Deliverable D2.1

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1. Executive Summary

This document presents the three HBB-NEXT usage scenarios and the high level use cases extracted from these scenarios.

Chapter 2 sets the agenda by outlining the framework provided by the project for this work, the basic terminology used and the approach chosen: The usage scenarios are told from an end user perspective and illustrate the innovations of HBB-NEXT. They describe HBB-NEXT service usage by individuals and groups during different usage situations and at different times. The use cases deducted from the scenarios describe the interactions between a user and HBB-NEXT system components. They are the starting point for extracting detailed functional requirements for Deliverable D2.2 System, Service and User Requirements and for the development work to be performed in work packages 3, 4, 5 and 6.

Chapter 3 details the goals, the methodology and the results of the work package 2 workshop early in the project. This very fruitful joint event was organised by K.U. Leuven for the purpose of early usage scenario development. It actively involved all HBB-NEXT partners and was based on a structured brainstorming process, resulting in three "skeleton"-scenarios which were the basis of all further work efforts. As HBB-NEXT has a user centered approach and focuses on multi user and multi device aspects, each scenario puts different target users to the centre of attention. Scenario 1 presents a family watching TV at different times during one day. Scenario 2 covers people with a shared interest over a week and scenario 3 features friends watching a TV Live Event. The "skeletons" derived in the workshop were fleshed out in narratives dealing with the motivations and resulting use cases of certain personas.

The three final detailed usage scenarios are documented in Chapter 4.

The usage scenarios are understood as instruments for collecting a great variety of HBB-NEXT-relevant use cases. Chapter 5 details the approach of systematically identifying high level use cases from the scenarios and grouping them. A list of these high level use cases for subsequent requirements extraction in Task 2.2 is provided. A total of 38 use cases was ex-

tracted, highlighting those use cases that are most relevant to the set of innovative HBB-NEXT enablers being developed in WP 3, 4 and 5.

Chapter 6 rounds off the document with an outlook to the further steps of work defined by the HBB-NEXT partners to move from HBB-NEXT use cases to HBB-NEXT functional requirements.

2. Introduction: Usage Scenarios / Use Cases in the Framework of WP 2

Work package 2 is one of two umbrella work packages in HBB-NEXT - together with the overall system integration work package 6 it runs for the complete duration of the project. The usage scenarios of Task 2.1 (Month 1 to Month 3) prepare the ground for deriving the requirements for technical development in Task 2.2 Requirements. Thus, the usage scenarios and their use cases described in this document are the basis for the development work to be performed in work packages 3, 4, 5 and 6.

The definition of usage scenario in HBB-NEXT is:
"A usage scenario tells a story in order to describe a service from an end user's perspective. It also describes roughly the production background from the professional user's perspective" (D1.1, p.30). In this document the professional user perspective is not yet included. In the process of establishing the usage scenarios it became clear that it was more efficient to fully take the perspective of the end user in order not to limit the use cases. The production background will come in for D2.2.

The definition of use case in HBB-NEXT is:
"A use case is a sub-element of a usage scenario which consists of one user action or a short sequence of user actions" (D1.1, p.30)". Use cases are defined and described in detail in Chapter 6 of this document.

The task posed by the HBB-NEXT Description of Work (DoW) was to create usage scenarios and use cases which illustrate the innovations of HBB-NEXT. When work in Task 2.1 started, it was consequently decided that all the seven HBB-NEXT technology enablers listed for the objectives of the project (DoW, p. 7ff.) would have to be mapped against our usage scenarios in order to make sure that the main objectives of the project would be reached. To this end, the term "enabler" from the HBB-NEXT DoW (DoW, 4ff.) was defined more specifically: "Enabler functionality is a basic functionality enabling a certain use case. A service proposed to a user consists of an organised set of enabler functionalities." It was also decided that the scenarios would have to reflect HBB-NEXT service usage by different users (both individuals and groups) during different usage situations and in different (successive) time slots. De-

tailed persona descriptions in the scenarios were to help to create realistic usage situations through understanding motivation of actions. From these prerequisites the usage scenario creation workshop started (Chapter 4). As indicated in the HBB-NEXT DoW the role of the usage scenarios is to form representative examples that implement the HBB-NEXT vision. As to the process of deriving use cases from the scenarios, the HBB-NEXT DoW states:
"As a first step, usage scenarios for next-generation multi-user hybrid TV services will be produced. Two of these scenarios will be selected and broken up into use cases". We slightly modified this approach: In order to integrate all elements related to the HBB-NEXT three scenarios were created. All three scenarios were then split up into use cases. This was done in order to collect a large variety of use cases with completely different personas using different types of content and services in different situations. This way we have sufficient critical mass to cover all aspects related to the HBB-NEXT enablers. It is important that we derive sufficient relevant use cases (and requirements in a later stage). Therefore, it might not be essential whether we hold on to 2 or 3 scenarios; instead it is critical that we make sure we have the relevant use cases for the project.

Consequently, the usage scenarios described in this document are not a simple blueprint for a potential demo showcase in HBB-NEXT in terms of content and features. They are instruments for deriving requirements via filtering out as many relevant use cases as possible - mapped against the HBB-NEXT innovations. This will be the basis for selecting the most relevant use cases and Requirements in Task 2.2 (Chapter 6 and 7 of this document).

3. Usage Scenario Development Process

Scenario-based design is an approach to designing interactive systems *"in which the use of a future system is concretely described at an early point in the development process"* (Rosson & Carroll, 2007). According to the same authors, scenarios should be concrete but rough, maintain an orientation to people and their needs, and be evocative so they can raise questions at many levels during the design process.

In order to achieve these goals, a structured approach was used to create scenarios describing possible applications in the HBB-NEXT project. Although it is preferable to base scenarios on user research in order to achieve a high degree of realism, because of the early stage the project is in this was not feasible yet. Therefore, a set of brainstorming techniques was used to generate the scenarios, while keeping a close link with the original goals of the project. In this section we will describe the goals of developing the scenarios, the methods we used to arrive at the scenarios, as well as the direct results from this approach.

3.1. Goals

For planning a scenario-based design approach, it is important to consider what needs to be achieved with this effort:

- Although the partners were already working together for the project proposal, it is still important to get to know each other better, especially at the beginning of the project.
- Creating scenarios is a way to envision a certain future or vision; in this case related to how next generation hybrid broadcast broadband solutions might come to life.
- Another important function of creating scenarios is the alignment of the visions of all partners on the project, especially given the multidisciplinary nature of the team.
- Finally, by working on a scenario together, it is easier to discuss the scope of the project from the beginning.

With these goals in mind, we decided to organize a face-to-face scenario creation workshop where all project partners were involved for creating the basic elements of the scenarios (or

"scenario skeletons"). Reviewing and fine-tuning the scenarios was done after the workshop, again involving all partners.

3.2. Methods

During the scenario creation workshop we used an approach consisting of six steps, including brainstorming, structuring and documenting techniques. In this section, we will describe these six steps and how they were applied during the workshop.

3.2.1. WWWWWH Technique

In the first step of the scenario creation workshop we used a popular brainstorming technique called "WWWWWH". The letters from this acronym stand for the starting words of the basic questions people ask when gathering information: Who is doing What, When are they doing it, Where, Why and How? These six words help to get a clear view on the basic elements needed to create HBB-NEXT scenarios: people/users (who), activities (what), time (when), location (where), motivation (why) and the means to achieve all this (how).

The project members were divided into three groups, making sure that people from the same partner organization were always in different groups in order to achieve multidisciplinarity in each group. Three tables were fitted with pens, paper and post-its notes, and two questions were assigned to each table with a pink post-it note stating the "w"-question dealt with at this table. The groups would then each sit at one table, and brainstorm on these two questions in relation to the HBB-NEXT project objectives, putting all their ideas on yellow post-its. After 10 minutes, the groups would rotate to the following table, working further on the results the previous group left behind. This phase ended when all groups had worked on set of questions.

Figure 1: Rotating groups thinking about their questions

3.2.2. Affinity Diagramming

A brainstorming technique like the one used in the previous step, results in a large collection of ideas on post-it notes. In order to make this information workable, and to make it possible to select these elements that are relevant for further use in the scenarios, a structuring technique is needed. We chose to use affinity diagramming, as it is a straightforward way to organize qualitative information and can be executed in groups.

