They are worried people will focus too much on the second screen and lose focus for the first.

"If you offer a good second screen application with a TV show and you can engage viewers trough this second screen, you will end up with a more attentive TV viewer." (E)

There is also the idea that the second screen should become a more permanent experience with updates that can be revisited at later stages of the show and even between airings of different episodes from the show.

"What we see so far is that second screen has a short life span, as it lives only during the airing of the show. That is not really the right strategy. The goal is to have something you can consult before, during and after the show." (A)

"What is also a point for attention, is attention before and after the show. If you also have a presence before and after the show, you will be more in the picture. If you are only 'there' once a week, it will be more difficult for people

to find you again and for you to pull them back in again. But for now people don't 'find' the second screen outside of the show's broadcasts." (B2)

Engagement for interactive TV is a multi faceted concept. Program makers try to use it to retain viewers after their favourite show ends. It is also theorized that interactive TV apps can help keep viewers more attentive on the show they are watching by eliminating other distractions. Some app and program makers would also like the second screen to live beyond the duration of the show.

> **Req.24** Retain viewers by offering interesting interactive TV alternatives after 'their show' ends.
> **Req.25** A good second screen experience can enhance attention to the first screen.
> **Req.26** To engage people even further, try to get them interested in your second screen outside of the broadcast times of the show itself.

7.4.5.5. Personalization

Both app makers see potential in personalising quiz scores and poll results, i.e. not just giving general figures but for instance scores per neighbourhood or household. HbbTV could play a role in facilitating this personalisation.

> "Closing the loop is something you can do in the studio with an overlay or with HbbTV. The disadvantage of the first two is that you can only report back general figures. With HbbTV however you can make it personal, for instance with figures from the household or the neighbourhood." (E)

> "What we did see is that if we visualised all the data we gathered during the show in a sort of recap show, that worked quite well. It pulled in about 50.000 people through the web." (for the show "Wie is de Mol" with 2million viewers and 12.000 second screen users) (A)

Personalizing content of shows, or the advertisements the users get to see, is also something new media and app makers see possibilities for.

> "That would be like personalizing the news" (C) (giving possibilities to watch other stories if the current section does not interest you too much)

> "For the commercial broadcasters we could for instance use profile data to offer targeted advertising." (E)

> **Req.27** Use interactive TV to offer viewers a more personalized experience by allowing them to participate or selecting different items.
> **Req.28** Use interactive TV to offer viewers targeted commercials.

7.5. Use Cases

As a finishing step in the first iteration of user research, the results obtained from the requirements analysis of the generated data were formalized as a set of user stories.

7.5.1. (Software) Development

User story	As a broadcaster/program creator/app developer I need to make sure of interactive TV apps is in accordance to the still

	relatively small audience
Category/topic/context	*Development, Financial*
Owner(s)/contacts	*Broadcasters, Program makers and App developers*
Abstract	*Because the audience for interactive TV is still relatively small it is essential for the development costs to be in proportion with the number of users.*
Detailed description	*From the interviews it became clear that financial issues are mainly about the non trivial development time combined with the low amount of people using interactive TV. Therefore the cost of creating HbbTV applications should not be too high.*
Justification for inclusion	*The financial aspects of interactive TV development have to be feasible for it to succeed.*

User story	**As an interactive TV developer I want to offer program makers a CMS they can use themselves to easily add content.**
Category/topic/context	*Software, Application, Development*
Owner(s)/contacts	*App developers*
Abstract	*By offering an easy to use CMS program makers can add content to frameworks thereby improving the content quality and reducing the development costs of interactive TV apps.*
Detailed description	*From the interviews with the app developers it becomes clear that having a well designed content management system allows for easy addition of content to any app framework.* *This is seen as a great advantage because program makers can add the content themselves and they are the best judges of what content is appropriate for their show.* *Having a CMS based development system seems a must. It allows program makers to add their own content to an interactive TV app framework, making development cheaper and giving the program maker more control.*
Justification for inclusion	*Cost reduction because program makers don't have to contact app developers and ask them to add or create certain content but they can simply add it themselves.* *Content quality improvement, because program makers know their show and the appropriate content to accompany it the best.*

User story	As an app developer I want to make sure the apps are technically sound and scale well to large groups of users.
Category/topic/context	*Application Development, Scalability*
Owner(s)/contacts	*App developers*
Abstract	*App developers stress the need for technically sound apps that can deal with large groups of users this is especially important during live broadcasts.*
Detailed description	*If interactive TV apps don't function flawlessly the upcoming audience will easily abandon the app again. For app developers the main issue is bandwith when confronted with an increasing amount of users.*
Justification for inclusion	*For users to keep using interactive TV applications they have to work perfectly.*

User story	As an app developer/program maker I want to be able to do user research and be able to share and spread this knowledge.
Category/topic/context	*Application Development*
Owner(s)/contacts	*App developers, Program makers*
Abstract	*App developers and program makers say user testing and knowledge building is especially important because interactive TV is still a relatively new development field.*
Detailed description	*App developers emphasise the importance of good user testing and knowledge building. They need knowledge about what kind of features users want and how to make sure these features have a good user experience especially because interactive TV is still a relatively new development field.*
Justification for inclusion	*To provide apps that end-users enjoy the developers need to know what users need and expect from interactive TV*

User story	As an app developer I need to make sure synchronisation is perfect when using multiple screens.
Category/topic/context	*Application Development, Synchronisation*

Owner(s)/contacts	App developers, Broadcasters
Abstract	For smooth operation of any interactive TV app that is used on more than one device synchronisation is crucial.
Detailed description	From the interviews it is apparent that easy, well working synchronisation is an important issue for app developers and that the options they have available now are not yet sufficient. In some cases synchronisation In some cases this can only be done by hand but for others well working technological solutions are necessary.
Justification for inclusion	For users to keep using interactive TV apps that use multiple screens, synchronisation needs to be very smooth. The methods for synchronisation need to be improved to achieve this.

7.5.2. Target group/Users

User story	As a program maker I want to stimulate group interaction for viewers to increase their engagement to my show
Category/topic/context	Users, Group interaction, Multi screen
Owner(s)/contacts	Program makers, App developers
Abstract	For interaction between the people who are watching a show together in the same roomprogram makers see the most opportunity in quiz shows where people can interact with eachother.
Detailed description	The challenge for successful group interaction seems to lie in the way the different devices (first and second screen) are used to accommodate this interaction. The first screen is mainly an aggregator, showing joint results from either the household or the public as a whole. The second screen is being used for personal interaction with the content (e.g. polls), and allows individual activity such as voting or social interaction with the outside world.
Justification for inclusion	Creating interaction between viewers in the same household can increase viewers' engagement to the show.

User story	As a program maker I want to get a good understanding on what users want through user research
Category/topic/context	Users, Target Group, Market

Owner(s)/contacts	*Program makers, User researchers*
Abstract	*Market research for interactive TV demand is not done yet by new media management, but they do however see the value in this.*
Detailed description	*Even though the importance of user research is acknowledged, it does not seem to be carried out much, mostly due the combination of high costs and the fact interactive TV is still a small market. However, there is awareness that focus should be more on what the user wants. Here lies a definitive opportunity to reach out to the interactive TV end user and find out what they require from interactive TV.*
Justification for inclusion	*Getting a good understanding about the expectations and needs of end-users can improve the quality of interactive TV applications immensely.*

User story	**As a program maker I want to get younger viewers more involved through offering interactive extras without alienating older viewers**
Category/topic/context	*Users, Age, Engagement*
Owner(s)/contacts	*Program makers, App developers*
Abstract	*The challenge in catering to the different age groups seems to lie in getting young viewers involved and back to TV, without alienating the core TV audience that is mostly comprised of older viewers.*
Detailed description	*The avarage age of the viewing audience is quite high. This can be seen as a reason why the number of interactive TV users is still quite low as older people are less prone to use it for now. The challenge is to make HbbTV applications easy to use and accessible for these target users. At the same time, it is necessary to reach out to the younger generations. To do this, it is important to know what kind of devices they use and how they communicate, and give this a place in interactive TV.*
Justification for inclusion	*It is getting more difficult to get younger viewers to watch TV adding interaction might get them back from online video offerings.*

7.5.3. Delivery (getting the interactive TV experience to the users)

User story	**As an app developer, I need Smart TVs that are powerful enough and comply to a standard.**

Category/topic/context	*Delivery, Smart TV, Standards*
Owner(s)/contacts	*Smart TV builders, Organisations responsible for setting standards*
Abstract	*App developers experience a lack of standards and computing power when developing apps for Smart TVs*
Detailed description	*One app developer believed in Smart TVs but the main issue for them is that they are not widespread enough yet, and most that are out there are not powerful enough to run advanced apps. The other app developer was less enthusiastic about smart TVs. Their main problem was the lack of standards.*
Justification for inclusion	*For Smart TVs to succeed they need great apps and for that to happen they need to be powerful and easy to create apps for.*

User story	**As an app developer/program maker, I need standards so I don't have to worry about so many different platforms.**
Category/topic/context	*Delivery, Standards*
Owner(s)/contacts	*Innovation centres, Organisations responsible for setting standards*
Abstract	*In general the interviewees are disappointed about the lack of standards, for both devices and software, and the way this complicates their work.*
Detailed description	*Standards are an important issue on the 'client side', the devices on which end users view the content. There are both a large number of different type of devices like tablets, smartphones, computers, and Smart TVs and different operating systems on these devices like Android, iOS, and windows mobile. Standards like HbbTV are necessary to overcome these issues.*
Justification for inclusion	*Standards are an important issue on the 'client side', the devices on which end users view the content. There are both a large number of different type of devices like tablets, smartphones, computers, and Smart TVs and different operating systems on these devices like Android, iOS, and windows mobile. Standards like HbbTV are necessary to overcome these issues.*

7.5.4. Content Production

User story	As an app developer/program maker, I need a good dialogue with program makers/app developers.
Category/topic/context	*Content production, Communication*
Owner(s)/contacts	*Program makers, App developers*
Abstract	*Often there is little communication between app developers and program makers. This effects app quality.*
Detailed description	*There is an issue between the people working on interactive TV experiences and program makers. Because the percentage of people that use the second screen is still quite small, it is difficult to convince program makers to adapt their show to enhance the second screen experience. At least in part this seems to come from a lack of communication between program makers and app developers.*
Justification for inclusion	*A good dialogue between program makers and app developers can lead to better apps.*

User story	As an app developer/program maker, I need a good dialogue with program makers/app developers.
Category/topic/context	*Content production, Communication*
Owner(s)/contacts	*Program makers, App developers*
Abstract	*Often there is little communication between app developers and program makers. This effects app quality.*
Detailed description	*There is an issue between the people working on interactive TV experiences and program makers. Because the percentage of people that use the second screen is still quite small, it is difficult to convince program makers to adapt their show to enhance the second screen experience. At least in part this seems to come from a lack of communication between program makers and app developers.*
Justification for inclusion	*A good dialogue between program makers and app developers can lead to better apps.*

User story	As a program maker, I want to know what type of content interactive TV content viewers appreciate the most.
Category/topic/context	*Content production, Genre*
Owner(s)/contacts	*User Researchers, Program makers*
Abstract	*Offering high quality content to viewers is essential but it is difficult to find the right type of content for interactive TV applications.*
Detailed description	*You want to make the content interesting enough for users without distracting them from the TV show. The right type of content is very much dependent on the genre and intensity of the TV show.*
Justification for inclusion	*Content is at the core of the users experience quality so it needs to be spot on.*

7.5.5. Consumption

User story	As a program maker, I want to offer viewers a personalised experience to engage them more.
Category/topic/context	*Consumption, Personalisation*
Owner(s)/contacts	*Program makers, App developers*
Abstract	*Offering a personalized experience to viewers can engage them more retain them even though part of the show does not interest them that much and offer opportunities for more personalized advertising.*
Detailed description	*All television makers want to hold the attention of their viewers both during the show and over the span of multiple shows. For some, interactive TV can be a way to make it easier to retain users when a show they watched just ended and the next show might not immediately appeal to them. Personalising content of shows, or the advertisements the users get to see, is also something new media and app makers see possibilities for.*
Justification for inclusion	*Personalization can help retain viewers thereby increasing market share. It can also help with targeted advertising increasing revenue.*

7.6. Conclusion

In this first iteration of the professional requirements, a set of important requirements for the TV-RING pilots where gathered. In general, these requirements pertain to innovative HbbTV applications and services. The requirements will be applied in the pilots or further examined in the 2nd iteration. The key findings: The scalability and standardization of HbbTV are important factors for professional users. A simple user interface, seamless working apps and interaction are the important ingredients for successful HbbTV applications. Finally, promotion is a key requirement for both HbbTV and more generally for specific applications and use cases as well.

7.6.1. List of User Requirements

Req.16 When creating Interactive TV applications, try to look for opportunities for advertisers.

Req.17 It is essential to have an easy to use CMS system so program makers can add content to the apps themselves thereby reducing the cost and enhancing the quality.

Req.18 Make sure apps are technically sound.

Req.19 Do user research to broaden the knowledge base

Req.20 Create a way to share and spread knowledge.

Req.21 Be aware of scaling issues for bandwidth when developing for large groups of users.

Req.22 When using multiple screens, smooth synchronisation between these screens is essential.

Req.23 To stimulate group interaction it is important to allow all participants to interact on an individual level while showing scores on a 'shared' screen.

Req.24 To get a good understanding of what users expect from interactive TV more user research is needed.

Req.25 Get younger viewers more involved by offering interactive extras without alienating older viewers.

Req.26 Promotion is critical for the success of any interactive TV app.

Req.27 Whether content is live or on demand, this should not make a difference for the user's experience.

Req.28 If you want people to watch your programs live, entice them with an interactive experience.

Req.29 If Smart TVs are to succeed they need to be powerful enough and find a single standard.

Req.30 For HbbTV to succeed it is important for the HbbTV signal to be freely distributed by all cable companies.

Req.31 Standards like HbbTV are necessary to further interactive TV development.

Req.32 When developing interactive TV apps, it is important not to intrude (too much) on the experience of the 'regular' TV viewer.

Req.33 A good dialogue between program makers and app developers is essential.

Req.34 For fiction shows the second screen content should be optional i.e. enriching but not essential.

Req.35 For non-fiction shows, it is possible to create a more content heavy second screen experience, as these shows do not usually require constant attention.

Req.36 Let viewers join in on the competition of a game show.

Req.37 Ease of use in both discovery and accessibility is crucial for any second screen app

Req.38 A way for users to interact with others watching the show is necessary for most apps.

Req.39 Retain viewers by offering interesting interactive TV alternatives after 'their show' ends.

Req.40 A good second screen experience can enhance attention to the first screen.

Req.41 To engage people even further, try to get them interested in your second screen outside of the broadcast times of the show itself.

Req.42 Use interactive TV to offer viewers a more personalized experience by allowing them to participate or selecting different items.

Req.43 Use interactive TV to offer viewers targeted commercials.

7.6.2. List of User Stories

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(Software) development

- As a broadcaster/program creator/app developer I need to make sure of interactive TV apps is in accordance to the still relatively small audience
- As an interactive TV developer I want to offer program makers a CMS they can use themselves to easily add content.
- As an app developer I want to make sure the apps are technically sound and scale well to large groups of users.
- As an app developer/program maker I want to be able to do user research and be able to share and spread this knowledge.
- As an app developer I need to make sure synchronisation is perfect when using multiple screens.

Target group / Users

- As a program maker I want to stimulate group interaction for viewers to increase their engagement to my show
- As a program maker I want to get a good understanding on what users want through user research
- As a program maker I want to get younger viewers more involved through offering interactive extras without alienating older viewers

Delivery (getting the interactive TV experience to the users)

- As an app developer, I need Smart TVs that are powerful enough and comply to a standard.
- As an app developer/program maker, I need standards so I don't have to worry about so many different platforms.

Content production

- As an app developer/program maker, I need a good dialogue with program makers/app developers.
- As an app developer/program maker, I need a good dialogue with program makers/app developers.
- As a program maker, I want to know what type of content interactive TV content viewers appreciate the most.