Performing affinity diagramming is very simple: two post-it notes that are closely related are placed close to each other; two post-its that are not related to each other are placed far apart. By applying affinity diagramming to the whole set of information, groups or clusters

will start to appear. As a result, we ended up with almost 30 thematic clusters. At the end of this step, we went over all the groups and labelled the clusters so it was clear what each group of ideas signifies. Individual items were not removed, as they were still needed for the selection process in the next step.

The following labelled clusters were created, among each of the multiple single elements were grouped:

- **When:** Time; Event Related; Technical; Content/Context; Action
- **Where:** At Home; Location; On the Move; Others
- **Who:** Individuals; Professional Users; Groups; Institutions
- **What:** Service; Acting; Devices; Content; Enhancement
- **Why:** Social; Information; (Personal) Need; Usability; UX Goals; Why for Providers
- **How:** Connect Broadband & Broadcast; HBB-NEXT Enabled; Action Functionality; Cloud Sync; UI

Figure 2: Creating thematic clusters

3.2.3. Selection

An essential principle in brainstorming is to create as many ideas as possible, and that those ideas are not reviewed or rejected at first. At this stage however, all ideas are still present, which is too much to be workable. Therefore, a selection technique for identifying the most relevant information is needed at this point.

We carried out a selection in two steps. For the first step, every workshop participant received 16 blue stickers to vote on post-its he or she found very relevant to the project. For the second step, every participant received one red sticker, to put on ideas he or she thought is a “must have” for the project. Because all project partners were involved in this process, and due to the multi-disciplinary nature of the team, this guaranteed that items that were relevant for each partner would be included in the scenarios. In a next step, an extra crosscheck was done to ensure that all objectives of the HBB-NEXT project were indeed included in this selection.

As a final selection, the post-its with the most votes (at least three blue stickers) and the post-its with the “must-have” votes (at least one red sticker) were retained and used to create the scenario skeletons in the next step.

Figure 3: The single elements in the clusters have been evaluated and marked

3.2.4. Creating Scenario Skeletons

In order to make sure that each single element selected in the previous step is included in at least one scenario, a 'skeleton' for each scenario needs to be created. This skeleton is a rough sketch showing the elements and their connections. The skeleton forms the basis of the story, which is 'fleshed out' later on with more details, i.e. writing comprehensive narrative stories with enough details to exemplify the use of the system in a realistic situation.

For creating these scenario skeletons, all participants were divided into three groups again. Each group was assigned to one table on which a large piece of white paper (from a flip-chart) was laid out. Each group could now start to form one usage scenario for HBB-NEXT making use of the selected post-its. At the start of the scenario skeleton creation we had a discussion on how to exactly start with this exercise. How could we avoid that the three groups would end up with very similar scenarios or parts of scenarios? To ensure that each scenario was different, and in accordance with our user-centred approach which focuses both on groups and individuals, we chose different target users as a starting point for each scenario. These target users were derived from the earlier brainstorming exercise: scenario 1 started with 'family' as target users, scenario 2 with 'people with shared interests' and scenario 3 with 'friends'.

Once this decision was made, first each group selected those post-its, which it thought to be relevant as the building blocks for its scenarios. One post-it could of course be used by different groups, as some elements are relevant for several situations. Most groups organized these post-its then via the WWWWWH structure at first (see step 1), because it provided a clear structure to start off with. Then, step-by-step more details and specifics where filled in and discussed among the members as well as between the groups. This resulted in the three scenario skeletons which include all the building blocks needed for "fleshing out" the scenarios.

3.2.5. Enabler Checking

Although the techniques used in the previous steps were already closely linked to the objectives of the HBB-NEXT project as well as to each project partner's competencies, it was important to check if the resulting scenario skeletons included all elements necessary to com-

ply with the HBB-NEXT project vision. Therefore, in the fifth step a paper was distributed to all workshop participants with the list of enablers from the HBB-NEXT proposal. Each group was asked to mark the enablers present in their scenario. Afterwards, all sheets were collected and checked to make sure each enabler was used in at least one of the scenarios. Similarly, all post-its with at least three blue stickers or at least one red sticker (see step 3) were checked to see they were also used in at least one of the scenarios.

Figure 4: Checking enablers and evaluated components for a scenario skeleton

3.2.6. Documenting

At the end of the workshop we documented each scenario by taking a picture of the resulting scenario skeleton paper. As the basic information on the sheet is not always sufficient to represent the whole idea behind the scenario, one member of each group presented their scenario for approximately five minutes, which effectively created already a short narrative description of the scenario. This presentation was recorded on video and shared with the partners together with the pictures. By documenting the scenarios using rich media, there was a solid basis for writing out the scenarios. Most of the photos taken are contained in this document, the videos of the scenario skeleton presentations from the workshop are accessible via YouTube:

Scenario 1 - http://www.youtube.com/watch?v=cPqlruzUUfk

Scenario 2 - http://www.youtube.com/watch?v=C7cWNMmNdjI

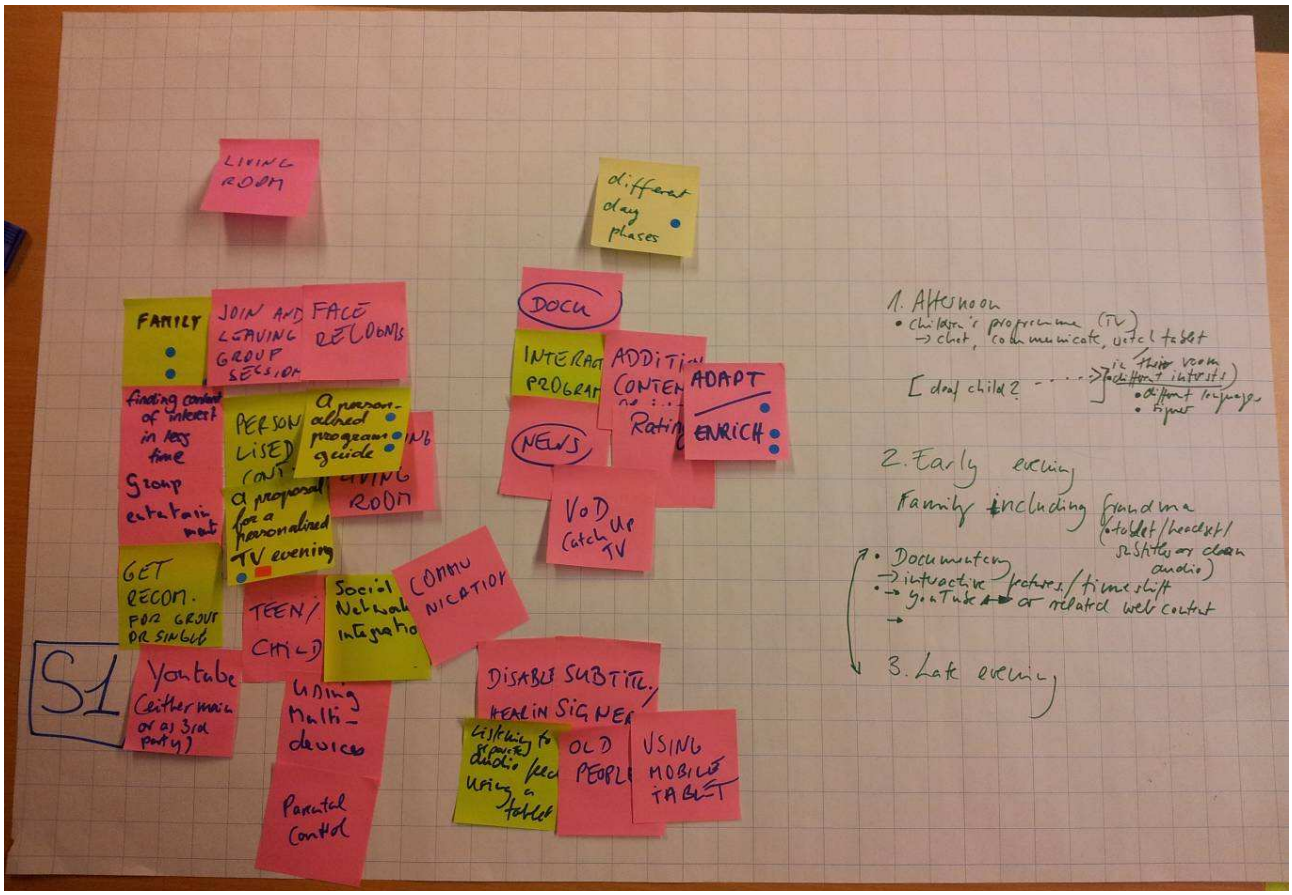
Scenario 3 - http://www.youtube.com/watch?v=0PgGYgZKYWQ

Figure 5: Presenting scenario sceleton 3 to the group

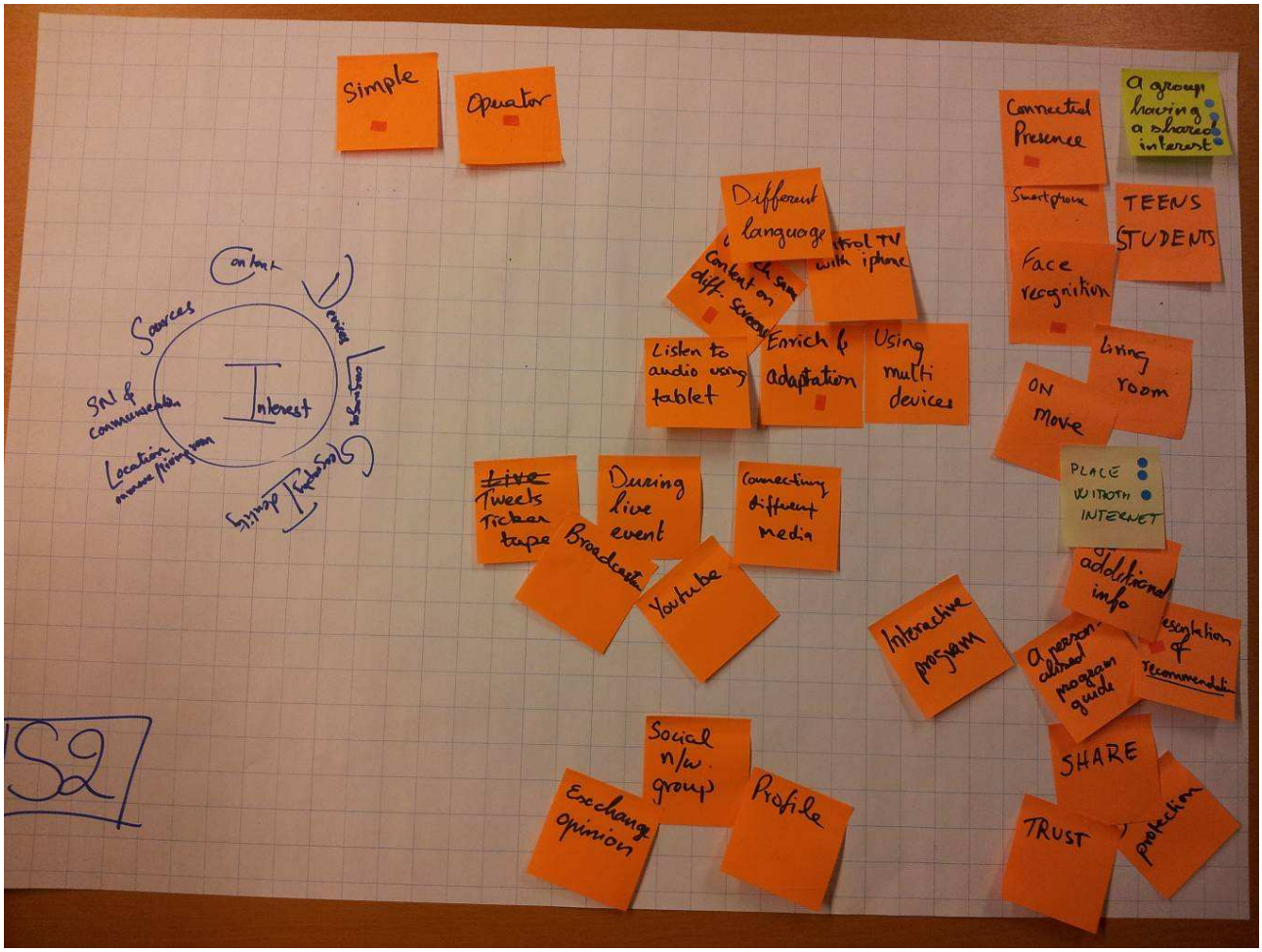
3.2.7. Results

As a result of the scenario creation workshop, the following three scenario skeletons were created:

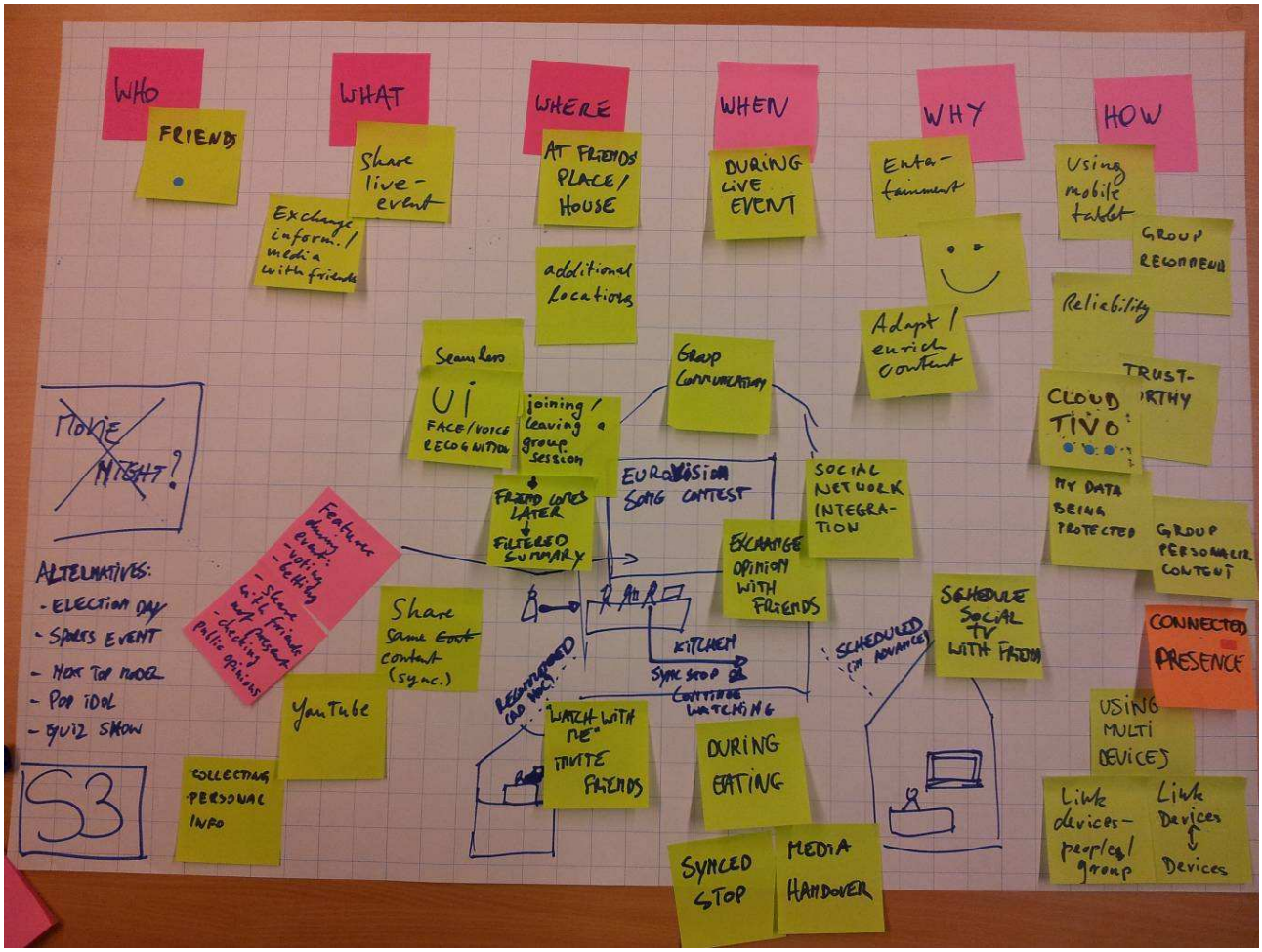
Skeleton of scenario 1 (family):



Skeleton of scenario 2 (people with shared interests):



Skeleton of scenario 3 (friends):



3.2.8. Final Steps

After the scenario creation workshop, in which all partners had the benefit of face-to-face cooperation, it was necessary to work out the scenarios in full narrative detail and derive initial use cases for the technical work.