Consumption

- As a program maker, I want to offer viewers a personalised experience to engage them more

8. Spanish Pilot Requirements

The aim of this section is to describe the process of professional user requirements elicitation and analysis that was performed for the Spanish pilot. First, an overview of the methods applied and the participants that took part in the user research actions is offered. The generated results are then analysed and discussed. The outcome is a list of professional user requirements for the pilot. These results are then further formalised as a set of user stories.

8.1. Methods Used

In the first iteration of T2.3, two main actions were performed in the Spanish pilot to elicit the requirements of the relevant stakeholders. Professional user research actions started with a round of five contextual interviews with different stakeholder profiles. This was followed by a requirements workshop, in which interview transcripts were analysed, processed and structured by a group of five (other) stakeholders involved with the project. Both actions were complementary, and the outputs of the first served as inputs for the second. This workflow led smoothly from the raw data elicited in the field, to the structured and categorised set of professional requirements below.

A contextual interview (or contextual inquiry) is an ethnography-based method, focused on understanding user-system interactions to derive implications for design (Beyer & Holzblatt 1997). In the scope of the TV-RING project, a main goal of the contextual interviews was to identify the key tasks performed by each professional user profile, to understand the specific technologies, and to elicit a first set of functional and non-functional requirements that each of these profiles had in regards to HbbTV. The interviews were carried out in the natural work environment of the informants: researcher and researched engaged in an open, two-way, non-hierarchical conversation on a series of topics regarding the informant's job.

The interaction was directed by a set of eight open-ended questions, taken from a common project-level interview guide. These gave ample opportunity for the researcher to probe deeper in the most interesting topics, clarify difficult technical matters, and follow unanticipated leads. The interviews lasted between 40 minutes and an hour and twenty minutes, which was deemed sufficient to reach an adequate level of understanding.

8.2. Participants

A total of four contextual interviews were carried out, one for each relevant profile. An initial set of profiles were identified in an early October work session, whose purpose was to kick-start the task and determine a roadmap for completion. The most relevant stakeholder profiles there indentified were the following:

Participant	Job description	Years of Experience Interactive TV
A	Chief of IPTV service exploitation department	11 years

B	Senior analyst digital services marketing department	14 years
C	Senior developer IPTV applications	7 years
D	Chief of IPTV engineering department	15 years

Table 3. Participants Spanish Pilot

The informants were purposefully sampled on the basis of their closeness of fit with the stakeholder profiles, sufficient work experience, and ample expertise in the topic at hand. Seniority and decision-making capacity were prioritised. Participants were contacted through their companies, and interviewed at a date and hour of their convenience in their regular work stations. All data protection and privacy standards were observed, including a signed informed consent form, which ensures compliance with ethical and legal regulations (including the Spanish Organic Law 15/1999 of 13 December on the Protection of Personal Data, and the Directive 95/46/EC of the European Parliament and of the Council of 24 October 1995 on the protection of individuals with regard to the processing of personal data and on the free movement of such data).

In addition to these four interviewees, at the requirements workshop five stakeholders involved with the project took part in the drafting of a preliminary set of professional requirements. These participants had complementary profiles in terms of technical skills and levels of seniority, to ensure an adequate balance of technical and non-technical aspects. Scans of the notes and the transferred data are available on request.

8.3.Data analysis

Following the contextual interviews, a requirements workshop took place. The goal of this focused work session was to develop a first set of professional requirements on the basis of the participants' inputs, taking into consideration the stakeholder interviews that had been performed previously as well. In this workshop, the contextual interviews' transcripts were thoroughly analysed.

Requirements workshops (also known in some circles as Joint Application Design sessions or JAD, e.g. see Davidson, 1999) are focused work sessions in which a carefully selected group of users work together with a facilitator to draft a list of functional and non-functional requirements. In this sense, requirements are defined as singular documented needs that a particular design, product or process must be able to perform. Requirements workshops are a way to involve stakeholders in the early stages of the innovation process, and if properly run, can be an important action for requirements elicitation and analysis, and provide valuable inputs for subsequent stages of the project (Kristensson, Matthing & Johansson, 2007).

Figure 4. Classification of requirements in categories during workshop, using a conceptual map on a whiteboard

8.4. Results

As a result of this round of professional user research actions, a first set of functional and non-functional end user requirements was created. These were developed on the basis of the participants' inputs and co-creation activities at the workshop, and taking into consideration the insights gained and lessons learned with the professional user contextual interviews that had been carried out before as well. These requirements were codified in natural language form in a preliminary workshop output document, and subsequently organized as an elaborate list of user requirements.

8.4.1. HbbTV application development and testing

8.4.1.1. MPEG-DASH streaming support

A main concern of both developers and service exploitation professionals is the proliferation of different codecs and the current lack of a universal standard for video streaming.

"From the service exploitation point of view, everything that simplifies codec and retrocompatibility issues would make our lives a lot easier. Otherwise, you are forced to invest a lot of money in infrastructure that quickly becomes obsolete…" (A)

"We spend a lot of time working on the particularities of each platform. That is, making sure that the applications we develop work properly across all platforms. Since nowadays manufacturers understand HbbTV implementation quite differently, making sure that apps work well in all the range of existing HbbTV sets can be a lengthy task. We truly need to work towards a standard, be it MPEG-DASH or tag video or whatever that we all agree to work with." (C)

The adoption of a widely held standard in the pilots, such as MPEG-DASH standard, would facilitate application development tasks and reduce development time spent on compatibility issues.

Req.01 Make receivers with MPEG-DASH streaming available for the pilot.

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8.4.1.2. HbbTV App testing tools

A clear requirement from developer stakeholder is to streamline the user-centred development process of applications, so that apps tested in a lab environment (with browser tools) can be easily transferred to the testing environment (on real-life HbbTV receivers).

> *"From the developer's point of view, there is a lack of tools for application development. For instance, if you have a graphics editor that allows you to do a live inspection of what you are currently seeing on the screen, so you can see the layers, the behaviour, a log, and so on.... all this would be great to have." (C)*

> *"To try stuff, we don't use a TV set directly because it is quite slow, we use a browser first and then use the TV." (C)*

> *"Interactive TV should be 100% compatible with browser implementations. The best possible arrangement for us would be one in which all TVs would have a webkit, so that you can be certain that what you're testing in a PC browser such as Chrome works every bit the same way in the TV" (C)*

This has important implications for the pilot, as it highlights the need to ensure that the iterative process of development and testing proceeds smoothly, and an agile stream of feedback can be established. The optimal solution, which may or may not be feasible, would be that the HbbTV receivers used for testing have 100% support of the HTLM5 that PC browsers support.

Req.02 Make more productivity tools available to HbbTV application developers.
Req.03 Develop a solution for the sharing of HbbTV software modules.
Req.04 Make HbbTV applications compatible with browser implementations, including HTML5.

8.4.1.3. Multicamera view switching

Another interesting functionality that must be supported by the pilot's infrastructure is multicamera views.

> *"To deliver a better service to the user, HbbTV should give me the chance to deliver several live objects on the same screen at the same time at an excellent quality of experience, so that I can create a truly exciting multicamera service" (C)*

However, the user's acceptance of such services is very likely to be linked to the user's experience with the transition between multicamera views. If significant delays and/or glitches are experienced by the user when switching, the user is almost certain to perceive the service as frustrating and low quality, leading to rejection of this innovation.

Req.05 Make switching between multicamera views as quick as possible.

8.4.1.4. Receiver interoperability

An important testing requirement has to do with the different implementations of HbbTV across different manufacturers.

> *"Normally, when we talk about HbbTV, an issue that creates a lot of trouble for us is that different receivers have different HbbTV implementations. We have the problem that, all things being equal, a LG set has a different behaviour than a Phillips set, not only at the level of the way these manufacturers have understood the implementation of HbbTV but also at the*

level of computing speed. We have found out that some devices are real slow, and some others real fast" (C)

To address this unpredictability, it is essential that the applications and services can be tested on a diverse set of receivers, and under a range of different conditions, to guarantee the interoperability of these applications and services across the whole range of manufacturers.

> **Req.06** A wide range of HbbTV receivers must be available for the pilot.

8.4.2. Production requirements

8.4.2.1. Multicamera service interface

There is a widespread belief that multicamera functionalities can enable very attractive and innovative services.

> *"I believe multicamera services can be really interesting for users [...] Unfortunately, our problem right now is that we lack such capabilities. Because older HbbTV receivers do not allow for true multivideo, the only thing we can do so far is a real-time merge of four videos, which is very costly to perform in terms of bandwidth."* (C)

To allow true multicamera services, from the stakeholder end of the story it is important to develop specific tools. These tools that would allow TV professionals to work effectively on these new services once these are in an exploitation environment. A live mosaic video that effectively manages a content selection menu is such a tool.

> **Req.07** Develop a live mosaic video to ease work on a content selection menu.

8.4.2.2. Pilot deployment

To optimise resources and deliver enhanced value to the broadcaster partners, the pilot deployment should not entail a departure from the usual production procedures followed at the broadcasting partners' organisations.

> *"We at TVC have a very complex production workflow, with several interlocking steps that have to be performed in a very specific way. [...] When you work in such a streamlined and established way, it is very difficult (not to say impossible) to change the way you work for a single project."* (A)

The objective of this requirement is that the transition from the pilot environment to the exploitation environment becomes almost seamless, requiring only minor adjustments.

> **Req.08** Pilot deployment must be consistent with the broadcasters' production workflow.

8.4.3. Service distribution requirements

8.4.3.1. Quality of service

The main requirement concerning service distribution has to do with the video quality that the user experiences. Cable users will naturally want the highest bitrate available, since their connections can afford the high bandwidth required. However, their requirements have to be

balances against the needs of users with less or bitrate-fluctuating connections, which require lower bitrates. This balancing of needs must not put too much of a strain on the exploitation department's resources.

> *"The best outcome for me would be to just launch a stream. And not have to worry about delivering different qualities, about the infrastructure that must be in place around the world so that people can connect to the closest server, and so on." (A)*

> *"One thing that has to do with quality that I think that should be more transparent is all about adaptative streaming. This already exists, you can stream in more than one quality and depending on the available bandwith, you get one quality or the other. […] This depends that we generate all these qualities, and this should be transparend and seamless: we should publish all that content and the network should handle the bitrates, the connection, etc., depending on the user." (A)*

A CDN that implemented adaptive streaming can be considered an optimal solution. Such a system would automatically adjust the video streaming bitrate to deliver to the user the best possible quality that the broadband connection can manage, without visualisation interruptions. This system should be transparent to the end user (no additional actions or even awareness of the system must be demanded from the end user).

> *"It should be possible to get much more user feedback on the quality of the service, because there are technological possibilities to do so. But it is still very difficult to know what is truly going on on the other side." (A)*

> *"I believe this is a really important matter so that we can have a progress here: to be able to get clear and reliable metrics on the quality of the experience with contents that we are delivering through the Internet, and clear and reliable metrics on what kind of usage patterns do people have of these contents. […] This way we would truly have a feedback we can rely on. People could just press a button from their homes and say "I'm watching it fine", "I'm not receiving it good enough", "I like this content, I don't like these other", "Improve this, improve that", and so on. All these are important pieces of information that we could get" (B)*

Another demand related to the quality of service that the user is actually experiencing is that of efficient feedback gathering systems. User feedback is essential to determine the degree of success of the pilot services, and mechanisms to gather and analyse it effectively must be in place before the pilot starts. Automated quantitative methods such as an on-screen questionnaire, that pops up on the user after viewing a show, could deliver the kind of monitoring and validation data needed in a cost-effective way.

Req.09 Deliver the best possible bitrate quality that each user's connection can afford.
Req.10 Enable adaptive streaming to maximise the user experience with the service in the most efficient way.
Req.11 Create an on-screen questionnaire to evaluate the user experience with the service.

8.4.3.2. Other content distribution network requirements

Another requirement related to distribution has to do with the role of content distribution networks in managing geolocalised content restrictions.

> *"A really important issue for us is geolocalised content. There are contents (such as football matches) that, because of contractual obligations, can only*

be delivered within Catalonia's or Spain's borders. At the state level this is a simple proposition, since it is easy to check which IPs belong to which state. However, at the Catalan level this is been really difficult to achieve so far, because sometimes people from Tarragona [within Catalonia] are connected to an ISP which is in Castelló [neighboring region outside Catalonia]. Then, the system blocks them out, because it believes these users are actually outside Catalonia. [...] In the IPTV of the future, these issues should be dealt with efficiently and transparently." (A)

Whenever geographically restricted contents are considered for inclusion in the pilot, these important legal matters should be dealt with efficiently.

> **Req.12** Manage content distribution to comply effectively with geolocalised broadcast rights contracts.

8.4.4. Audience analysis and business requirements

8.4.4.1. User segmentation

The transition from conventional TV channel broadcasting to HbbTV has brought new challenges for audience analysts. Paramount among these is the new patterns of user behaviour related to multi-device audiovisual content consumption. New technological possibilities enabled by ultra-fast mobile Internet and powerful handheld devices mean that users are no longer consuming contents on one device (the TV) at one location (the living room), but are now empowered to watch programmes at all times and at all locations. Although this transition has opened up new markets for the delivery of audiovisual contents and increased user satisfaction, it has led to the problem of the identification of unique users that consume content on several technological platforms.

> *"The paramount problem we're facing right now is the identification of unique users that are watching contents on several devices. [...] It is no longer enough with analysing a user's behaviour on connected TV: we must know as well that user's content consumption patterns on handheld devices, on PCs, and on other TV sets in other locations, for example the user's summer or weekend house." (B)*

> *"In the end, the crux of the whole issue is the following: what is the user's behaviour regarding audiovisual content consumption through all devices and all technologies available to him? User behaviour in conventional TVs is already more or less well covered with the data that we can gather through DTT technology, but nowadays this user is also using second screens, and whatsapping and tweeting with his friends while watching TV shows." (B)*

Thus, it becomes clear that there is a need for refined tools for audience professionals to analyse the user's content consumption behaviour across multiple devices. It must be possible for audience analysts to segment users according to several variables, including quality of connection, type and model of receiver, and user profile (age, sex, location, and so on).

> **Req.13** Enable segmentation of users by bandwidth for audience analysis.
> **Req.14** Enable segmentation of users by device for audience analysis.
> **Req.15** Enable segmentation of users by socio-demographic variables and consumption patterns for audience analysis.

8.4.4.2. Audience analysis

Another audience analysis requirement has to do with the difficulty of keeping track of the several streams of user behaviour data related to each device.

> "We've got Flash streams, Apple smartphones, Windows smartphones, HbbTV sets… we've got a whole carrousel of separate monitoring systems for each and every existing device. This really complicates keeping track of all the information." (A)

> "Nowadays, when we are talking audiences we cannot just constrain ourselves to one device, because we have television sets, smartphones, tablets, laptops, and so on. And at the end of the day, regarding audience analysis, what it really boils down to is user behaviour, and how these users visualise content though the means of one huge multi-device audiovisual system. [...] So, at the audience analysis level, what we really would want to achieve is the identification of each unique user through this multi-device system." (B)

> "Those complexity levels we do not know where they will go, but we should suppose that it will go towards a system that is less technically complex. Solutions should be found that simplify the system and lower costs, for pure efficiency reasons." (B)

> "Another complex project is how to monetise advertising on the Internet, which is not that well paid, even though it is growing steadily. In the TV business itself, advertising is highly structured and payment for watching is well known." (D)

An effective integration of these currently separate systems for the monitoring of content consumption would be an important step towards solving the problem of the identification of unique users across multiple platforms. This has important implications for advertising revenue, because these are linked to the broadcaster's ability to report reliable audience figures to the advertisers.

> **Req.16** Enable the tracking of the content consumption of each unique user across multiple devices.
>
> **Req.17** Enable the collection and analysis of all audience related data in a single system that encompasses all devices.