At the end of the workshop, the following procedure for the remainder of the scenario creation effort was defined and executed:

First Version of full Scenarios

Three partners each worked out one scenario in detail, based on one of the scenario skeletons.

Exchange of Scenarios for Feedback

The same three partners exchanged their scenarios in order to look at the other scenarios and generate first feedback.

Update the Scenarios

The scenarios were handed back to the original creator, and each partner updated his/her scenario according to the feedback by the other partner.

Feedback from all Partners

The scenarios were sent to all involved members of Task 2.1 for feedback.

Use Case Generation

From each scenario a number of use cases were derived according to an approach which had been agreed jointly in the workshop (section 6 of this document).

Update the Scenarios

The three partners writing the original scenarios again updated the scenarios based on feedback from all involved partners.

Enablers checked again

The enablers listed in the project proposal were checked once again in each scenario and all enablers were attached to the use cases.

4. Usage Scenarios

The following section lists the three developed usage scenarios. At first sight the scenarios might appear verbose, too detailed. The fact that the scenarios are very rich is because we needed to make them realistic from a user point of view and for this purpose needed to work them out to a sufficient level of detail: Realistic and more fine grained use cases can only be derived if personas act in every day situations, only then motives of individuals (personas) can arise and from the motives the use cases just follow. The workshop at the source of this approach helped as an important envisioning exercise. The motivation was that we wanted to make sure we cover all enablers related to the project. During the course of the project, by conducting user experiments and the insights that will arise from them, the vision carried out in these scenarios can be refined further.

As outlined in chapter 3, the scenarios were used to deduct use cases. Both the approach for this and the singled out use cases are described in detail in chapter 6. However, the use cases are referenced in brackets (e.g. U.001) here in each scenario as they turn up. As will be described in more detail in chapter six, not only use cases but also actors were defined in order to describe and differentiate the use cases as interactions of certain types of users with the HBB-NEXT system. These actors are also referenced in the scenarios in brackets (e.g. A.001).

4.1. Scenario 1: Family Sharing a House

4.1.1. Background: Hybrid Broadcasting-Based Services for a Heterogenous Group

Like done for all of the three scenarios, here a specific user group was defined first of all, in this case the user group “family”. Furthermore a certain focus was chosen: hybrid services starting from a (public) broadcasting perspective. Moving from there, the work group responsible for this scenario chose those elements from the brainstorming session which were thought to be relevant for scenario 1. “Family” as a user group reflects a heterogeneously structured target group: children, teens, grown ups and older people may be portrayed (diverse socio-economic and demographic background). The personas were described in detail to illustrate the motivation behind the user actions. Describing motivation was found to really help in creating a great variety of realistic use cases for hybrid services.

In order to generate a great variety of relevant use cases the scenario was divided into three time phases during one day, each time phase reflecting different members of the group acting and different programmes (formats) being broadcast.

4.1.2. Personas: The Weber Family

The Weber family lives in Berlin. Both parents are working and they have a fairly good living standard and a high level of education. The Webers are people who are interested in the world around them, they are not in a political party but they are interested in society and politics and they want make their voice and opinion heard whenever topics touch their experience.

The Webers are open to new media but they want to use them just for what and how they need them. Likewise, there are days when they watch a lot of TV and other days when they don't at all because they simply do not have time or participate in the "real world", seeing friends or doing sports. They are not zappers but selective viewers who are always happy about a good recommendation along their interests.

With a grandma that is hard of hearing and slightly sight impaired, the Webers have needs which are quite common related to the demographic changes in society.

Tom is 8 years old. He is attending primary school. Tom owns no individual device (but would like to, of course). Being a little brother, he would also like to do more of the things that his big sister is already allowed to do and he is often jealous of her. But he also admires her and likes to spend time with her and learn more about social communities and communicating with distant friends. As many others in his age, Tom loves interactive games and takes all opportunities to live out his childhood creativity. But he always tries to show his maturity through his behaviour, if he is together with his sister. Tom also plays in a theatre group of the primary school which is great fun for him. And he particularly likes animals and nature and the rawness within.

Lisa is 12 years old and is attending high school. Since last Christmas, Lisa owns a smartphone. Her best friend is Mia. Both girls are "online" most of the time, chatting with each other and are also members in special online communities for girls of this age. Lisa really likes to communicate with her friends all the time, about everything they do. Clearly, she

wants to be online if she is on the move. And Lisa looks forward to being a teenager but still enjoys the time she spends with her little brother Tom. She likes to explain things to him and care for him. But, as big sister, Lisa is the “cool” one and can always tease and annoy him and she can use him as an excuse for “childish” behavior on her side.

Marie - 75 years old - is Tom and Lisa’s grandma. She is hearing and sight impaired due to her age. She wears glasses but refuses to use a hearing aid – not yet! She has been widow for five years now and she is happy to have her own flat in the same house as her daughter and her family. She can support them and feels integrated into family life. Also because both parents work full-time she often is with her grandchildren. Marie helps them doing homework, together they play games and watch TV. According to her age she has a more traditional attitude, which is reflected for example in her interest in folksy music and documentaries about old customs and traditions. On the other hand, Marie is ahead of her generation. Through her grandchildren she learns a lot how to handle new technologies and is game for any new feature that is not too complex and helps getting access to media, communication and other services. She owns a smartphone and understands and uses a number of offered features, although she sometimes forgets things. Marie really enjoys that she can easily stay in touch with so many people, either from her past or people who live far away. And she really likes the large offer of convenient services which are provided via the internet.

Hanna is Tom and Lisa’s mum and Marie’s daughter. She is 41 years old, works in a museum and likes modern art a lot. Her working hours are very varying and it's great that the family can be supported by her mother as well. Therefore, Hanna is grateful and tries to tolerate the traditional attitude of her mum, which is very different from her own. Perhaps because of her more conservative mother, she is very liberal and open minded. But Hanna still wants to teach her kids respect for others, to know rules and sets value on fair behavior. Hanna is well educated and well informed, so she tries to provide her children with a lot of knowledge. She wants to be sure that her children only use media appropriate to their age and that the children watch TV at proper times and do not spend too much time in front of the TV set. Hanna really likes to discuss contemporary and controversial topics. It is important

to have a mind of one's own and stand up to voice you opinion. This is also one of the reasons why she married the self-confident Ben 15 years ago.

She owns a smartphone and usually leaves her tablet on the coffee table in the living room – it might be useful for somebody else. Hanna has never been particularly interested in technology; she just wants a simple approach to being well informed. She does not like it at all when things are complicated and take a long time to understand and she can get impatient very quickly. So everything has to work slick and easy. Hanna is not interested in technological background information, on how a system works or something, it should just work well and adapt to her life - for example time-independence is very important for her, because of her working hours.

45 year-old **Ben** is Tom and Lisa's dad. He is a university professor teaching modern history. He is very interested in politics, society and recent history. He always searches for the human perspective behind the large historical and political picture. For example, he loves getting witness accounts. For seven years Ben has been following the global media change including the new multimedia possibilities and web 2.0. He is especially interested in the changes of communication and participation. Ben is a man who likes to take the centre stage. He often tells his kids about his lectures, when he is standing in front of his students. But even if this sometimes bores the kids, he can always motivate his family to join and take advantage of new media opportunities - to use them just as they need it. For Ben it is most important that he can contribute to any topic in which he is interested. This means a new way of democracy for him and a revived freedom of speech. He owns a smartphone and a tablet. As a professor Ben is often on the move, he holds lectures and has to join many meetings and conferences. So he likes to use multimedia tools and to communicate with his family, also about certain TV shows on his travels.