8.4.5. HbbTV technology dissemination

8.4.5.1. End user promotion

A precondition for the success of innovative HbbTV applications is that end users learn about the qualities of this technological offering.

> "We must find a way to convince users that, beyond buying the HbbTV set just because it's the latest in the market, they must enable the wifi connection and perform a series of steps that might not be easy for some users." (D)

> "From the user point of view, it is quite difficult to understand differences between HbbTV and other IP TV services. […] from that point of view HbbTV is an opportunity, because it goes like "look, content that you watch on TV3 you

can keep watching in the same channel, just pressing here on the HbbTV button" (D)

"Clearly on demand connected TV will continue growing, but if it's going to be HbbTV or other propietary technologies is still to be seen. If we play our cards well we can have HbbTV winning this game which is the one beneffiting us the most." (D)

"I think that a task that we must accomplish successfully if we want HbbTV to be a success is to design very agile navigations at the user experience level […] Things are easy for users when the applications' behavior is expected, and well-known patterns are applied […] So the bottom line is: we must have lots of exciting contents to lure users, but find a way to navigate through this content that is not keyboard-based." (D)

This is an important requirement to ensure sufficient adoption of the HbbTV services resulting from the pilot. A multi-pronged strategy was suggested as the most appropriate for this task, including direct promotion and advertising of HbbTV services, focusing HbbTV application development on the broadcasters' most attractive contents, and ensuring that once users are willing to try HbbTV out, their quality of experience is enhanced by a carefully designed navigation and control system which facilitates the browsing of contents.

Req.18 Promote HbbTV services among end users.
Req.19 Produce an interesting supply of contents for HbbTV to enhance its attractiveness.
Req.20 Design a navigation and control system which is consistent with the users' expectations.

8.4.5.2. Professional promotion

From the broadcaster's point of view, the HbbTV standard is more interesting than other manufacturer-led systems. This is so because these proprietary systems often highlight pay-per-view contents and channels (of which they get a percentage of revenue) in their navigation designs, relegating HbbTV applications to positions of lesser visibility.

"We are experiencing some problems with the linking of both worlds. On the one hand, there is a production world which has a tendency to overlook the interactive and web-based side of the story. They tell you "this is not our business, our business is making good TV programmes". And then, on the other hand, there is an interactive TV world which does not fully grasp why is it in our best interest as public broadcasters to promote an HbbTV standard" (D)

"The main problem with interactive TV is that we have to convince internal stakeholders of the differences between one tech and the other, for instance, between HbbTV and a propietary SONY or Samsung system. Convincing people about the need of a broadcaster to go to open standards is something very difficult, we have to promote that because not everybody thinks like that." (D)

"The reservations that you may encounter with journalists, for instance, are how to convince them that HbbTV should be their priority as well. Because they are truly motivated to do their best in their jobs, but their concerns regarding innovative technology are more focused on issues such as how can technology help them to be the first to cover a particular news story. […] But if you explain to them well enough, they understand the opportunities that HbbTV opens up for them too." (D)

This suggests that HbbTV should be actively promoted in professional circles as well, including internal and external stakeholders. Specifically, an important goal is that content producers from the broadcasting partners become knowledgeable about the possibilities of Interactive TV in general, and of HbbTV applications in particular.

Req.21 Promote HbbTV technologies among professionals.
Req.22 Make it easy for content producers to publish contents in IP distribution channels.

8.4.6. Table of user stories

As a finishing step in the first iteration of user research, the results obtained from the requirements analysis of the generated data were formalised as a set of user stories. Some of the most feasible and interesting of these stories will be further elaborated and will inform the development of the pilot's HbbTV applications and services. The present section describes these stories in detail.

8.4.6.1. HbbTV application development and testing

User story	*As a developer, and as an end-user of the pilot, I need a receiver with HbbTV 1.5 support for MPEG-DASH streaming*
Category/topic/context	*HbbTV application development and testing*
Owner(s)/contacts	*Developers and end-user of pilots*
Abstract	*Obtain receivers that implements HbbTV 1.5, which will allow the implementation of streaming services based on MPEG-DASH Protocol.*
Detailed description	*In order to implement the services defined in the Spanish Pilot, we need to obtain receivers that implements HbbTV 1.5. This version of the HbbTV specification includes the use of MPEG-DASH protocol, which includes the required features for live streaming and adaptive streaming.*
Justification for inclusion	*This kind of receiver enables the new kind of services proposed.*

User story	*As a developer I need better tools for development and testing of HbbTV apps to increase productivity*

Category/topic/context	HbbTV applications development and testing
Owner(s)/contacts	App Developers
Abstract	Set the necessary environment and tools to enable developers to create and test the HbbTV applications of the project more effectively.
Detailed description	In order to create and test more effectively the HbbTV applications of the project it is necessary for developers to establish the appropriate environment that should include the tools for the following purposes: - Text editor for code development. It should include the appropriate facilities modules for programming (CE-HTML, JavaScript, Ajax…) - Debug environment on PC for quick development. It should be browser-oriented and should include facilities equivalent to Safari Webkit and Chrome Inspector. - Testing environment on TV set. It should allow validating the HbbTV applications on real TV sets.
Justification for inclusion	Solving this story will accelerate the development, and it will allow focusing on creative issues. The solution of this story is also applicable to future HbbTV developments, so it will reduce future investment requirements.

User story	As an end-user of the pilot I would like to switch between multicamera views as quick as possible
Category/topic/context	HbbTV applications development and testing
Owner(s)/contacts	Production staff, Developers
Abstract	Provide HbbTV multicamera services with the necessary mechanisms to assure a quick switch between different streamings for a good user experience.
Detailed description	An HbbTV multicamera service allows the user to switch to the desired video view at any moment. In order to obtain a good user experience the different video views shall be synchronized and the switch between views shall be quick

	enough. The views synchronization is an issue that should be resolved by de production staff in charge of the content generation and the staff in charge of the encoding. For the switch implementation, the application developer shall implement the necessary API calls to manage it. Some verification test with different encoder parameters should be perform in order to minimize the switch time between streams and obtain the best user experience.
Justification for inclusion	This is essential for the implementation of multicamera services at an acceptable level of satisfaction for the user. If the user experience is not good enough, the service could be rejected.

User story	As a developer I need to test the developments on a park of receivers for assuring interoperability
Category/topic/context	HbbTV applications development and testing
Owner(s)/contacts	App developers
Abstract	Test the HbbTV service developments on a pool of different receivers (manufacturer and models) in order to assure the interoperability of the solution.
Detailed description	Although the HbbTV standard is intended to offer solutions that work fine in different devices, actually little differences between manufacturer's implementations leads to different behaviours of the applications. To assure the interoperability of the proposed solutions, it is necessary to test it across a widest range of receivers, and modify the application to avoid the problems detected in some specific devices.
Justification for inclusion	Assuring device interoperability of the solution allows achieving a wider audience.

8.4.6.2. Production requirements

User story	As a developer I need a live mosaic video for creating a content selection menu in multicamera services

Category/topic/context	Production requirements
Owner(s)/contacts	*Broadcasters - Production chain staff*
Abstract	*Generate a mosaic video that joins the available inputs of a multicamera production to provide the HbbTV application with a way to implement a content selection menu.*
Detailed description	*An HbbTV multicamera service needs a visual way to present to the end-user a content selection menu. The current HbbTV 1.5 specification does not allow playing more than one stream simultaneously, and this functionality is not expected in the HbbTV 2.0 specification.* *This use case proposes an alternative method by generating a mosaic video that joins the available inputs of a multicamera production. The HbbTV application could overlay the necessary visual elements to implement a content selection menu. The selected content could be played using a zoom effect over the mosaic video or/and tuning and independent streaming. The transition should be as quick and seamless as possible.*
Justification for inclusion	*This is important for the professional side of the implementation of multicamera services, and allows for the introduction of new kind of service that could attract more audience.*

User story	**As a broadcaster I need to deploy the pilot in a production environment**
Category/topic/context	*Production requirements*
Owner(s)/contacts	*Broadcasters - Production chain staff*
Abstract	*Deployment of the services defined in the pilot over the production environment of the broadcaster.*
Detailed description	*Once the pilot services are ready, the broadcaster has the need to integrate any successful services into its production and emission infrastructure. This story requires commissioning and deploying the required hardware, spaces, staff and workflow for the exploitation of the new HbbTV services.*

Justification for inclusion	*This integration is a previous necessary step for exploiting and taking profit from the new services.*

8.4.6.3. Service distribution requirements

User story	***As an end-user I need the best possible video quality that my network connection can support***
Category/topic/context	*Service distribution features*
Owner(s)/contacts	*Broadcasters, CDN*
Abstract	*Provide video services based on adaptive streaming in order to offer to the end-user video services that automatically are adapted to the real bandwidth available, always showing the best possible quality. The maximum quality will be HD video content.*
Detailed description	*The best video quality that an end-user could dispose is largely determined by the bandwidth of his network connection, which could be variable in time. The HbbTV video services proposed in this pilot aims to be HD quality, but the video streaming shall degrade its quality without disrupting the viewing when the available bandwidth is not enough. As a solution, this story proposes the use of the features for adaptive streaming included in the MPEG-DASH protocol.* *Besides bitrate, other parameters such as resolution shall be considered and tested for choosing the degraded-quality streamings.*
Justification for inclusion	*Adaptive streaming allows distributing the service over a greater audience group, since low-bandwidth users will nevertheless enjoy the content without disruptions.*

User story	***As a broadcaster I need to transparently distribute my streaming contents through the internet agents to the end-users***
Category/topic/context	*Service distribution features*

Owner(s)/contacts	*CDN and Anella staff*
Abstract	*Verify the transparency of the internet agents, the CDN and the Anella, with the distribution of the streaming contents of the project.*
Detailed description	*The pilot includes video services with HD content, multicamera views and adaptive streamings. The distribution of these contents from the broadcaster to the end-user goes across the infrastructures of the internet agents: the CDN for users with ADSL connection and the Anella for professional users. This story aims to validate that the distribution is done transparently through the internet agents' infrastructure.*
Justification for inclusion	*This story is necessary for assuring viability of the new services, validating that such a service can be deployed effectively.*

8.4.6.4. Audience analysis and business requirements

User story	*As an audience analyst I need a network connection segmentation of the pilot users for analysing the user experience of each segment*
Category/topic/context	*Analysis of results*
Owner(s)/contacts	*Broadcaster - Marketing department*
Abstract	*Segmentation of the users that form part of the pilot following as a criteria the quality of their network connection for later analysis of user experience in each segment.*
Detailed description	*Despite the Spanish pilot aims to be a High Quality video service, users could receive a degraded quality according to the available bandwidth of their network connection. In order to avoid disparity, the user experience analysis that has to be performed after the pilot needs to process the user data separately in groups of users with similar network connections. For this reason this story proposes the segmentation of the pilot users according to the criteria of network connection quality.*
Justification for inclusion	*Measurement of the user experience and the service acceptance is essential to analyse the new service's real*

	impact.

User story	*As an audience analyst I need the detection of the device and real bandwidth of user's connections for segmentation and analysis of user experience*
Category/topic/context	*Analysis of results*
Owner(s)/contacts	*Broadcaster - Marketing department*
Abstract	*Provide a method to detect the device used by the user during the access to the service, and also a way for determining the available connection bandwidth.*
Detailed description	*The user experience analysis that has to be performed after the pilot could report confusing information if it simply mix all the data, due to the fact that the best possible user experience could be limited by the quality of the network connection and/or by the used device. This story proposes collect the connection information about device and available bandwidth for performing segmentation of tracking data.*
Justification for inclusion	*Measurement of the user experience and the service acceptance is essential to analyse the new service's real impact.*

User story	*As an audience analyst I need tracking of the application for statistical analysis of usage*
Category/topic/context	*Analysis of results*
Owner(s)/contacts	*Broadcaster and app developers*
Abstract	*Provide tracking information about the use of the application in order to perform a statistical analysis.*
Detailed description	*The broadcaster has the need to know the usage of the service for technical planning and also for marketing and advertisement issues. This history proposes that the app developers implement the tracking functions defined by the*

	broadcaster's staff.
Justification for inclusion	*Measurement of the user experience and the service acceptance is essential to analyse the new service's real impact.*

8.4.6.5. HbbTV technology dissemination

User story	***As a broadcaster I need to disseminate the concepts of HbbTV technology over the production chain staff***
Category/topic/context	*HbbTV technology dissemination*
Owner(s)/contacts	*Broadcasters*
Abstract	*The broadcasters should perform the necessary dissemination actions about HbbTV technology to internal staff related with the production chain in order to foster the creation of content that takes advantage of this technology.*
Detailed description	*The broadcasters should perform the necessary dissemination actions about HbbTV technology over the staff related with the production chain in order to foster:* *- Creation of program's additional content distributed through HbbTV applications.* *- Creation of applications customized for each TV channel.* *- Production of programs that take advantage of the multicamera transmission developed in this project.*
Justification for inclusion	*Greater acceptance and awareness of HbbTV possibilities among production chain staff will allow new ways to distribute content.*

User story	***As a broadcaster I need promotion of HbbTV services to the end-users***
Category/topic/context	*HbbTV technology dissemination*
Owner(s)/contacts	*Broadcasters*
Abstract	*The broadcasters should perform the necessary promotional actions to disseminate the presence of the HbbTV services to*

	the audience.
Detailed description	*In order to make the audience know about the presence of the HbbTV services, the broadcaster should perform some promotional actions such as:*
	- Presentation of HbbTV service in own programs (news, magazines…)
	- Promos through the own TV channels.
	- Promotional actions in other related distribution channels (web, radio, press…).
	The goal to achieve with this promotional actions is to have the audience know that:
	- They can get attractive content from the broadcaster with HbbTV services.
	- Their TV sets support the broadcaster's HbbTV services, not only the manufacturer 'Smart TV' services.
Justification for inclusion of use case	*The promotion will increase the market penetration and audience of the new service.*

8.5. Conclusions

The user research actions performed in this first iteration of professional requirements gathering have led to the identification of a set of important requirements for the deployment of the TV-RING pilots and, more generally, of innovative HbbTV applications and services. Among these, a few recommendations stand out, such as implementing a CDN that delivers contents with an efficient and transparent adaptive streaming system, enabling the identification of unique users across multiple platforms, and heightening awareness of the qualities of HbbTV technology *vis-à-vis* its competitors. If these issues can be tackled or mitigated to a great extent, the barriers for a successful takeoff of HbbTV will have been significantly lowered.

8.5.1. List of User Requirements

Req.44	Make receivers with MPEG-DASH streaming available for the pilot.
Req.45	Make more productivity tools available to HbbTV application developers.
Req.46	Develop a solution for the sharing of HbbTV software modules.
Req.47	Make HbbTV applications compatible with browser implementations, including HTML5.
Req.48	Make switching between multicamera views as quick as possible.
Req.49	A wide range of HbbTV receivers must be available for the pilot.

Req.50 Develop a live mosaic video to ease work on a content selection menu.

Req.51 Pilot deployment must be consistent with the broadcasters' production workflow.

Req.52 Deliver the best possible bitrate quality that each user's connection can afford.

Req.53 Enable adaptive streaming to maximise the user experience with the service in the most efficient way.

Req.54 Create an on-screen questionnaire to evaluate the user experience with the service.

Req.55 Manage content distribution to comply effectively with geolocalised broadcast rights contracts.

Req.56 Enable segmentation of users by bandwidth for audience analysis.

Req.57 Enable segmentation of users by device for audience analysis.

Req.58 Enable segmentation of users by socio-demographic variables and consumption patterns for audience analysis.

Req.59 Enable the tracking of the content consumption of each unique user across multiple devices.

Req.60 Enable the collection and analysis of all audience related data in a single system that encompasses all devices.

Req.61 Promote HbbTV services among end users.

Req.62 Produce an interesting supply of contents for HbbTV to enhance its attractiveness.

Req.63 Design a navigation and control system which is consistent with the users' expectations.

Req.64 Promote HbbTV technologies among professionals.

Req.65 Make it easy for content producers to publish contents in IP distribution channels.

8.5.2. List of User Stories

HbbTV application development and testing

- As a developer, and as an end-user of the pilot, I need a receiver with HbbTV 1.5 support for MPEG-DASH streaming.
- As a developer I need better tools for development and testing of HbbTV apps to increase productivity.
- As an end-user of the pilot I would like to switch between multicamera views as quick as possible
- As a developer I need to test the developments on a park of receivers for assuring interoperability.

Production requirements

- As a developer I need a live mosaic video for creating a content selection menu in multicamera services.
- As a broadcaster I need to deploy the pilot in production environment.

Service distribution requirements

- As a broadcaster I need to deliver the best possible video quality that the user's network connection can support.
- As a broadcaster I need to transparently distribute my streaming contents through the internet agents to the end-users.

Audience analysis and business requirements

- As an audience analyst I need a network connection segmentation of the pilot users for analysing the user experience of each segment.
- As an audience analyst I need the detection of the device and real bandwidth of user's connections for segmentation and analysis of user experience.
- As an audience analyst I need tracking of the application for statistical analysis of usage.

HbbTV technology dissemination

- As a broadcaster I need promotion of HbbTV services to the end-users.
- As a broadcaster I need to disseminate the concepts of HbbTV technology over the production chain staff.

9. Combined Requirements

During the first plenary meeting in Munich on 18 and 19 December, a workshop was held to combine the results from the three pilots. The workshop was attended by at least one representative from each institution. There were fifteen people in total of which 7-8 people actively participated at any given time.

9.1. Aggregation

The basic set of questions used by all the pilots was the same for each pilot and is listed in section 6.1. However there was a difference in the type of professional users each pilot interviewed. This was due to practical reasons (availability of and access to the professional users) as well as a difference in focus topics between the pilots. The Dutch pilot included four broadcasters where the Spanish and German Pilots focussed more on the technical and analytical professionals that work with interactive TV. To end up with a unified end result that could be easily benefited from by all three pilots, the end result for each pilot was structured in the same way. All pilots extracted a set of requirements and more formal use cases from the data they had gathered. These requirements and use cases can be found in the respective pilot sections.

The procedure to aggregate the professional user requirements from the three pilots was similar to that of the internal workshop of the Dutch Pilot as described in section 6.3 of this deliverable. The exact procedure was as follows:

9.1.1. Procedure

The professional user requirement subcategories that were discovered in the three pilots were printed and cut into individual snippets. These snippets were then divided among the workshop participants. They were asked to go through the following procedure:

- Step 1: Free Clustering
    - Take your 'snippets' and place them with other related snippets
    - If there are no related snippets yet place it on its own
- Step 2: Challenging/ Reclustering
    - Everyone gets a chance to argue why a certain snippet belongs with a different cluster of related snippets
    - Alternatively if a snippet features multiple clusters a duplicate can be made
    - It is also possible to merge or split clusters
- Step 3: Final Labeling
    - When everybody is happy with the clustering, come up with a appropriate name/label for each cluster

9.2. Results

The result is the final clustering that originated from the workshop. The main and subcategories have the names that were agreed upon during the workshop. The requirements

that make up the subcategories are the results from the individual pilots. The letters behind the requirements indicate from which user research they originate. The 'D' indicates a requirement from the Dutch pilot, 'G' indicates a requirement from the German pilot and 'S' indicates a requirement from the Spanish pilot. The topic of each category is briefly discussed. This discussion also looks at the differences and similarities between the three parties. Were requirements regarding the topic discovered in all three and if not is there an explanation for this. More details about each of the requirements can be found in the relevant chapters describing the results of the indicated pilot.

9.2.1. Business

Business involves all the internal processes for the broadcasters and app developers. On the one hand they are concerned with the end-user of interactive TV through marketing and audience analyses. On the other hand it is also important to have a high level of internal engagement and good internal communication.

In the workshop one snippet was found to be an overarching requirement in the business category:

- *Financial aspects of Development, expensive for relatively small audience (D)*

This snippet was based on the Dutch 0: "Because of the relatively small number of interactive TV users, applications should be cost effective." This requirement did not directly come up in the other pilot interviews the reason is probably that they interviewed technical professionals who deal more with technical feasibility and less with program budgets. During the workshop however all parties agreed that the main difficulty from a business point of view is that production costs are high in comparison to the relatively small audience.

Overall Requirement 01:	Because of the relatively small number of interactive TV users, it is crucial that broadcasters, program makers and app developers work together to make Interactive TV applications be cost effective.

9.2.1.1. Marketing

In the workshop the following three snippets were added to the marketing subcategory:

- *Promotion/Reach, promotion is crucial (D)*
- *Market (for end users), more research needed (D)*
- *As a broadcaster I need promotion of HbbTV services to the end-users. (S)*

These snippets deal with both promotion of current interactive TV apps as well as market research to estimate the potential interactive TV market and its wishes. In the Dutch pilot Req.09 and Req.11 represent this category. From the Spanish results Req.18 deals with marketing. There were no requirements directly related to marketing in the German requirements but this can again be attributed to the technical background of their interviewees. From both the Spanish and the Dutch results it is clear that from a professional user point of view promotion for interactive TV is indispensible and care should be given to market research.

Overall Requirement 02:	Because interactive TV is still relatively new, not very common, or well known by end-users, promotion for interactive TV apps is essential for these apps to succeed.
Overall Requirement 03:	The market for interactive TV use is not well known. Therefore more market research is necessary.

9.2.1.2. Internal Engagement

During the workshop Internal Engagement emerged as a large category. It contains the following snippets that deal with communication between the different parties involved in the production of interactive TV as well as the priority or lack thereof that is given to interactive TV within parties. Due to the relatively small audience it is sometimes hard to get all departments in a company fully engaged in interactive TV development.

- *Expectations: A general HbbTV awareness within the departments (G)*
- *Communicating and interfacing (G)*
- *As a broadcaster I need to deploy the pilot in production environment. (S)*
- *Program Makers, communication with app makers important (D)*
- *As a broadcaster I need to disseminate the concepts of HbbTV technology over the production chain staff. (S)*
- *Less time available for HbbTV work (G)*
- *HbbTV work is inferior to efforts for other services (G)*

All three pilots discovered requirements related to this category. This clearly shows its importance. The following requirements from the individual parties are relevant: Req.18,Req.15, and Req.21. From these we infer the following overall requirements:

Overall Requirement 04:	For interactive TV development to succeed, there is a need for good communication between broadcasters program makers and app developers.
Overall Requirement 05:	For interactive TV development to succeed, it is important that engagement is high for all involved departments.

9.2.1.3. Audience Analysis

Audience Analysis is the last subcategory of the Business category. It mainly deals with the analysts requirements for data from the interactive TV system to be properly gathered.

- *Expectations: Proper test environment (G)*
- *As an audience analyst I need tracking of the application for statistical analysis of usage. (S)*
- *As an audience analyst I need a network connection segmentation of the pilot users for analysing the user experience of each segment. (S)*
- *As an audience analyst I need the detection of the device and real bandwidth of user's connections for segmentation and analysis of user experience. (S)*

There were no requirements from the Dutch pilot that match this category. This is probably because they interviewed no analysts or other professional-users responsible for the gathering of usage data. From the German and Spanish requirements the following are related to this category: Req.03, Req.13, Req.14, Req.15, and Req.16. This subcategory results in the following overall requirements:

Overall Requirement 06:	To analyse the usage of interactive TV, it is essential to create an infrastructure that makes it simple to gather all relevant data.

9.2.2. UX

User experience includes everything that has an influence on the end users' experience with using the interactive TV app. With the rise of multiple screen use when watching television, keeping users engaged is no simple feat. Design, features and content for interactive TV apps have to be very good and well balanced to keep the viewers' attention.

An overarching point here is the disappearing difference between on-demand and live broadcasts for end-users.

- *Ondemand vs Live, line gets blurred (D)*

This snippet came from the Dutch interviews and the related requirement is Req.12. For the broadcasters that were interviewed it was important that for end-users it wont make any difference if they are watching on demand or live streams. There were no relating requirements in the other pilots but it was still deemed as an important issue for the end-users experience.

Overall Requirement 07:	Whether content is live or on demand, this should not make a difference for the end-user's experience.

9.2.2.1. User Engagement

This sub-category holds the snippets that deal with issues professional users deem important for the end-user to get engaged with interactive TV. The snippets come mainly from the Dutch pilot but there is also a snippet from the Spanish. The relevant requirements are <list>

- *Social, communication (D)*
- *Multiscreen, merging vs battle for attention (D)*
- *Group Interaction, stimulate it (D)*
- *Engagement (short and long term) (D)*
- *Personalisation (for different groups) (D)*
- *Age (of users), reach out to younger users, include older users (D)*
- *As an end-user I would like to switch between multicamera views as quick as possible (S)*

The requirements to take away from this category are: Req.08, Req.10, Req.23, **¡Error! No se encuentra el origen de la referencia.**, Req.27, and Req.05

Overall Requirement 08:	Stimulate interaction between viewers in the same room and through social networks to get viewers more engaged.
Overall Requirement 09:	Offer interaction within the app to get users more engaged (this works the best with quiz shows or by adding quiz elements to non fiction shows but can also be in the form of stream selections).
Overall Requirement 10:	Create a good second screen experience to enhance attention to the first screen.

9.2.2.2. Design

Design consists of just two snippets the questions for this first round of professional-user requirements gathering dealt with interactive TV on a high level. This is the reason why detailed design of apps was not mentioned often. Design is a category that would be well suited for extra research in the second iteration once there is a clear direction for the prototypes.

- *Design, where to put the information (D)*
- *Usability, ease of use (D)*

From the two snippets that are related to requirement Req.22 the following overall requirement can be extracted.

Overall Requirement 11:	Ease of use in both discovery and accessibility is essential for any second screen experience for any second screen app.

9.2.2.3. Content

Content is about the content of the interactive TV app. When it comes to interactive TV certain program genres to combine better (easier) with interactive TV. Respective genres also require different interactive content for the end-user. All these snippets came from the Dutch interviews because both app makers and broadcasters from those interviews have been directly involved in content creation.

- *Genre: Fiction, difficult attention and adaptivity wise (D)*
- *Genre: Non-Fiction, works well (D)*
- *Genre: Gameshow/Competition, seems to work well (D)*

These snippets are related to the following requirements: Req.19, Req.20, Req.21.

The overall requirement to take away is:

> **Overall Requirement 12:** When creating interactive TV apps be very aware of the programs genre and adapt your setup and content accordingly.

9.2.3. Engineering

Engineering is about the technical issues and challenges when creating interactive TV apps. It includes concerns for the backend and the front end as well as protocols and standards that are important issues in both.

9.2.3.1. CMS

CMS's were a topic that came back in all pilots. It is a large subcategory within the Engineering category. CMS's are considered to be essential tools, they have to work flawlessly to assure smooth functionality within the apps. When made available to program makers by app developers they can also be used by the program makers to update their content themselves. This has the benefit that it reduces costs because content updates do not have to pass through app makers and it enhance quality because program makers know which content fits their programs the best.

- *Tools: XML file formats (G)*
- *Expectations: Up-to-date CMS (G)*
- *Tools: Content Management Systems for web pages (G)*
- *Standard compliant tools (G)*
- *Tools: Web-based editors (G)*
- *Monitoring - adding, checking, updating and correcting data (G)*
- *As a developer I need a live mosaic video for creating a content selection menu in multicamera services. (S)*
- *CMS (content management systems), easy content addition (D)*

Individual pilot requirements that are related are: Req.02, Req.08, Req.09, and Req.07.

> **Overall Requirement 13:** It is crucial for CMS's providing data for interactive TV applications to be failsafe and reliable.
> **Overall Requirement 14:** It is essential to have easy to use CMS systems so program makers can add content to apps themselves thereby reducing costs and enhancing quality.

9.2.3.2. Protocols

Snippets on protocols all came from the Spanish pilots. Protocols are however related to standards, which were mentioned in both the German and Dutch pilots. The snippets in the protocol category stress the importance of access to equipment that complies with the different protocols in existence.

- *As a developer, and as an end-user of the pilot, I need a receiver with HbbTV 1.5 support for MPEG-DASH streaming. (S)*
- *As a developer, and as an end-user of the pilot, I need a receiver with HbbTV 2.0 support for Companion Screen functionality. (S)*
- *As a developer I need better tools for development and testing of HbbTV apps to increase productivity. (S)*
- *As a developer I need to test the developments on a park of receivers for assuring interoperability. (S)*

Related requirements form the Spanish interviews are: Req.01, and Req.06

Overall Requirement 15:	*It is important to have access to a wide range of devices for app developers and for pilot implementations.*

9.2.3.3. Standards

Standards are a very important topic in any emerging field. This category has snippets from the Dutch and the German pilots but there are snippets from the Spanish interviews in the related Protocols subcategory. Having standards that are widely used increases efficiency through reuse and being able to focus on one or two platforms instead of many. It also improves the ability to share knowledge.

- *Smart TV, difficult due to lack of standards (D)*
- *Tools: Standard compliant, HbbTV-enabled TV sets (G)*
- *Synchronisation, options not yet sufficient (D)*
- *Standards (interactive TV/ mobile devices) (D)*
- *Standard compliant end devices (D)*

These snippets are related to the following requirements: Req.14, Req.16, and Req.12.

Overall Requirement 16:	HbbTV end devices must be standard compliant.
Overall Requirement 17:	Standards are necessary for further interactive TV development.

9.2.3.4. Technical Performance

The snippets in this subcategory mainly deal with technical issues that can have a severe impact on the end-users experience of interactive TV. The issues are mainly related to the infrastructure needed to provide end-users with stable high-quality signals. Snippets from all pilots are present stressing the importance of a good delivery infrastructure.

- *Scalability, important issue, load (D)*
- *Expectations: Direct access to DVB parameters (G)*
- *Planning and management of HbbTV services (G)*
- *Passthrough (for delivery) (D)*
- *Expectations: Fail-safe HbbTV and data base servers (G)*
- *As an end-user I need the best possible video quality that my network connection can support. (S)*

- *As a broadcaster I need to transparently distribute my streaming contents through the internet agents to the end-users. (S)*

These snippets are related to the following requirements: Req.06, Req.15, Req.04, Req.11, Req.13, Req.09, and Req.12.

Overall Requirement 18:	Enable adaptive streaming to maximize the end-user's experience with the service in the most efficient way.
Overall Requirement 19:	For HbbTV to succeed, it is important for the HbbTV signal to be freely distributed by all cable companies.

9.2.3.5. Front End App Development

Front-end development is very closely related to design from the UX category. It deals with the same issues but from a more technical point of view the tools used for front-end development by professional users, have to be user friendly just like end-user apps..

- *Expectations: High-performance HbbTV applications and end devices (G)*
- *App Development, robust and user friendly (D)*

These snippets are related to the following requirements: Req.03, Req.20.

Overall Requirement 20:	Development tools must integrate standardized and consistent user interfaces.

9.3. List of Combined User Requirements

Overall Requirement 01:	Because of the relatively small number of interactive TV users, it is crucial that broadcasters, program makers and app developers work together to make Interactive TV applications be cost effective.
Overall Requirement 02:	Because interactive TV is still relatively new, not very common, or well known by end-users, promotion for interactive TV apps is essential for these apps to succeed.
Overall Requirement 03:	The market for interactive TV use is not well known. Therefore more market research is necessary.
Overall Requirement 04:	For interactive TV development to succeed, there is a need for good communication between broadcasters program makers and app developers.
Overall Requirement 05:	For interactive TV development to succeed, it is important that engagement is high for all involved departments.
Overall Requirement 06:	To analyse the usage of interactive TV, it is essential to create an infrastructure that makes it simple to gather all relevant data.
Overall Requirement 07:	Whether content is live or on demand, this should not make a difference for the end-user's experience.
Overall Requirement 08:	Stimulate interaction between viewers in the same room and through social networks to get viewers more engaged.
Overall Requirement 09:	Offer interaction within the app to get users more engaged (this works the best with quiz shows or by adding quiz elements to non-fiction shows but can also be in the form of stream selections).