4.1.3. Detailed Description/Story: A typical Afternoon and Evening in a Berlin Family

Afternoon – School's over, lets relax

Tom and Lisa are home from school at 15:30. They go to their rooms and do their homework. Once Lisa has finished, she wants to relax and be simply entertained. Lisa goes to the

living room, sits down on the couch and switches on the TV set. Lisa (A.002) says “hello I am here” – her identifying phrase - and is instantly being identified (U.001) by the system.

Recommendation from a Friend

Straightaway, a notification pops up (U.002) on the screen that her friend Mia (A.002) is currently watching (U.003) “Rapunzel” a fairytale movie. Mia (A.002) has already rated the movie and gave 4 of 5 stars (U.004) because she likes the main actor, who is also lead singer of her favourite pop band “UpAbove”.

Recommendation from the System

At the same time, according to Lisa’s profile, the system has adapted its offerings to her abilities, age, interests and additional devices. Based on Lisa’s profile the system recommends several broadcasts, on-demand and other services, presented as a list (U.026, U.005). Both Mia’s recommendation and the fact that the main actor is also lead singer of Lisa’s favourite pop band “UpAbove”, bringing the fairytale movie on top of the list. As she (A.002) agrees to this top recommendation, the programme is displayed on the TV set (U.006).

Chatting with the Smartphone

Lisa is also a member of the social network “ThatzMe” where she is member of a dedicated group of fans of “UpAbove”, so the system connects to this group as well (U.007). Right now the system asks (U.005) if she (A.002) wants to join a group chat (U.039) about the movie (U.002). She (A.002) agrees and chats in between with the help of her smartphone (U.023), where the chat app is transferred to (U.008) on her voice command (U.012). Because her brother hears the movie he suddenly appears and Lisa asks him if he wants to join her watching the movie.

Profile for the little Brother

Now that Tom (A.002) is inside the room the system recognises him (U.001), verifies his age, and asks if it should load his profile (U.009). As his sister agrees and the TV adapts to the group profile (U.010), no external chat can be offered, because Tom (A.002) is profiled (U.010) as being too young for this (U.011). Instead, on the bottom of the TV screen, right in the area of the lower black bar of the letterboxed movie, Tom (A.002) is being offered information on more fairytale and knights movies by this broadcaster and also video-on-

demand providers (U.025, U.005). Tom (A.002) approves (U.015) with some quick voice command (U.012) that the system should re-offer "Puss In Boots" ("Der Gestiefelte Kater") next weekend (U.013).

Additional Content on "Rapunzel"

But for now Tom really adores the actress acting "Rapunzel" (U.005). She is so sweet, but Tom will not tell his sister. Anyway, the small application at the bottom of the TV screen tells them that there is more ("you want to see more?") (U.014a). He asks Lisa to stop the film (U.020) and goes to the web to access the additional content (U.016) – he might find a few pictures of the actress (U.040). This makes Lisa quite angry, she screams: "Not now, it's so exciting, go away!" Tom also gets really angry and they fight. Finally she pities him and allows him to use their mother's tablet for accessing the application and the additional content (U.008) while she continues to watch the film on big TV screen (U.020). Tom (A.002) looks at a couple of interviews, finds lovely pictures of his Rapunzel and downloads a wallpaper (U.014). He then dreamily looks at an eCard with the actress's picture. Lisa is curious and wants to see what he is doing: "You can send this to Finn"! "No, that's embarrassing – I will not". "Ok then I send it", she says. She (A.002) writes an eCard using the tablet (U.008) and off it goes to her friend Mia who is living next door (A.002, U.009).

No Online Purchase for Children

After 15 minutes Lisa comes back (U.009) and both kids (A.002) go to the online shop (U.016) to look at the fairy tale DVDs on sale, Lisa (A.002) wants to buy one – but she cannot – a purchase lock is built into profile (U.011).

Figure 6: Age verification (U.011)

So the girl (A.002) sends this purchase to her mothers profile for approval.

Early Evening – Mom, Dad, Grandma and Children enjoy Family TV

After the fairytale movie has ended at 17:30, Grandma Marie is coming in. She lives in the same house and joins the family for dinner everyday. Hanna has just arrived from work and starts preparing dinner in the kitchen. At 18:05 Marie (A.003) enters the living room just as the system recommends the regular animal documentary “Panda, Gorilla & Co” (PGC) based on the Weber’s group profile (U.005). PGC is about the two very popular Berlin Zoos and its animals.

Clean Audio Track for Grandma

Tom and Lisa ask her Grandma if she wants to join them watching PGC. Marie (A.003) agrees and is being identified by face recognition (U.001b). Because of Grandma’s attendance, the system asks if it should either add subtitles or a clean audio feed to the programme (U.010, U.014b). Marie (A.003) decides to have the clean audio track on her smartphone (U.008), using earphones because she does not want to get disturbed by background noise of the animals or the surroundings and does not want to disturb the rest of the family with embedded subtitles.

Using the HBB-NEXT App with Timeshift

Marie (A.003), Tom and Lisa (A.002) are enjoying today’s episode of PGC. An interactive HBB-NEXT application, holding additional PGC texts, images, behind-the-scenes-footage and other video clips and information, was started automatically and is displayed minimised (hidden) on the bottom of the TV screen, so that only one line of text-links can be seen (U.014a). When Marie (A.003) maximises the application by pressing the red button (U.018) a notification pops up (U.002): "Pause the programme?" Marie decides to pause the show (U.020) and watch the rest once she has closed the HBB-NEXT-App. Now all the content can be seen and accessed (U.014). In line with the graphic animations, which lead over from one zoo to the other, in the real programme a rotating road sign illustrates the navigation paths through all the content.

Buying Tickets by a Swipe

Marie suggests going to the Zoo at the weekend, the kids are enthusiastic. Marie (A.003) asks Hanna if this is okay and has a look at the opening times via the HBB-NEXT application.

A link to the zoo website is included which Marie (A.003) sends to her smartphone (U.008) by doing a swiping gesture in front of the TV set (U.019). Now the TV Sets asks if PGC should be continued, Marie agrees and (A.003) buys the tickets online using her smartphone. The children want to know how long it takes to get there because they are both invited to a birthday party on Sunday afternoon. With the help of a Google Maps application running on the TV set (U.014b), Marie (A.003) collects all needed information how to get there.

When Ben arrives at home Hanna has the dinner ready and asks the kids for joining them at the dinner table. The whole family has now left the living room and sits around the kitchen table. The system recognises that nobody is in reach anymore (U.009), pauses and saves the viewing session (U.020).

Identifying Mom - EPG on her Tablet

After dinner, while Marie and Ben are clearing the table Hanna and the kids are returning to the living room. The system identifies all of them (A.001, A.002, A.003)(U.001) including Hanna who is now identified as a newly arrived member of the group (U.009). Because it is obvious that Hanna (A.001) is new in this session, the system offers her (U.005) EPG data of the resumed programme on her tablet which is lying on the coffee table (U.008). The system asks for resuming the PDC documentary without a clean audio track (U.014) because Marie (A.003) is not there at this moment.

Later Evening: Watching News

Personalised for Grandma

At 19:30 Hanna brings Tom to bed and reads to him. At the same time Lisa, Ben and Marie start watching “rbb Abendschau”, the main news show for Berlin (U.006). Because Marie (A.003) is back in the group now the system instantly adds HBB-NEXT- powered subtitles to the TV screen (U.014a) which are adapted according to Marie’s profile (U.010). The subtitle stream comes in via the IP network (U.40a), but Grandma does not want to know every detail. She has once entered her subtitle priorities into a simple application and the system remembers: For news programmes and magazines Grandma prefers subtitles to have quite large letters with a dark grey semitransparent background. The grey box behind the subtitles helps contrast with all the graphics and letters on the screen. Whenever there is a fictional programme she prefers simply rimmed letters for the subtitles as contrast is not such

a problem here (U.014a). Sometimes Granny prefers the subtitles with the TV programme displayed synchronised on a tablet (U.41c) for reception because she does not want to disturb the other family members. Then she would get a complete video stream having both, the video and the subtitles on the tablet (U.41d, U.035, U.035a). But not this time as everybody agrees on having the subtitles on the screen.