Overall Requirement 10: Create a good second screen experience to enhance attention

Overall Requirement 11: Ease of use in both discovery and accessibility is essential for any second screen experience for any second screen app.

Overall Requirement 12: When creating interactive TV apps be very aware of the programs genre and adapt your setup and content accordingly.

Overall Requirement 13: It is crucial for CMS's providing data for interactive TV applications to be failsafe and reliable.

Overall Requirement 14: It is essential to have easy to use CMS systems so program makers can add content to apps themselves thereby reducing costs and enhancing quality.

Overall Requirement 15: It is important to have access to a wide range of devices for app developers and for pilot implementations.

Overall Requirement 16: Development tools must integrate standardized and consistent user interfaces.

Overall Requirement 17: Enable adaptive streaming to maximize the end-user's experience with the service in the most efficient way.

Overall Requirement 18: For HbbTV to succeed, it is important for the HbbTV signal to be freely distributed by all cable companies.

Overall Requirement 19: HbbTV end devices must be standard compliant.

Overall Requirement 20: Standards are necessary for further interactive TV development.

10. Dutch Pilot Refined Requirements

For the second round of professional user requirements gathering, we wanted to delve deeper into the specific concept for one of the Dutch pilots namely a second screen companion app, that has quiz/game elements accompanying a program that is not a quiz or game itself.

To do this we were interested in interviewing people from all the parties involved creating a TV show and its companion app.

Goal of the interviews was to find out how their experiences related to the general requirements we found in round one of requirements gathering. Which requirements represent issues they also ran into?, which requirements were less important or irrelevant?, and were there any requirements we did not discover in round one?

In short, to learn from their experience in creating a second screen companion app with game elements and discover which requirements matter the most.

10.1. Methods Used

Just like in the first round of professional requirements gathering, we did interviews with professional users. The method that was used is semi-structured interviews. Audio recordings were made of all the interviews (a transcription of these interviews, in Dutch, can be found on the annex). The set of questions that formed the basis of the semi-structured interview are listed below. To take into account the lessons that were learned from the first round of interviews, we made sure that every requirement from the first round was represented in at least one question for the second round interview. In this way it was least likely we would miss anything from our initial set of requirements.

- Why did you implement a second screen app for the RR?
- What was the goal of the RR app?
- What were your expectations for the RR app?
- Were these expectations met?
- What went right?
- What could have gone better?
- Where did you experience difficulties?
- Where you happy with the overall experience?
- Is there anything we haven't discussed yet that you think is important in future for interactive Quiz/Tv(/HbbTV) development?
- Do you take advertisement opportunities into account? (probably not very applicable since it's a public broadcaster) **req1+28**
- Did you acquire some knowledge from an external source before development? Did you do any research? Did you share knowledge afterwards? **req4+5+9**
- Did you have any troubles with stability when the app was live? **req3** Does scaling (bandwidth constraints) play a role? **req6**
- Did you have any consideration in respects to attention and the second screen? **req7+20+21+25** What about people who don't want to play along? **req17**
- Did you have any consideration to group usage/social interaction? **req8, req20+21+23**
- Did you consider the age of your users? **req10**
- Did you do any promotion? How much and why (this amount)? Did this have an impact? **req11**
- Did you give consideration to the on demand play along? <it was not implemented> Why didn't you implement this? **req12+13**
- What technology did you use and why? **req2, req14+15+16**

- How was the communication between all the involved parties (program vs. app) **req18**
- Did you ever give consideration to offering a second screen experience outside of the broadcast periods? **req24+26**
- Did you give any consideration to personalization of the experience? **req28**

10.2. Participants

The table below gives an overview of the people we interviewed and their respective roles within the production and development of the Rijdende Rechter app. A, B and C all work for the broadcaster of the show and are part of the digital and innovation department that is responsible for all the shows 'new-media aspects'. D is the head of the iTV developer company that did the technical implementation of the Rijdende Rechter app, and E is Executive Director for the Rijdende Rechter show itself.

Participant	Job description
A	Content manager for the Rijdende Rechter
B	Commissioning editor for the Rijdende Rechter program
C	Senior Content Manager for the Rijdende Rechter
D	Head Interactive TV Development Company, the company did all the technical development for the Rijdende Rechter app
E	Executive Director off the Rijdende Rechter

Table 4. List of participants Dutch pilot round 2

10.3. Data analysis

The first step was to write out all the interviews. Everything that was relevant was written out verbatim. Unlike the first round were we held a workshop with people from KU Leuven and the NPO, this time a single researcher from KU Leuven did the following analysis. In the first round it was about discovering all new general requirements where as in round two it was about matching a specific case to the general requirements and discovering new ones, was ones only part of it. The approach was similar in that snippets with interesting quotes were extracted from the written out interviews and then clustered. The difference was that the clusters from the first round were used as a base for clustering the new snippets and new categories were only created when no relevant category existed already.

10.4.   Results

For the second round results, we will review our initial set of requirements and see which ones are present and which ones are not in this specific second screen case. The initial requirements can be refined or supported by the findings of round two. If there was indication of a specific requirement we will discuss possible reasons for it. Next we will discuss new requirements that emerged from the second round of interviews.

10.4.1.   Round One Requirements Reviewed

10.4.1.1. Financial

Req.01: When creating Interactive TV applications, try to look for opportunities for advertisers.

The Rijdende Rechter is broadcasted by a public broadcaster in the Netherlands, therefore they are not allowed to monetize their apps trough advertisements. This requirement was not applicable to them. This requirement is still relevant just not in this specific context.

10.4.1.2. CMS (Content Management System)

Req.02: It is essential to have an easy to use CMS system so program makers can add content to the apps themselves thereby reducing the cost and enhancing the quality.

In development a CMS system was created so that the shows new media department can do all the weekly upkeep themselves. They indicate that this makes the time they have to spent on creating the second screen experience for a new episode relatively low. This finding supports the already found requirement.

> " We have a CMS and they <app developers> build the functionalities. And that is just something we can utilize without limitation per show."(C)

> "And what is nice, the start of the process has cost a lot of development time but now we work on this about 6-8 hours in the week. That is not a lot for such a second screen concept." (A)

10.4.1.3. App Development

Req.03: Make sure apps are technically sound.

All parties involved are convinced that delivering a technically sound product is a base demand that you cannot forgo. If it does not work flawlessly no one will use it. This finding definitely supports the existing requirement.

> "The technical side is very important of course because sometimes something doesn't work and then you are watching thinking here come the 'home judges'' scores and then nothing appears. That is really a shame." (B)

> "I think it was a successful project in terms of yield, it really never failed or had any major issues and always functioned properly." (D)

> "All the technical things should work flawlessly because if that does not work properly then that is extremely annoying. If it is not in sync for instance, cause the show isn't live and the presenter says you can see the scores in the bottom of your screen then that has to be correct. So technically it has to be 100% in order or else it is extremely frustrating." (E)

Req.04: Do user research to broaden the knowledge base.

The creators of the Rijdende Rechter app did not do much user specific research before and during the initial stages of development. They did however perform both a user test session with colleagues and a questionnaire after the first version launched to make improvements. They felt this user research was very valuable for the continued development. This supports our previous findings.

"A very important issue was that we did not start from the user perspective enough and too much from the concept of the show itself. You really have to find a balance in there if you want to get lots of people involved with your app." (D)

"After the first season, we send out a questionnaire to our followers to ask… because we were not sure if we were supposed to continue to invest an develop the concept. And the results we got from it turned out to be really positive." (C)

Req.05: Create a way to share and spread knowledge.

The people working at the new media actively share the knowledge they acquire with their colleagues who work on other shows. They see this as a very valuable practice and the only way to keep making progress. The sharing with the outside community is not that abundant, but they do present their projects at conferences. This supports the existing requirement.

> "It was also a very informative process. Which is very important to me and our department because you can share that information with the other departments." (A)

> "We actively share it <learnings> with the NPO <the overarching broadcaster> but not so much with the other broadcasters or the public. We could do better there. I believe there is a lot to gain from knowledge transfer from innovative projects in general. So we do often speak on conferences or give presentations and then we also 'bring the second screen'." (C)

10.4.1.4. Scalability

Req.06: Be aware of scaling issues for bandwidth when developing for large groups of users.

Scalability was not really an issue for this specific case because the amount of users was relatively low, somewhere around six or seven thousand at a time.

> "As far as peak load goes it always went fine. But that was also because we never had very high numbers with 5000 it should always go ok. With De Slimste Mens <a different show from the same broadcaster> we sometimes have 100.000 that when you can really talk about peak load." (C)

10.4.1.5. Synchronization

Req.07: When using multiple screens, smooth synchronization between these screens is essential.

Likewise synchronization was less of an issue because the timing for the statements to appear on the second screen was not very strict.

> "In the way we do it now the biggest de-synchronization that can occur is 30 seconds and this concept does not depend on 30 seconds. We also come up with the statements ourselves whereas in a show the questions are in the script and then you need to abide by the time code and we don't have that issue here." (C)

10.4.1.6. Group Interaction

Req.08: To stimulate group interaction it is important to allow all participants to interact on an individual level while showing scores on a 'shared' screen.

In the case of the Rijdende Rechter app, there is some feedback on the first screen from the actions on the second screen. During the course of the show there are two moments when percentages are displayed that show which party the second screen players believe will be ruled in favour off by the judge. However the goal of the application was not to increase the social interaction between players, but to have players place themselves in the mind-set of a judge who has to rule impartial and objective. Because of this and because no participants were observed it is impossible to support this requirement for this specific case.

> *"The goal is to ask questions that make people view the show in a different way I think that is more interesting. No doubt there will be discussion because of it sometimes but that happens now as well because of the show itself especially if something 'remarkable' happens. So that is the same when there is a 'remarkable' question but it is not meant to increase conversation." (E)*

10.4.1.7. Market

Req.09: To get a good understanding of what users expect from interactive TV more user research is needed.

Market research was performed by the creators on the one hand a student did research into second screen for the broadcaster and the app developer did a market analyses of into similar second screen games. Although they felt this was valuable, it was also difficult to draw any hard conclusions from it because especially at that time (two years ago) second screen was very much in its initial development stage. This clearly states the case that more research is still needed.

> *<on the graduate students research>. "But what here research showed was that many developers <of second screens> also did not know. So they were also not sure about the examples that existed if it was good or not and if things would work or not. So the research pretty much concluded that much was still a question. But back then in 2013 the first second screen apps appeared and people just though we will just start and see what happens." (A)*

> *"We mainly did market analyses into similar games. So play along games with more abstract goals so no quizzes but more opinion based ones." (D)*

10.4.1.8. Age

Req.10: Get younger viewers more involved by offering interactive extras without alienating older viewers.

Age plays an important role in this case. The average viewer age for the Rijdende Rechter is quite high (between 55 and 65). One goal of the second screen is to over something to the younger viewers. At the same time care has to be given to not alienate the older viewer and possibly make the second screen appeal to them as well. The age requirement is very much supported in this case.

> *"We draw a big audience but the problem with all our shows is that the average viewing age is about 55-65. And they will still be watching for a while*

but if we still want to make shows in 10 years, then you also have to get young people to watch your shows." (C)

"What they had to take into account was that a lot of older people watch the show and they aren't up to date with tablets and playing along so that it could also not disturb to much for the evening broadcasts." (E)

"We have a very diverse audience and it seemed nice to me to respond to that. And you also see that older people start to play along because it is quite manageable and straightforward." (E)

10.4.1.9. Promotion/Reach

Req.11: Promotion is critical for the success of any interactive TV app.

They are aware that promoting the second screen app is crucial however especially in the first season this was not done very much. This could be one reason for the relatively low amount of second screen users. This offers support for the requirement from the first round.

"The figures <from the questionnaire after the first season> showed there was a lot of potential for people who wanted to play along but people just did not know it existed. That means something went wrong in the line from the first to the second screen. So the past summer we really tried to see how we could improve those referrals and that's where we are at now." (A)

<specifically about the first year> "It was not really a hit, it was really badly announced on the show itself." (D)

10.4.1.10. On-demand vs Live

Req.12: Whether content is live or on demand, this should not make a difference for the user's experience.

The Rijdende Rechter like most shows can be watched on-demand on the public broadcasters website. There is however no support for the second screen version in the on-demand version. It is even edited in such a way that no mention of the second screen is made. Although they do mention it might be an option to do it if it can be done well with relatively low cost as the on-demand viewer simply is not a big group for this show. These findings do not support the requirement from the first round. Depending on the amount of on-demand viewers a show has this could still be an important requirement.

"We thought about it but shows on our channel do not have big on-demand viewing numbers." (C)

"For the repeats and on-demand there is a different cut of the show without the call to actions to the second screen." (E)

Req.13: If you want people to watch your programs live, entice them with an interactive experience.

This is not an issue for the Rijdende Rechter team, which is also understandable as the amount of live viewers is quite substantial for the Netherlands with between 1 to 1.5 million viewers.

<So not having an on-demand version of the second screen experience is not because you are worried about losing live viewers?> "No people watch the show if it is on and there is a group that watches it on-demand and that is it. I don't believe that would happen." (B)

The findings from this case do not support this requirement from the first round and state that it might have no impact at all. It should be further investigated in follow up research as it could very well depend on program genre and target audience how important second screen can be to entice viewers to watch a show live.

10.4.1.11. Smart TV

Req.14: If Smart TVs are to succeed they need to be powerful enough and find a single standard.

As the Rijdende Rechter app is purely a second screen experience, no evidence for or against this requirement was found.

10.4.1.12. Pass through

Req.15: For HbbTV to succeed it is important for the HbbTV signal to be freely distributed by all cable companies.

Like with the previous requirement, as the Rijdende Rechter app is purely a second screen experience, no evidence for or against this requirement was found.

10.4.1.13. Standards

Req.16: Standards like HbbTV are necessary to further interactive TV development.

HbbTV does not play a role in the Rijdende Rechter second screen application therefore no evidence for or against this requirement was found.

10.4.1.14. Multiscreen

Req.17: When developing interactive TV apps, it is important not to intrude (too much) on the experience of the 'regular' TV viewer.

This is something that was definitely taken into consideration for the Rijdende Rechter second screen. They try to cater to the second screen user but always with the non-second screen users' experience clearly in mind.

> *"We always try to consider the different entry levels. If you are an active player you will get the 200% experience. But if you are only lean-back, apparently you don't find that interesting nut you should also not find it annoying that those people are there. So we should not put so many call to actions in the show that this type of viewer thinks: "sod off with your second screen"" (C)*

> *It's quite a lot 5000 everybody is pretty happy about that. But relatively <to the regular viewers> its only peanuts you can't compare that. And therefore I don't think that you should bother the non -players with it constantly because then you'll think: "forget it" and you do not want that either." (E)*

Actions from second screen users can however also be used to enhance the experience of the 'regular viewer' even if they are not actively participating.

> *We also receive a lot of reactions from viewers who like it a lot that they can see how the percentages of the 'home judges' are and who they think is going to get ruled in favor off <these percentages are shown in overlays twice during the show>. So I believe it is enriching for the format itself." (C)*

So instead of focusing on not intruding on the 'regular viewers experience also look for opportunities to enhance their experience even without them actively participating. This leads to a refined requirement 17:

Req.17: When developing interactive TV apps, it is important not to intrude (too much) on the experience of the 'regular' TV viewer. Instead find ways to have the interactive part enhance their viewing experience.

10.4.1.15. Program Makers

Req.18: A good dialogue between program makers and app developers is essential.

Communication between the different parties is clearly one of the most important issues. All involved parties talked it about extensively. There were sometimes differences of opinion about how far a second screen experience should go especially between the people creating the second screen experience and those making the show. Despite this all parties also said that communication between them was generally very good. The way they accomplished this was by involving all parties from the absolute beginning of development and keeping everybody involved through continued development. This strategy works out so well for them that we deem it appropriate to update requirement to:

Req.18: Involving all parties from the earliest stages of concept development is essential.

"The program makers were involved in the brainstorm process but that is always difficult you have to explain a lot. They are not involved in a very new innovation process of course. They do not understand why you should do certain things. "That has not proven itself yet, why would we do that." Especially when you are doing something experimental there will be some distrust: "It is a popular format so we do not want to mess with that." you see." (A)

> *"That reservedness is something that goes for all TV makers. We come in and start messing with 'sacred cows'. About how the media landscape is changing, how media changes consumers and how the viewers' needs change. And TV makers are on a moving train and they just want to make their show and are not always eager to hear these things. But that is not something that is inherent to tis project, it is something you see in all projects. And what you notice the most, is that if you do it together, create successful cases, and they see the benefits they get from it as well they will come around." (C)*

> *"The communication was very good actually. In the conceptual phase we closely worked together. That is essential otherwise you should not do it. We do not believe you can create an application without involving the stakeholders." (D)*

> *"We have been involved from the beginning. So as far as development goes, I was there from the start. We discussed how we could present things on screen in the best way. And the guys from Belgium <app developers> had a lot of experience with that. I was able to express my wishes and opinions." (E)*

> *"Above all do a lot of face to face deliberation. Work together from the start and take every step together and also talk about the design. Not just*

presenting a finished product. Involve them in every choice so you all feel responsible for the eventual end-product." (C)

10.4.1.16. Fiction

Req.19: For fiction shows the second screen content should be optional i.e. enriching but not essential.

As the Rijdende Rechter is not fiction, no evidence for or against this requirement was found.

10.4.1.17. Non-Fiction

Req.20: For non-fiction shows, it is possible to create a more content heavy second screen experience, as these shows do not usually require constant attention.

The Rijdende Rechter is a bit of a strange case in that it is a non-fiction show but the second screen app is a game. The game is very closely linked to the show though and you have to pay close attention to answer the statements form the app correctly. It is however very difficult to classify it as a content heavy second screen without user feedback. The fact that you have to pay attention and consider the statements at the same time could be considered intensive.

> *"I think it is a difficult show to handle that double layer. What we talked about before a show like the IQ quiz where you have the same question in the show as on your second screen or if you only have to press yes or no that is quite different then here where you have to think about what is being asked have to answer that in a few seconds and still keep paying attention to the show." (B)*

10.4.1.18. Game show/Competition

Req.21: Let viewers join in on the competition of a game show.

As the Rijdende Rechter is not a game show or competition, no evidence for or against this requirement was found.

10.4.1.19. Usability

Req.22: Ease of use in both discovery and accessibility is crucial for any second screen app.

Ease of use is something all parties consider important and it is something they are constantly working on relying on their own experience as well as feedback from viewers. This supports the previous found requirement.

> *"In the beginning we had the experience of "I am doing it but I have no idea when the next statement will come". Can't we add something like a timer so I do not constantly have to look at the thing? I can see that it will take a while and then I will look again. These things have all been adjusted during the testing." (B)*

"And to make the second screen successful apart from the technical aspects a lot of initiative was taken to constantly fine-tune the app. It was not easy but the more focused and clear you make it and the simpler you show it, the better it gets." (E)

10.4.1.20. Design

In the first round we did not find enough information about design to come up with any requirements. In the second round a very important issue was discovered namely the focus in the design of the app. In the beginning the app lacked a real focus. It was not really clear if you

were supposed to give your own opinion to the statements or if you had to place yourself in the position of the judge. To solve this the character of the judge was given a way more prominent place and the statements were rephrased in such a way that it was much more clear that they should be answered from a judge's viewpoint.

> *"In the beginning we were very much doubting if we should focus on the prize or the fact that you can compare yourself to your friends and we were not sure. So that is why we asked that in the questionnaire and from that we learned that people were mainly interested in Judge Visser and that that was the most important reason to play and not so much friends or the incentive. So then we thought we should show the fact that you can win something less prominent on the homepage and the fact you can compare yourself to your friends not at all but focus on compare yourself to judge Visser." (C)*

> *What was not clear from day one was the goal for the game. You got the page and it just said Rijdende Rechter second screen and it didn't really say what you had to do and what was the goal of the game. I think that is much clearer now. The goal is very simple compare yourself to judge Visser but now that is made clear from the first to the last screen. That has been done visually but also content wise. The questions were more general in the first season and are now also focused more on what would judge Visser think." (D)*

This finding can be worked into a more general requirement to give a prominent role to the features that are important as to give a clear focus to the app.

NewReq1: Make sure your interface has a clear focus.

10.4.1.21. Social Communication

Req.23: A way for users to interact with others watching the show is necessary for most apps.

There is no way for users to interact with other watching the Rijdende Rechter app apart from the fact that it was possible to see what your friends scored if you were both signed in. So that goes against this requirement from the first round.

> *"No in principle it is an individual experience so we did not look at it. We do look at it for other projects because I think digital project in general are quite individual and lately we try and see how we can offer that collective experience. I am unsure how we would do that for this project though maybe that is also because we have not really considered it." (C)*

10.4.1.22. Engagement (short and long term)

Req.24: Retain viewers by offering interesting interactive TV alternatives after 'their show' ends.

This was not something part of the Rijdende Rechter second screen experience but also something that was not asked about in the interviews therefore we can unfortunately not say anything supporting or dismissing about this requirement.

Req.25: A good second screen experience can enhance attention to the first screen.

This is something that all parties agree on. The new media and app developer people said it took a bit of convincing to convince the program makers of this fact but as the quote below shows they are also convinced that this is the case. The reason is that the game is very closely linked to the show and you have to pay close attention to answer the statements form the app correctly. This supports the finding from the first round.

"They only strengthen each other. Without the show you cannot even do anything. So it is not like with 'De Slimste Mens' <a different show from the same broadcaster> where the app is separate from the TV. You can play the game and you don't need the TV. But here you need the TV to be able to play. Moreover you have to even watch live cause it does not work on-demand." (B)

"And we did not only test it with ourselves. We also tested with a bigger group including older users who were very skeptical at the start but afterwards said "Actually this only enriches your viewing experience by participating it forces you to watch the show in a certain way and because of that the intensity with which you watch increases."" (C)

"And if you go along with the wondrous train of thought of judge Visser then you will also pay attention to all kinds of details in the show so that means you will watch more intensely." (E)

Req.26: To engage people even further, try to get them interested in your second screen outside of the broadcast times of the show itself.

This was not part of the Rijdende Rechter second screen experience, which could be an indication that it is not important. The app developer is however of the opinion that this is a very important requirement and that it could help increase the user base.

"Most apps we do during the show don't really have a huge uptake. What does have a huge uptake are things we do between shows and between episodes. And that is not present in the Rijdende Rechter which is an old school second screen app where you are only active during the show. And that is just not enough. We need to go fully towards activity between the episodes." (D)

10.4.1.23. Personalization (for different groups)

Req.27: Use interactive TV to offer viewers a more personalized experience by allowing them to participate or selecting different items.

Personalization was considered and is something they find interesting, but deemed too costly and unclear to implement in the current format.

<You found there were too few statements for some and too many for others did you ever look into personalization?> Not really, good idea, it's just that… What is difficult about it is that it would mean you do not really have a clear winner anymore. You would have to have winners in different categories, best in the category least questions and most questions. And you would also not have a best judge of the season anymore. Personalization sounds great but in practice it is difficult to implement. And I also wonder to what extent people are interested in all kinds of choices. Don't they just want to be taken along in the experience you offer them?" (C)

Req.28: Use interactive TV to offer viewers targeted commercials.

The Rijdende Rechter is broadcasted by a public broadcaster in the Netherlands, therefore they are not allowed to monetize their apps trough advertisements. This requirement was not applicable to them. This requirement is still relevant just not in this specific context.

10.4.2.   Other Findings

What was a much deserved topic that came up in this specific case but also seems very important to any second screen application is how viewers see your show and how you want to cater to that with your second screen experience. There were two conflicting viewpoints on this. On Twitter the show usually gets a lot of negative tweets about the people who are in conflict and ask the judge for a ruling. The shows' producer and new media department really wanted to put the focus of the second screen on getting the viewer to think differently about the show. By having the viewer place themselves into the mind of the judge they had to objectively look at the case and not judge the people on their appearances or the way they talk. According to the app developer this creates sort of a mismatch between viewer and second screen, which could be one of the reasons for the low participation numbers. It is unclear who is correct but it does pose a very interesting question to other second screen developers. How do your viewers see your show and do you want to cater to their expectation or do you have a different goal in mind with your second screen.

This is why we put forward the following new requirement.

NewReq2: Think carefully about what your viewers expect from your show and what you want to achieve with your second screen.

Another issue that deserves some attention is the focus on innovation and the value especially the people from the new media department see in this. They feel that in order to make any progress and not fall behind you have to keep innovating. This inevitably leads to some failures or less successful concepts but as long as you share this information your broadcaster or even iTV as a whole can benefit greatly.

> *"It is also quite tricky for instance my mother has just bought an iPhone a few months ago. You want to be ahead of that. It is better to be too early then too late." (A)*

> *"Even if the group of second screen users is quite small compared to the viewers but it is a way to develop something like this second screen app further and to see what of the know how you gain you can apply to other programs." (B)*

> *<are there other reasons for doing a second screen> "It is also about experience. Every project that you do not do is lost knowledge to us. So all the knowledge you acquire content wise but also technical is just very valuable." (C)*

10.5.   Conclusion

In this first iteration of the professional requirements, a set of important requirements for the TV-RING pilots where gathered. In general, these requirements pertain to innovative HbbTV applications and services. The second iteration looked at a specific second screen case and looked at how the requirements from the first phase applied to this specific case. In the process some requirements were supported some were refined and a few new ones were discovered. Below is the full list of updated requirements. Requirements form the first round that we found supporting evidence for in the second round are marked with a *. Updated requirements are marked with **. Requirements that conflicting evidence was found for are marked with a #. The new requirements are listed at the end. Most of the relevant requirements for this specific case were supported by the new findings. Communication is clearly one of the most important issues and is something that should get a lot of attention in

the development process. When developing our own pilots in Work Package 4 all these requirements will be taken into consideration.

10.5.1. List of Refined Professional User Requirements:

Req.1 When creating Interactive TV applications, try to look for opportunities for advertisers.

*Req.2 It is essential to have an easy to use CMS system so program makers can add content to the apps themselves thereby reducing the cost and enhancing the quality.

*Req.3 Make sure apps are technically sound.

*Req.4 Do user research to broaden the knowledge base.

*Req.5 Create a way to share and spread knowledge.

Req.6 Be aware of scaling issues for bandwidth when developing for large groups of users.

Req.7 When using multiple screens, smooth synchronisation between these screens is essential.

Req.8 To stimulate group interaction it is important to allow all participants to interact on an individual level while showing scores on a 'shared' screen.

*Req.9 To get a good understanding of what users expect from interactive TV more user research is needed.

*Req.10 Get younger viewers more involved by offering interactive extras without alienating older viewers.

*Req.11 Promotion is critical for the success of any interactive TV app.

#Req.12 Whether content is live or on demand, this should not make a difference for the user's experience.

#Req.13 If you want people to watch your programs live, entice them with an interactive experience.

Req.14 If Smart TVs are to succeed they need to be powerful enough and find a single standard.

Req.15 For HbbTV to succeed it is important for the HbbTV signal to be freely distributed by all cable companies.

Req.16 Standards like HbbTV are necessary to further interactive TV development.

**Req.17 When developing interactive TV apps, it is important not to intrude (too much) on the experience of the 'regular' TV viewer. Instead find ways to have the interactive part enhance their viewing experience.

**Req.18 Involving all parties from the earliest stages of concept development is essential.

Req.19 For fiction shows the second screen content should be optional i.e. enriching but not essential.

Req.20 For non-fiction shows, it is possible to create a more content heavy second screen experience, as these shows do not usually require constant attention.

Req.21 Let viewers join in on the competition of a game show.

*Req.22 Ease of use in both discovery and accessibility is crucial for any second screen app

#Req.23 A way for users to interact with others watching the show is necessary for most apps.

Req.24 Retain viewers by offering interesting interactive TV alternatives after 'their show' ends.

*Req.25 A good second screen experience can enhance attention to the first screen.

#Req.26 To engage people even further, try to get them interested in your second screen outside of the broadcast times of the show itself.

#Req.27 Use interactive TV to offer viewers a more personalized experience by allowing them to participate or selecting different items.

Req.28 Use interactive TV to offer viewers targeted commercials.

NewReq1 Make sure your interface has a clear focus.

NewReq2 Think carefully about what your viewers expect from your show and what you want to achieve with your second screen.

11. German Pilot Refined Requirements

This section describes the specific approach of gathering professional user requirements for the German pilot. The discussion starts with the specific user research methods used, introduces the participants that took part in the actions, presents the research outcomes.

11.1. Methods Used

Gathering user requirements related to the production and development of high-bandwidth HbbTV applications such as for the daily documentary show "Verknallt & Abgedreht". The show covers the approach of a transmedia service offering high-quality content items spread over several devices including the exploitation of MPEG DASH video. The functions of the application involve a large amount of essence data items like images, texts and video and can be described as follows:

- Resume of actors
- Picture galleries
- Collection of all shows (UHD, MPEG-DASH)
- Extra video clips (some in UHD, MPEG-DASH)
- Quiz, voting and live blog (only for live contribution in phase 2 starting February 2015)
- Comments and rating on content (only for live contribution in phase 2 starting February 2015)

The interviews should help to learn about the challenges the professional users have to face when producing the show, setting up the application and aggregating amounts of content for an automated delivery through the application, and what they would need to improve this, or what they would like to do more in the future. It is necessary to know how professional users currently perform their tasks, in order to improve the design of the current apps.

The second iteration of task T2.3 for the German pilot activities and its requirements started with a number of contextual questions for according stakeholders. Three different stakeholder groups were defined to participate in this requirement gathering:

- Broadcasting engineers
- Manufacturers of HbbTV devices
- HbbTV app developers
- Web editors

These professional user groups are directly involved in HbbTV application production. The persons interviewed are all familiar with HbbTV and working primarily on different HbbTV topics depending on their jobs. They are from various countries and therefore have different experiences. The aim was to learn about the challenges the professional users have to face when producing such applications, and what they would need to improve this, or what they would like to do more in the future.

There were three types of questionnaires, one for every stakeholder group. The questions were structured in two types. The first set consisted of three questions which were more generally and for each stakeholder group the same. The second set of questions aimed to be more group specific. To understand what they are working for and what they are thinking when producing (for) such applications. The questions that formed the basis of the interview are listed below.

Generally questions:

- What do you generally think about HbbTV?
- Why do you develop/implement/support HbbTV?
- How do you see the future of HbbTV?

Specific questions:

- How much extra effort do you have for HbbTV implementation?
- From where do you gather your information for HbbTV programming?
- From where do you gather your information for HbbTV content?
- What's the main challenge, developing HbbTV apps?
- What's the main challenge, supporting MPEG-DASH in HbbTV apps?
- What is the main challenge maintaining content for HbbTV apps?
- For which HbbTV version do you develop applications?
- What's your strategy regarding the implementation of HbbTV 2.0?
- What do you think about using HbbTV to deliver a video quality beyond HD (or better than the broadcast distribution over satellite or cable) to the consumer?

The peoples interviewed answered directly on the questionnaire by writing on the paper or in digital form by typing it in the MS Word document. Later all answers were transferred into paragraphs of digital form. Scans of the notes and the transferred data are available on request.