Figure 7: Accessing service (U.006), HBB-NEXT application (U.014a), Updating group profile (U.010)

Once the news is finished Ben tells Lisa to go to bed and goes to another room to make a phone call while Hanna comes back to the living room. (U.009) Now, at 20:00 the main national news programme “Das Erste - Tagesschau” starts. Because Marie (A.003) is still in front of the TV set, the IP-based HBB-NEXT subtitles are still being displayed on the screen.

After Tagesschau has finished, Ben comes back to the living room. Right then, a notification pops up on the screen of Marie’s (A.003) smartphone (U.002). It reminds Marie of her favourite TV programme - a folksy music show. Ben and Hanna secretly roll their eyes as they hate German folk music. Marie knows – she takes her leave and returns to her own flat where she has to feed her cat anyway.

Late Evening – A Couple using an Interactive Programme

Useful Timeshift

Hanna and Ben decide to go for a walk now. As they are about to leave the living room, the system notifies them (A.001) on the TV screen (U.002) about tonight’s talk show “Klipp & Klar” (“In plain language”, abbreviated as KuK in the following) on violence among young

people (U.005). This is their topic: Just recently, Marie has been hassled after school by a strange gang of youngsters and they feel helpless what to do about it. It is scheduled for 21:00 and the system automatically asks the users if it should remind them to trigger the time-shifting of the programme or should do nothing (U.002). Ben (A.001) confirms the time-shift schedule – just in case (U.020).

Second Screen App for Information and Voting

Hanna and Ben return home just in time at five minutes past 21:00 and make themselves comfortable on the couch having snacks and wine while watching KuK (U.020). The KuK HBB-NEXT application offers several additional content bits: image slide shows, information on guests in the studio, recent KuK programmes as video-on-demand, polls and additional background information on recent and current topics (U.014a). At the start of the programme, and in between, the presenter recommends viewers to use the HBB-NEXT app to take part in a user voting regarding a controversial question. As Hanna (A.001) has announced her tablet as an additional device for this TV session (U.022), the voting is also displayed on her tablet's screen (U.008). She (A.001) votes "Yes" while Ben (A.001) votes "No" with his smartphone (U.023), which is also registered as part of the TV session (U.022).

Figure 8: HBB-NEXT application (U.014a), Devices recognition (U.022), Re-routing synchronized content device-to-device (U.008), User input – additional device (U.023)

Videochat: Being Part of the Programme

While watching the programme Ben becomes increasingly concerned about the problems his daughter encounters. He wants to ask a question – the expert on screen might be able to help him. So Ben (A.001) takes the opportunity to virtually enter the show via video chat with this expert (U.024). Ben (A.001) uses his smartphone and its built-in camera (U.023). After having passed the editorial team and the show's producer this video chat is now part of the live show and transmitted to each TV viewer (U.006).

Timeshift for discussing On Demand Content

Hanna and Ben (A.001) discuss in between and look for additional information on the show's topic by using the given HBB-NEXT application (U.014a). Ben (A.001) chooses an audio interview of an expert on these issues, which was aired on the radio this morning (U.014). Instantly, the KuK programme is time-shifted (U.020), so that Ben and Hanna can focus on the on demand audio interview. The radio piece has a very conservative approach and recommends parents to be stricter and more authoritarian with their children. Hanna gets angry: "Stupid egghead, I am sure he has no children himself and he is really reactionary", Ben contradicts because he sometimes thinks Hanna is too liberal with their children. Thank God they have such a type of relationship that they do not take it personally if their opinions are different. But just as well that the time shift allows them to finish their discussion and then resume the talk show without missing anything (U.020). At the end of the show the KuK host announces the topic of next week's KuK talk, about recent decisions in the regional educational system – the budget for private schools in Berlin is going to be cut. Hanna and Ben have friends with children on private and really alternative schools, and indeed they are just thinking about sending Tom to one of them for secondary school. Hanna remembers the HBB-NEXT info about the option of attending the live show in the studio next week. So Hanna (A.001) maximizes the HBB-NEXT app (U.014) and registers for joining the next show in the TV studio (U.018). And of course they want to see now what it will be like there. So Hanna (A.001) starts the picture slide show "Behind the scenes" (U.014a).

Slideshow in the Cloud

This slideshow has a lot of advanced transitions which will be rendered in real-time. But the TV set has insufficient computing power, so the slide show is rendered in "the cloud" and

smoothly displayed on the TV screen, though (U.035, U.035b). Hanna and Ben do not notice any delay or interruption. Having finished watching the slide show, Ben is tired now and goes to bed (U.009). But Hanna feels that after the discussions she must calm down a bit and is still playing around with the tablet. She (A.001) starts the EPG app on the tablet (U.025). Now she can scroll and slide with her fingers through the programme items, up and down for the different TV channels, left and right for going through the time line of channels and for instance can add bookmarks for upcoming broadcasts (U.013). She now confirms her channel of choice "ARD" with a finger tip, so that the TV switches the channel accordingly (U.008d). By going beyond the left-hand side "Now" limit on the tablet EPG, she accesses the last episode of her favourite soap opera which she missed this afternoon. This item is already highlighted, because the system knows her favourites already (U.005). With one more finger tip she confirms the playback of the chosen video-on-demand programme, which starts displaying on the TV screen (U.017). As the episode ends Hanna is ready for bed (U.009).

4.2. Scenario 2: A Community of Like-Minded

4.2.1. Background: Organising and Communicating around a Hobby

The main focus for this second HBB-NEXT usage scenario is a group of people having a shared interest. Inspiration for this scenario is drawn from a Belgian mountain bike community- organized via a website and a bulletin board. This broader community is a collection of local mountain bike clubs and mountain biking individuals who come together online to (among other things):

- Organize mountain bike tour events.
- Talk about the latest competitive cycling news.
- Discuss new cycling technologies or mountain bike parts.

The BikeMe community in the scenario is a fictional online community by and for mountain bikers. All the available tours are placed on a calendar so you can check when you want to go where. These tours are mostly organized by local organizations such as football clubs, fire departments, or mountain bike clubs. People can register for these tours online, and have to pay a small fee (€5 on average). But then they get the following in return:

- A number of mountain bike distances (25km and 45km are most common)
- Guidance in the form of plastic arrows placed at every turn on the tour, and a GPS track so people with GPS devices can use these as well
- Provisions (bananas, waffles, energy bars, sport drinks) at certain places on the tour
- Insurance (by registration)
- Pictures: most organizers try to find an amateur photographer to take pictures of the mountain bikers at different places on the tour and place them online; people always like to see themselves on these occasions
- Emergency pick-up when you or your bike is in trouble.

The mountain bike community is an interesting case as a usage scenario for HBB-NEXT:

- The involvement of local clubs
- A group of people with a diverse socio-economic and demographic background
- A group with diverse technical skills
- A scenario that originates more from the Broadband side in HBB, but offers sideways into the Broadcast side
- Some of the people use a number of different devices such as GPS devices for tracking tours, for following routes, heart rate monitors for training, speedometers
- a clear shared interest, and one that is quite different from entertainment scenarios commonly associated with television and social networks
- options for business modelling since a dedicated part of such communities is talking about new cycling technologies and asking for advice what to buy, or suggestions for travelling to interesting mountain bike locations
- an activity or shared interest that stands on its own without the technology, but for which technology can provide significant added value

4.2.2. Persona - Luca, 22 years old

Luca (A.001) studies Physiotherapy at the University in Leuven, and is in his final year. As most Belgian students he stays in a dorm room in Leuven during the week, and returns to his parents' home every weekend with his dirty laundry. He has always liked sports and

leads a very active life. He likes to go out and hang out with his friends, but he always tries to watch his diet; he wants to stay sharp for the mountain bike races. From time to time he participates in a mountain bike race; he is very competitive and wants to find out how good or bad he is compared to other people his age. Luca also pays close attention to his bike: everything needs to be in perfect shape. He knows a lot about mountain bike maintenance and mechanics. In between the few competitive races each year, Luca rides mountain bike tours either as training or just to have some fun with his friends.