11.2. Participants

The number of stakeholders working within the HbbTV production chain still is relatively small, as most of the professional users are involved in TV or online content provision. Despite that fact German pilot partners managed to interview 14 professional users from different parts of the HbbTV chain. They are responsible for different TV, online and HbbTV services or the development of end devices and thus different departments and responsibilities. During the interview preparation we identified four stakeholder roles based on the already chosen interviewees:

Participant	Gender	Profession/User profile
A	M	Broadcasting engineers
B	M	Broadcasting engineers
C	F	Broadcasting engineers
D	M	Manufacturers of HbbTV-devices
E	M	Manufacturers of HbbTV-devices
F	M	Manufacturers of HbbTV-devices
G	M	HbbTV app developers
H	M	HbbTV app developers
I	M	HbbTV app developers
J	M	HbbTV app developers
K	F	HbbTV app developers
L	M	HbbTV app developers
M	F	Web editor
N	M	Web editor

Table 5. Participants German Pilot

11.3.   Data analysis

After having processed all the interviews as described in section 11.6, the documented answers and comments of the interviewees were fed in a small workshop, where a group of three people thoroughly analysed and then split quotes and feedback blocks into snippets. These snippets were then re-grouped and along common topics allocated to a number of categories. If necessary, categories were renamed, merged or split up.

Figure 5. Snippets and their categories

In the end the names of the categories were re-thought and re-named again, in order to ease the deduction of requirements. Now these input bits were summarised and thus prepared for the careful deduction of requirements.

11.4. Results

The results of the user research carried out in the German pilot can be grouped under the following main themes:

Opportunity for program accompanying apps

Today linear TV is no longer enough, to inspire the audience. Multimedia content like pictures, videos or interactive offers are expected by the end users. In addition, there is the opinion, HbbTV apps make only sense if they are related to broadcast programs. On the production side, there is the desire to have the opportunity to use the additional content twice, for the TV and for the web. The content is used for both distribution types and therefore it should be produced once for both fields.

Exceeding video quality

Video quality is a very important. HbbTV has the opportunity to deliver better video quality to the customers than the DVB broadcasts at the moment. There are two things, which have to be noticed, the bandwidth limitations and the appropriate video codec. To bypass the bandwidth constraint, technologies like MPEG-DASH could be used. In terms of video formats beyond HD, H.265 codec will be necessary. This codec has to be established first in the field of production and end devices.

Market estimation

HbbTV is a standard with a high market penetration and therefore with a huge reach to end devices and end users. This is possible, because HbbTV is an open standard without proprietary requirements. Nevertheless end users just started to realize HbbTV. They will notice HbbTV as far as there are enough inventive and suitable applications. New business models can also force this process.

Development issues

There are still standard implementation issues which should be remedied. Special requirements for implementing rich media or high quality video applications are imposed on the CPU and the media player of the end device. Content management systems for app developers are still needed.

The following results show the requirement categories identified. Each requirement is illustrated with a selection of the quotes that made up this category. The resulting requirements are listed in a separate box.

11.4.1.   Opportunity for program accompanying apps

Some of the interviewees reported that it is necessary to offer additional content in order to reach customers better. Today linear TV is no longer enough to inspire the audience. Multimedia content like pictures, videos or interactive offers are expected from the users. Completing the broadcast program with HbbTV applications increases the audience binding.

> *"HbbTV is a good additional offer for viewers. Here they find lots of additional information on the television program of their choice. Multimedia information as videos or galleries that were previously offered only through the Internet can be accessed directly via the remote control. HbbTV also offers the possibility of interaction (for example: voting)." (Interviewee M)*

> *"An extension of the offer in a non-linear experience. Viewer binding through greater flexibility. Strengthen the program through additional offers and new ways of posts." (Interviewee C)*

> *"HbbTV offers many opportunities: Viewers can retrieve time-shifted programs and additional multimedia information. HbbTV makes the fusion of Internet and television possible." (Interviewee M)*

> *"To provide a better user experience for the viewers and more enhanced features." (Interviewee H)*

In this context interviewees also wrote, that they need the possibility to use the additional content twice, for the TV and for the web. Content-wise and technically it should be produced in that way, that it can be easily used for both fields of applications later.

> *"The creation of HbbTV content was part of the multimedia bid to rbb youth series "Abenteuer Liebe". The idea was to reach the viewer directly to the TV and to provide them additional information. The content of the HbbTV application is also part of the website." (Interviewee M)*

> *"Creating and maintaining content for HbbTV is quite similar to web content management. The main part of content is still available at WebCMS. Looking*

at content oriented HbbTV-apps the challenge is to enable existing WebCMS to address the HbbTV channel." (Interviewee N)

Four of the interviewees stated that HbbTV applications belong to broadcast programs. For them HbbTV apps make only sense if they are related to a broadcast show. One person even thinks, that standalone applications like TV-Games and portal apps will not be used by the audience.

"Provides additional services over the Internet which are managed directly by the broadcaster." (Interviewee A)

"Portal apps (expect a few), TV-Games, Internet Browsing - as they are implemented currently do not get much use. HbbTV coms to user with a content (a channel or program)." (Interviewee B)

"It is a great technology to offer additional services to the running broadcast program, enabling catch-up-TV solutions and much more in one standard for every TV." (Interviewee K)

"With HbbTV an added value to the linear program is supported. Based on an open standard its offers are freely available for everybody." (Interviewee C)

Req.01 For a better audience reach and binding, rich media HbbTV apps are required.
Req.02 The possibility to use the rich media content for HbbTV and web should be given.
Req.03 The HbbTV application has to have a relation to a broadcast program.

11.4.2.   Exceeding video quality

All interviewed persons think that the video quality is a very important fact in the television world. To use HbbTV to deliver better video quality to the customers than the DVB broadcast can, is an opportunity and should be used. Only one vote is against this suggestion.

„Quality has the top priority at all. Whether in the implementation of an application or the video material used." (Interviewee C)

"Since the video quality plays a major role in the television and also in the audience, it makes sense to offer the best possible quality to the viewer." (Interviewee M)

"HbbTV is ideal to deliver all qualities." (Interviewee J)

"We might move to UHD soon. So we will need UHD content." (Interviewee D)

"Definitely not a good Idea!! HD must stay on Broadcast!" (Interviewee F)

Only two interviewees also think of the technical side of the exceeding video quality, the bandwidth limitations. Before such services could be offered enough bandwidth has to be guaranteed or technologies like MPEG-DASH have to be practical.

"As long as there is enough bandwidth available that is a great idea and it is an important field to be researched." (Interviewee K)

"It is ok with good bandwidth in VOD applications." (Interviewee I)

A further remark to be considered before implementing videos with high bitrates is the video codec. So far the codec of choice is H.264. This video codec works really reliably and efficient

and is the most used video codec, but for video formats beyond HD, H.265 is necessary. This codec has to be established first in the field of production and end devices.

> *"So UHD over HbbTV? Depends on the codec I guess. With H.264 then in theory is possible. With H.265 then there will be a price premium."* (Interviewee E)

> *"It's definitely possible by relays on the broadband service of the customer and the quality of the CDN. HEVC will help make this possible."* (Interviewee A)

Req.04 Use the opportunity to deliver very high video qualities to the end user over HbbTV.   **Req.05** Bandwidth considerations to guarantee successful applications.   **Req.06** H.265 has to be established.

11.4.3. Market estimation

Most of the peoples mentioned, that HbbTV is a standard with a high market penetration and therefore with a huge reach to end devices and end users. This is possible because HbbTV is an open standard without proprietary requirements. It makes sense to write new and varied applications for a technology like HbbTV which future prospects are so well predicted.

> *"I see great potential in the development of HbbTV, since it has penetrated the market more than other standards (MHP Open TV) so far. Yet, not all possibilities are exhausted and it is a varied challenge to accompany this development process."* (Interviewee C)

> *"Our company has been in market since 2008 in the creation of the HbbTV specs. We think this is an opportunity for growth."* (Interviewee F)

> *"It is interesting. It is a growing market. It is fast to implement and deliver to end users. It is (or it is supposed to be at least) device independent."* (Interviewee I)

> *"HbbTV is a necessary approach for standardized Smart TV. Necessary means – interest of users and content providers. I don't see a bigger interest from TV manufactures, they still trying to establish their own idea of TV-Apps and trying to get into a door keeping role."* (Interviewee N)

> *"Because it's an open standard without proprietary requirements. It means that we can provide services once to many receivers."* (Interviewee A)

> *"It is an adopted standard, supported by all main devices."* (Interviewee J)

Despite of the adaption of HbbTV in almost every European country it is still not noticed by everyone. End users just started to realize HbbTV and also the integration in devices has to grow. But end users will notice HbbTV as far as there are enough inventive and suitable applications.

> *"It is growing and adapted in more countries. It will be a more valuable service when more supporting devices are in use. Yet in Finland not so many people know HbbTV or have a TV that it supports. In future it will be common way to implement services in TV."* (Interviewee I)

> *"Monetization of services, devices, interoperability."* (Interviewee J)

"It is still developing and new, but I guess it will grow as the amount of supporting devices grows. It is a good way to implement broadcast-related extra services or other services and has great potential." (Interviewee I)

The common broadcasting will be completed by internet applications. Linear television is still needed but people would like to have simple access to additional information while watching TV. HbbTV applications are able to realise this demands. Based on this a lot of new business models occur. Broadcaster are preferred to use this opportunity to create a new business segment.

"Because of previous answer! Create a new business around the TV." (Interviewee F)

"We need a provider or market that mandates it." (Interviewee E)

"Business oriented, if customers look for this feature!" (Interviewee F)

"Hybrid TV is needed to complete broadcasting." (Interviewee J)

"Smart TV concept, seem to replicate or reproduce a computer in the form of a TV. HbbTV is the most important, in this respect, application. It does not require a very active user – similar to content consumption on TV." (Interviewee B)

Req.07 Working on applications of a promising technology.
Req.08 Inventive and suitable applications are needed to inspire end users.

11.4.4. Development issues

Especially HbbTV app developers are complaining about the inhomogeneous implementation of the HbbTV standard. The behavior of TV-Sets varies and much time must be spent in order to adapt incorrect representations. Special requirements for implementing rich media or high quality video applications are imposed on the CPU and the media player of the end device.

"Interoperability and differences in expected behavior in different devices." (Interviewee I)

"Stability and performance of HbbTV-apps are quit insufficient nowadays. The interoperability problems are not comprehensible for users which bought a new 1000 Euro device a few months ago. At this time a 3 years old SmartTV is HbbTV-stone age, the expiration seems to be faster than at personal computers. A common TV operating system platform could be helpful. Hopefully there would be less interoperability issues. Further users could update their system to extend the life period of their television deice." (Interviewee N)

"Performance across multiple devices is hard. There is no standard for CPU/Memory and a lot of devices are quite slow." (Interviewee H)

"Limited support in receivers and still many issues with video players." (Interviewee A)

"Making it look and work the same on different TV-Sets." (Interviewee K)

Content management systems for app development are still needed. The tools, available at the moment, aren't failsafe and don't run reliable. Tools which are able to create web applications as well as HbbTV applications would be a preferable.

> *"For the maintenance of websites content management systems are used, which are already highly developed. The tool "JSON" used for HbbTV applications "Abenteuer Liebe" is not very comfortably and very error prone. If the same data is used for the Internet offer and HbbTV app a link to the existing content management system makes sense. Otherwise a content management system should be developed for the special requirements of HbbTV applications." (Interviewee M)*

Req.09 CPU/Memory and video player implementation of end devices are often not good enough for rich media applications.

Req.10 CMS system for web and HbbTV applications.

11.5. Conclusions from second iteration

In this second iteration of the professional user requirements, a set of important requirements for the TV-RING pilot where gathered. In general, these requirements show that we are on the right track. The requirements are very close to reality and therefore easy to solve. What, however, still represents a major hurdle is the heterogeneous implementation of the HbbTV standards in the TV-Sets. The application development succeed much better and faster if implementation issues could be avoided. The key findings: Rich media and high video quality applications are important ingredients for successful HbbTV applications. Bandwidth considerations are necessary to succeed. HbbTV is still the technology of choice.

11.5.1. List of new professional requirements from second iteration

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NewReq3 For a better audience reach and binding, rich media HbbTV apps are required.

NewReq4 The possibility to use the rich media content for HbbTV and web should be given.

NewReq5 The HbbTV application has to have a relation to a broadcast program.

NewReq6 Use the opportunity to deliver very high video qualities to the end user over HbbTV.

NewReq7 Bandwidth considerations to guarantee successful applications.

NewReq8 H.265 has to be established.

NewReq9 Working on applications of a promising technology.

NewReq10 Inventive and suitable applications are needed to inspire end users.

NewReq11 CPU/Memory and video player implementation of end devices are often not good enough for rich media applications.

NewReq12 CMS system for web and HbbTV applications.

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12. Spanish Pilot Refined Requirements

This section describes the specific approach of gathering end-user requirements for the Spanish pilot. The discussion starts with the specific user research methods used, then introduces the participants that took part in the actions, and ends with the presentation of the research outcomes.

12.1. Methods Used

In the second iteration of T2.3, two main actions were performed in the Spanish pilot to elicit the requirements of the relevant stakeholders. Professional user research actions started with a round of five contextual interviews with different stakeholder profiles. This was followed by a requirements workshop, in which interview transcripts were analysed, processed and structured by a group of five stakeholders involved with the project

Timeframe	Activity
10'	Introduction. Explanation of workshop structure and procedures.
20'	Facilitator-driven elicitation of insights and feedback from the participants
20'	In-depth discussion of main topics
40'	Development of high-level categories and subcategories on the requirements canvas
20'	Selection of most relevant subcategories for the development of user stories
10'	Wrap-up and closure

Table 6. Structure of professional requirements workshop for 2nd iteration in Spanish pilot

After the meeting, more work was undertaken to refine and transform the high-level topics into requirements, taking into account all relevant data from professional interviews and pilot evaluation.

Figure 6. Requirement workshop second iteration Spanish pilot

12.2.   Participants

A total of four contextual interviews were carried out, one for each relevant profile. The professional profiles interviewed were the following:

Participant	Professional profile	Years of Connected TV experience
1	Connected TV marketing specialist	22 years
2	Lead CDN engineer	6 years

| 3 | Digital journalist | 9 years |
| 4 | Lead HbbTV app developer | 17 years |

Table 7. Professional interview profiles for 2nd iteration in Spanish Pilot

Participants were contacted through their companies, and interviewed at a date and hour of their convenience in their work stations, so that they could exemplify their statements and clarify their responses with recourse to the actual tools they use in their everyday work.

All data protection and privacy standards were observed, including a signed informed consent form, which ensures compliance with ethical and legal regulations (including the Spanish Organic Law 15/1999 of 13 December on the Protection of Personal Data, and the Directive 95/46/EC of the European Parliament and of the Council of 24 October 1995 on the protection of individuals with regard to the processing of personal data and on the free movement of such data).

12.3. Data analysis

Following the contextual interviews, a requirements workshop took place. The goal of this focused work session was to develop a first set of professional requirements on the basis of the participants' inputs, taking into consideration the stakeholder interviews that had been performed previously as well. In this workshop, the contextual interviews' notes were thoroughly analysed.

12.4. Results

The following results show the requirement categories identified. Each requirement is illustrated with a selection of the quotes that made up this category. The resulting requirements are listed in a separate box.

12.4.1. Interaction and participation

Engaging audiences via Connected TV applications was a main concern of the professionals interviewed during this second iteration of requirements research.
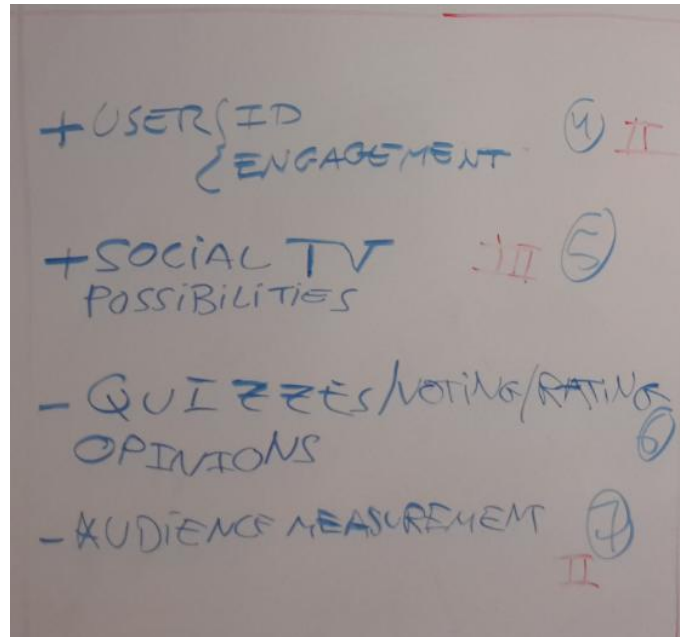
Figure 7. User Engagement & Audience measurement mentioned as important requirements

The many possibilities offered by Connected TV applications to reorient the audiences' online social interactions *"away from Whatsapp and to our own companion second screen applications"*, as one interviewee aptly put it, was considered a very interesting opportunity. Being able to infer audience ratings and to collect useful market data from these applications was also cited as a key aspect of their attractiveness for TV professionals.

Req.01	Social TV possibilities in the area of viewer participation in quizzes, voting, rating of opinions, etc… must be pursued.
Req.02	The possibilities to use these forms of audience participation via Connected TV applications for audience measurement purposes should be explored.

12.4.2.   Content

Providing suitable contents for multicamera HbbTV applications, such as the one tested at the Spanish pilot of the TV-RING project, was a complex matter.
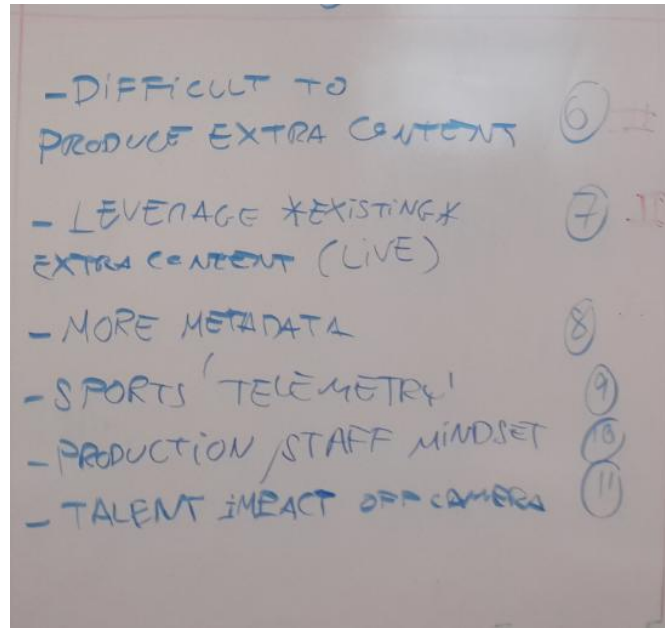
Figure 8. Requirements for content

The main difficulty was one of cost. If more than one video stream had to be shot, edited and transmitted to the users, costs for the program have to be doubled or tripled, in the case of two or three streams, or multiplied by the number of delivered streams in the case of programs with more than three streams.

A solution worth exploring is to reuse contents that are already being produced, but only marginally used; for example local sports broadcasts from which only tiny fragments are used for news programs.

Req.03	Explore ways to leverage existing extra content that could be offered live to viewers, for example local sports transmissions for news programs or sports telemetry and metadata.
Req.04	The difficulty and impact that new ways of producing multicamera content for Connected TV have for the workflows of production staff must be adequately taken into account.

12.4.3.   UX

From a professional point of view, the limitations of existing remote controls posed a challenge, on several grounds, for the uptake of innovative Connected TV services and applications.
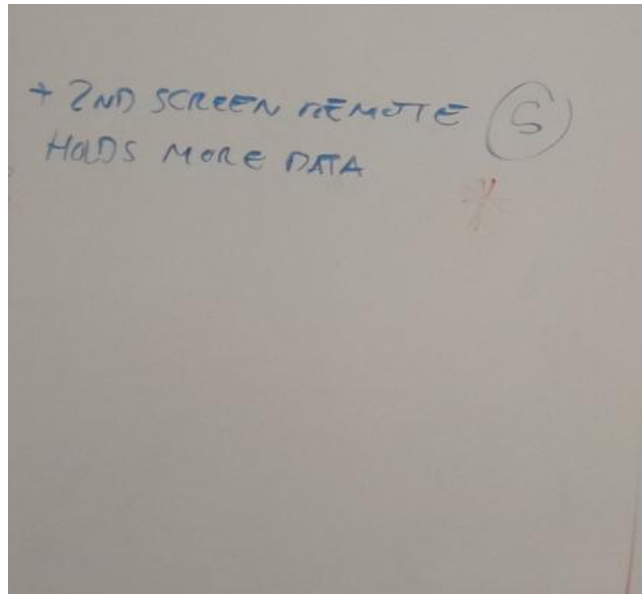
Figure 9. Requirements for UX

Traditional remote controls, with their poor usability and their lack of data-generating capabilities, were overwhelmingly perceived as an item poised to disappear in the near future. Remote controls are to be superseded by second screen applications. These not only can deliver superb usability, but also collect market metrics and audience information inconspicuously, thus improving the knowledge of the user's behavior and their needs and desires.

Req.05 A remote control application in a second screen device should deliver additional information to the user, such as advertisements to user-tailored content.

12.4.4. Quality and performance

The differences in the implementation of the HbbTV standard across manufacturers were reported as troublesome by developers and broadcasters alike.
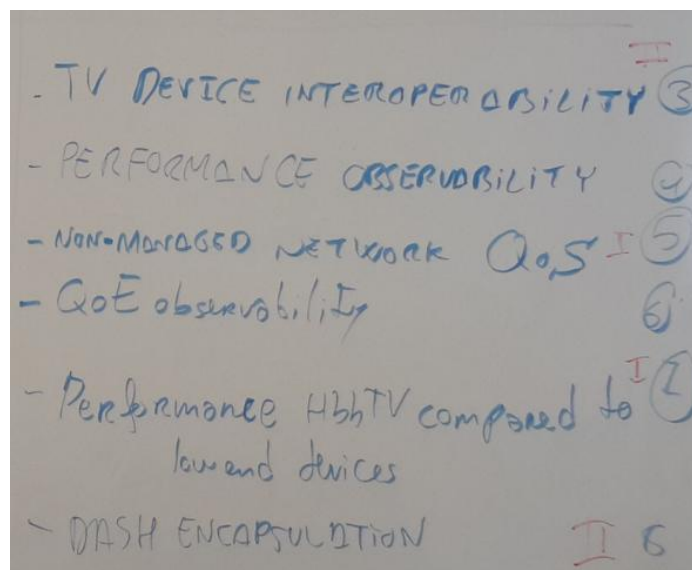

Figure 10. Requirements for quality & performance

In terms of interoperability, existing Connected TV have wildly differing performances. This puts a heavy strain on HbbTV app developers, as they are forced to tets their applications on a huge range of TV models (30-40 models) to ensure that their apps are working fine in all of them. Among others, a severe limitation of low-end devices was that these can only handle one broadband DASH-encoded stream, thus putting a serious constraint to the possibilities for delivery of widespread multicamera services. Since these lower-end models are also the most widely sold in Southern European countries such as Spain, the fact that many HbbTV applications may not work properly in these models poses a significant challenge.

This problem is compounded by the current impossibility of knowing how is the Quality of Service and the Quality of Experience that is actually experienced by audiences, when these access the HbbTV contents via a non-managed network.

> **Req.06** Because of problems with TV device interoperability, it is essential to leave enough time for testing when developing applications for Connected TV.
> **Req.07** There should be procedures and/or methods to test the Quality of Service that is actually delivered to the viewers via the non-managed network.
> **Req.08** There should be procedures and/or methods to test the Quality of Experience that is actually delivered to the viewers via the non-managed network.

12.5.   Conclusions from Spanish pilot second iteration

The user research actions performed in this second iteration of professional user requirements gathering have led to the identification of a set of important requirements for the improvement of the TV-RING pilots and, more generally, of innovative HbbTV applications and services. The use of second screen applications to focus the attention of users away from third-party social applications such as Whatsapp and on to program-specific companion apps is considered as a key area of research and development for the next years.

Another crucial aspect that can be addressed by Connected TV applications is audience measurement and marketing. The importance of this issue cannot be overstressed, as it impacts the financial sustainability of the whole ecosystem: advertisers, who are by and at large the largest existing source of revenue, will pay as a function of audience size and composition, which are currently not well known enough. In this sense, TV apps can provide a way to track and analyze the user behavior across multiple platforms and devices, thus providing reliable data upon marketing efforts can be based.

Within organizations, the potential of innovative Connected TV applications to disrupt traditional content production workflows and existing application development schedules should be addressed as well. Thus, adequate communication and commitment at all levels has been necessary to ensure project success.

12.5.1.   List of professional requirements from second iteration

> **NewReq13** Social TV possibilities in the area of viewer participation in quizzes, voting, rating of opinions, etc… must be pursued.
>
> **NewReq14** The possibilities to use these forms of audience participation via Connected TV applications for audience measurement purposes should be explored.

NewReq15 Explore ways to leverage existing extra content that could be offered live to viewers, for example local sports transmissions for news programs or sports telemetry and metadata.

NewReq16 The difficulty and impact that new ways of producing multicamera content for Connected TV have for the workflows of production staff must be adequately taken into account.

NewReq17 A remote control application in a second screen device should deliver additional information to the user, such as advertisements to user-tailored content.

NewReq18 Because of problems with TV device interoperability, it is essential to leave enough time for testing when developing applications for Connected TV.

NewReq19 There should be procedures and/or methods to test the Quality of Service that is actually delivered to the viewers via the non-managed network.

NewReq20 There should be procedures and/or methods to test the Quality of Experience that is actually delivered to the viewers via the non-managed network.

13 Conclusions

The first iteration of professional user requirements gathering the TV-Ring project already provided many valuable insights, which were extended and refined in the second iteration of requirements gathering. Due to the different focus of each pilot and the different type of professional users who were interviewed, a varied results with some overlap emerged. We aggregated the professional user requirements from the three pilots and generated an overall list of professional user requirements.

The main conclusions are clustered around three areas namely Business, User Experience and Engineering. Business involves all the internal processes for the broadcasters, app developers and possible paid business models. On the one hand they are concerned with the end-user of interactive TV through marketing and audience measurement and analyses. On the other hand it is also important to have a high level of internal engagement and good internal communication. Key Business points are the high production costs in comparison to a relatively small audience, internal engagement and the need for promotion and market research. User experience includes everything that has an influence on the end users' experience with using the interactive TV app. With the rise of multiple screen use when watching television, keeping users engaged is no simple feature. Design, features and content for interactive TV apps have to be very good and well balanced to keep the viewers' attention. For User Experience the key points are interaction, usability and accessibility of the services and applications developed for end users. Rich media and high video quality applications are required for better audience reach and binding. Engineering is about the technical issues and challenges when creating interactive TV apps. It includes concerns for the backend and the front end as well as protocols and standards that are important issues in both. The key points addressed in this area are standardization, scalability and the access to a wide range of devices and tools for developing and testing.

To conclude, the requirements gathered in this document are not only relevant as a basis for developing applications in the different pilots of the TV-Ring project but also offer more general recommendations for developing HbbTV applications. This should take into account costs, internal engagement, promotion and market research as well as user experience and technical issues like standardization and scalability.

13.1 Final list of combined professional user requirements gathered in two iterations

Some requirements of the first iteration are extended in the second iterations and we added a few new ones. This is the final list of overall professional requirements after two iterations:

Overall Requirement 01: Because of the relatively small number of interactive TV users, it is crucial that broadcasters, program makers and app developers work together to make Interactive TV applications be cost effective.

Overall Requirement 02: Because interactive TV is still relatively new, not very common, or well known by end-users, promotion for interactive TV apps is essential for these apps to succeed.

Overall Requirement 03: The market for interactive TV use is not well known. Therefore more market research is necessary.

Overall Requirement 04: For interactive TV development to succeed, there is a need for good communication between broadcasters program makers and app developers.

Overall Requirement 05: For interactive TV development to succeed, it is important that engagement is high for all involved departments.

Overall Requirement 06: To analyse the usage of interactive TV, it is essential to create an infrastructure that makes it simple to gather all relevant data.

Overall Requirement 07: Whether content is live or on demand, this should not make a difference for the end-user's experience.

Overall Requirement 08: Stimulate interaction between viewers in the same room and through social networks to get viewers more engaged.

Overall Requirement 09: Offer interaction within the app to get users more engaged (this works the best with quiz shows or by adding quiz elements to non-fiction shows but can also be in the form of stream selections).

Overall Requirement 10: Create a good second screen experience to enhance attention and make sure your interface has a clear focus.

Overall Requirement 11: Ease of use in both discovery and accessibility is essential for any second screen experience for any second screen app.

Overall Requirement 12: When creating interactive TV apps be very aware of the programs genre and adapt your setup and content accordingly. Think carefully about what viewers expect and what you want to achieve.

Overall Requirement 13: It is crucial for CMS's providing data for interactive TV applications to be failsafe and reliable.

Overall Requirement 14: It is essential to have easy to use CMS systems so program makers can add content to apps themselves thereby reducing costs and enhancing quality. Use one CMS for web and HbbTV applications.

Overall Requirement 15: It is important to have access to a wide range of devices for app developers and for pilot implementations and for testing.

Overall Requirement 16: Development tools must integrate standardized and consistent user interfaces.

Overall Requirement 17: Enable adaptive streaming to maximize the end-user's experience with the service in the most efficient way.

Overall Requirement 18: For HbbTV to succeed, it is important for the HbbTV signal to be freely distributed by all cable companies.

Overall Requirement 19: HbbTV end devices must be standard compliant.

Overall Requirement 20: Standards are necessary for further interactive TV development.

Overall Requirement 21: For a better audience reach and binding rich media and high video quality applications are required

Overall Requirement 22: Audience participation, measurement and marketing are crucial aspects in connected TV applications

14 Bibliography & References

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Davidson, E. (1999). Joint application design (JAD) in practice. Journal of Systems and Software, 45 (3), pp. 215-223.

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15 Annex. List of research documents, transcripts and templates

This annex contains a list of all research documents and outputs generated by the user research actions at each pilot site. The original documents (interview transcripts, audio and video recordings, participant worksheets, and others) can be retrieved by following the links.

Please note that the files are password-protected for privacy and data protection purposes. The password can be obtained on demand, by sending an email to the following mail address stating the purpose of the enquiry: audiovisual@i2cat.net

A few documents were shared or generated by all partners. These were:

- Informed consent form for professional informants (research ethics document, in English, docx file)
- Professional interview guide (methodological guide, in English, docx file)
- Data analysis workshop guide (methodological guide, in English, docx file)
- Combined requirements workshop pictures (5 pictures, jpg files)

These documents can be retrieved at:

https://files.i2cat.net/public.php?service=files&t=61be0192816e3f5c9671a3a1488130ce

German pilot

The user research conducted at this pilot site yielded the following outputs:

- Interview notes (5 contextual interviews, in German, pdf & docx files)

These documents can be retrieved at:

https://files.i2cat.net/public.php?service=files&t=176c2c8f1df25e5c4f59a9fb01fc785a

Dutch pilot

The user research conducted at this pilot site yielded the following outputs:

- Observation audio (5 contextual interviews, in Dutch, m4a files)
- Observation transcripts (5 contextual interviews, in Dutch, docx files)

These documents can be retrieved at:

https://files.i2cat.net/public.php?service=files&t=f742ee449b835c2bce23a7eee40d707d

Spanish pilot

The user research conducted at this pilot site yielded the following outputs:

- Interview audio (4 contextual interviews, in Catalan, mp3 files)
- Interview transcripts (4 contextual interviews, in Catalan, docx file)
- Professional requirements workshop notes (workshop minutes, in Catalan, pdf file)
- Professional requirements workshop pictures (5 pictures, jpg files)

These documents can be retrieved at:

https://files.i2cat.net/public.php?service=files&t=871fa41bfe615a9457511b43076db4d6