He started quite late with technology compared to his friends. But now he has found the added value this can bring into his life. He heard about the BikeMe community when he was having a drink after one of the mountain bike tours, and joined it immediately.

4.2.3. Detailed Description/Story: Enjoying Cycling, Organising and Sharing it

Wednesday 2nd November 2011: Weekend Planning

Luca is at his dorm room searching for a nice guided mountain bike tour to ride next week-end. He lies on the couch in front of his new HDTV set still resting from the training he just performed. On his smartphone he opens the mountain bike community app BikeMe and logs in (U.025, U.033). Then he makes a gesture sliding the app towards the television (U.022, U.019, U.028), because he knows there is a lot of information visually presented, including videos, and he prefers using the app and watching videos with his parents' larger HDTV set getting the full multimedia experience instead of handling everything provided by the BikeMe HBB-NEXT app on his smartphone only.

Smartphone as Remote Control

The BikeMe app now opens on the television screen (U.014a, U.033) and he can use the smaller clone on his smartphone as a remote control for his TV application (U.018).

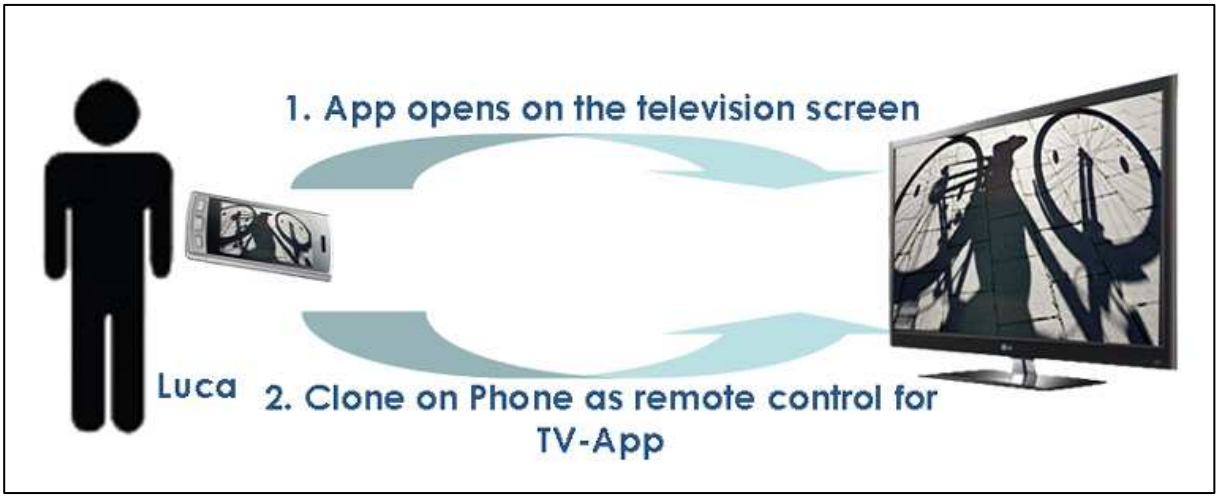


Figure 9: HBB-NEXT application (U.014a), Connect device-to-device (U.018), Link device to profile (U.033)

The TV-set has observed that he is the most frequent user at his dorm room, so it asks him, if he wants to be set as a permanent user. He agrees and saves his profile (U.013).

A part of the television screen ("Next Weekend") shows the mountain bike tours for next weekend organized in the range of 30 kilometres of Luca's parents' home: Luca has created this setting in the BikeMe app because he is at his parents' home in the weekend (U.025). Luca selects this part of the screen: "Next weekend". Essential information on these tours is displayed on the entire screen, and is also rated on a scale of five by the community:

- Overall rating of the entire BikeMe community of this tour: Luca wants to select a good tour out of all options, and the community rating is a good predictor for this,
- Distance from his parents' home: He wants to start as soon as possible because most mountain bikers come somewhat later. This way he can keep going quite fast. Therefore, 30km is a kind of mental limit. Going further means getting up extremely early in the morning,
- Price: being a student he does not have that much money to spend. Usually, the registration fee is never a problem,
- Distance and Altitude Difference: Luca is a good and competitive mountain biker and therefore does not want to ride the easy tours,
- Provisions: sometimes the quality of the provisions is not good enough for competitive Luca

- Availability of showers and a cleaning stand for the bike: he lives at his parents' row house in the weekends and therefore cannot drag a dirty bike through the house to clean it in the garden,
- Plans of his friends of his local bike club: sometimes he goes to a competitive race all by himself. Therefore he really likes to join his friends in the normal mountain bike tours.

Selecting what you and your Friends like

The TV lists the tours organized next weekend in the range of 30 kilometres of his parents' house (U.034, U.005). In the right column he sees the avatars of his friends next to the tour organized by the local fire department (U.007, U.010); one has indicated his preference for a different tour organized by the Vikings mountain bike club. To get some more detail on both these tours he first selects the tour organized by the Vikings on his smartphone remote. The Vikings went through some trouble to create a video of the most interesting parts of their mountain bike tour: Luca starts the video and makes it full screen. The video shows the toughest climbs and spectacular descents alongside a voice commentary of these parts of the track. It is a very impressive way to attract a lot of people to their event. Then he views the tour organized by the local fire department: they offer mountain bike trials of 25, 45 and 70 kilometres and 250, 458, and 670 meters of climbing respectively. The BikeMe community has rated last years' tour with 4.5 stars out of 5 (U.007, U.003).

Using Pictures and Videos on TV and Smartphone

Luca thinks he remembers this tour, but is not really sure because he rides different tours almost every weekend. Normally, you can consult your own profile on the BikeMe app: it contains all yours actions in the community, all the tours you have driven in the past etc. But Luca only has his smartphone for six months and therefore his riding history has not been recorded. Therefore, he selects the media overview for this tour (U.006); now he can browse all the pictures taken at this tour. He chooses to do this on his smartphone because browsing through pictures is faster (U.008). After looking at a couple of pictures he starts to remember this tour. Members of the community also post comments online about the tour (U.007): before the tours they mostly state how excited they are, with whom they are coming, what the state of the terrain currently is (due to weather changes, bikers need to change to mud tires sometimes). After a tour people write how it went, what they like

about the tour, what they found the organization did wrong (for example certain arrows that weren't clearly placed, or insufficient provisions). Luca then notices that Mark recorded the tour on a camera attached to his bike. He is known inside the community to create amazing videos. Mark always edits some dance music on his videos, and speeds up the video so you can watch an entire tour in one or two minutes. The speed of the video always slows down for the interesting parts - the climbs and descents. After having watched the tour on the TV screen he is sure: he has actually ridden this mountain bike tour, and he remembers that he liked it too. So he will go for this one. Because it was another great video by Mark he shares it on Facebook (U.007) referring to Mark's profile by pressing the share button next to the video. Just to be sure, he looks if there is a bike cleaning stand, because at his parents' home he cannot clean his bike. But as in most tours, participants can clean their bikes after the ride. He registers for this tour on the television and his payment is arranged via his smartphone identification (U.006, U.032).

Friday 4th November 2011: Fixing the Bike

On Friday evening, Luca arrives back from a week at his dorm room in Leuven. At his parents' home, when checking whether his bike is OK for Sunday, he finds a strange problem with his gears. There is too much friction when changing gears. Luca knows a lot about bike mechanics, but he has never had this problem. Having washed his hands he searches for a solution using his smartphone. The BikeMe community has a Twitter channel in which you can ask for solutions to problems by using the #bikemeproblem hash tag. After tweeting his problem on his smartphone or (U.007), he takes care of the rest of his bike. One of the community members answers his tweet and includes a link to a YouTube video embedded in the BikeMe community's Tips section. He watches it on his smartphone; afterwards he thinks this might be the solution but he cannot really see the fine details of how to exactly fix it. Therefore he goes into the living room to watch the video on the TV in HD format (done automatically after the sliding gesture from his smartphone in the direction of the TV (U.019, U.035, U.035c).

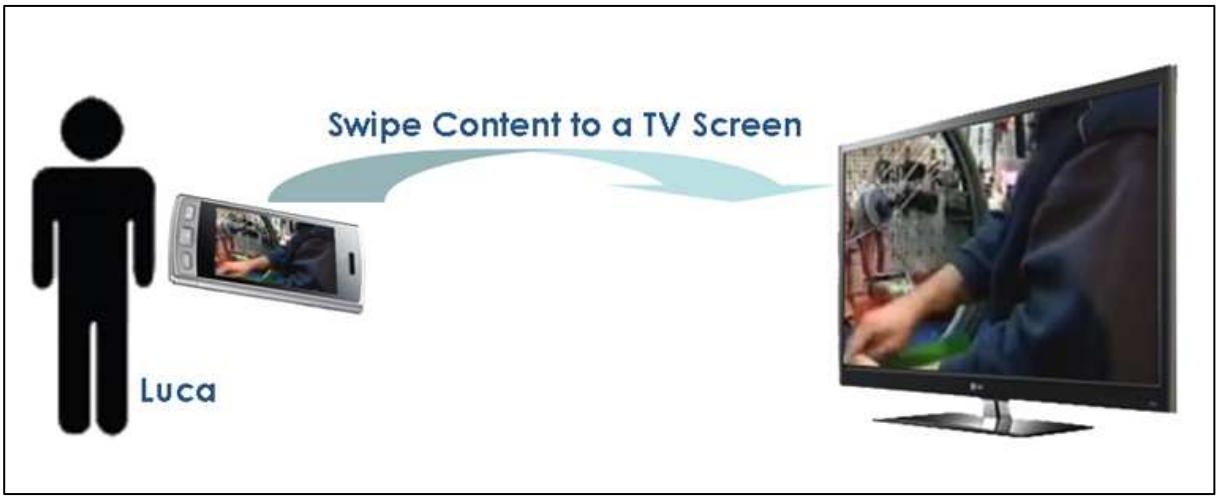


Figure 10: User input – gesture (U.019), Cloud offloading: Pre-render/transcode/mix video content (U.035)

In HD he can see the small details and understands how he can fix his bike's gears. Now he is curious and wants to find out who found this solution to his problem. Turns out it is Peter (A.001), the owner of a bike shop not far from his home. Perhaps Luca will go there sometime. Next to the video, Luca votes "Helpful +1"; this is now associated with both the video, as with Peter's profile (U.004, U.013).

Friday 4th November 2011: Inviting Friends to watch an International Race

Tomorrow the final mountain bike world cup race is held in Val di Sole, Italy. The broadcast is not available via his parents' regular cable subscription, but the BikeMe community has negotiated a price together with other international mountain bike communities and the international mountain bike federation (A.004) for viewing rights (U.036). So tomorrow he will be able to watch the race on television at his parents' place. After he has prepared his bike for the tour on Sunday, he goes to the living room and sits down to relax a bit. He opens world cup channel on TV (U.006) and watches the highlights from last world cup race. Then he watches a pre-race analysis of the updated track in Val di Sole. Last year two severe accidents happened so they updated the track. The analysis might reveal how the new track might impact the race. After watching the analysis, Luca sends an invitation to watch the race together at his parents' house (U.037). To do this he navigates first from the analysis to tomorrows live race broadcast in the video's list (U.026) on the world cup channel, After having selected this item, he receives all information for this race. The HBB-NEXT overlay has an "invite" button. When Luca presses this button (again via his smartphone re-

mote)(U.018) a list appears on the TV screen with friends from his social network associated with mountain biking (based on their profiles)(U.007). In this list, Luca selects four of his friends, and then presses “Send Invitation” (U.037).

Friday 4th November 2011: Requesting a Lift to the Tour

Today Luca wants to find out how to get to the fire department’s tour on Sunday as his father needs the car and cannot take him. On the BikeMe app on his smartphone, he opens next weekend’s tour. Luca presses the button “carpool request” (U.038). Now, all members going to this tour will view his request and can decide whether they can pick up Luca on their way. Those community members who come from the same direction are automatically selected based on their location (U.005, U.034). They receive an invitation showing their new route on a map when they would pick up Luca (U.002). This request is sent via multiple channels. When people watch the request via BikeMe app on TV for example, they receive a map with their normal route, and the adapted route to pick up Luca. This visualization helps people to give an idea of what it would mean to make a minor detour. When deciding to pick up Luca (U.038b), their GPS will automatically be updated for Sunday (U.008, U.034). Luca will receive the answer, and can then confirm this pickup (U.029) after which the request will no longer be shown. People picking up other bikers along the way; receive reputation points for this in the BikeMe community, which is also shown on their community profile (U.003, U.013).

Saturday 5th November 2011: Watching the World Cup Race

Watching TV together, yet in different Places

he BikeMe app on Luca’s smartphone shows notifications (U.002) of Jamie (A.001) and Rick (A.001), two friends of his and of his uncle Michael (A.001) who all want to join Luca for watching the race taking place in Val di Sole. Rick has notified that he will watch (U.002), but he will have to stay at home; he became father last month to Julia and his wife is seeing her friends for a rare but very desired time out. So Rick will watch the race at his home, taking care of his newborn baby. At 14.30h everyone has arrived and is set to watch the race. Rick joins the party from his house at 14.50h (U.008, U.009), as a message indicates on the television screen in Luca’s parents’ living room (U.002). He has fed the baby and she has fallen asleep. However she wakes up repeatedly as she has the typical baby digestion prob-

lems. Rick's system detects when he is leaving the room (U.009) and automatically pauses the content until he returns (U.020).

Synchronising the Chat, too

This however does not solve all the problems since all the chat conversations by his friends are also live (U.039): typically when Rick returns he can continue watching the race after the end of the timeshift, but for him this is not live anymore. So when his friends are chatting now, they are actually talking about events that Rick has not seen yet. For this dilemma, the HBB-NEXT system offers two options. Option 1 is the chat is time shifted, too, this means that he can read his friends comments as they happened during the live broadcast say five minutes ago, but that he cannot reply because his friends have moved on both in watching TV and in chatting.

Option 2 is that Rick has a fast forward feature which enables him to view what he has missed in a faster pace (or only the highlights), allowing him to join the live broadcast and the live chat again after his pause. Michael just bought the iPad 3 and can keep a part of his screen space for the race if he wants (U.022, U.008). During the race they can look up extra information about the professional mountain bikers, and the current rankings (U.024). There are also special features available such as cameras hidden beneath the jumps in the race, and a map displaying where each participant is at each time during the race. Additionally, special replays are made available by the editorial team. One such replay shows a trick jump by the world champion. All these special features are available via the second screen app (U.027), and via the HBB-NEXT overlay (U.025) on the world cup channel (U.014). This group normally uses the second screen app (U.008), because Luca, as a competitive mountain biker, does not want to miss anything from the live broadcast (U.010). The second screen app allows his friends to look at the special features from time to time.

Sunday 6th November 2011: Looking back at the Tour

When Luca arrives at his parents' home back from his tour on Sunday, he wants to share his experiences with the community members and the organizers (U.007). Being tired, he sits down in front of the TV and opens the BikeMe App on TV (U.014, U.025). He is not as enthusiastic as the last time and has a few negative comments to make (U.007): At the final stop in the tour, the organizers ran out of snacks, and the showers ran out of warm water. Therefore, he navigates to the tour's page using his smartphone as a remote. There he en-

ters the ratings: Luca rates the provisions 2/5 and the showers 1/5 (U.004). Ah well, otherwise it was a great tour once again. Luca is eager to see the first pictures of this year's tour made by the amateur photographer (U.007). On the BikeMe app on TV he opens the tour's Photo Album (U.006). The loading bar indicates that the amateur photographer is still uploading picture, but he can already see the uploaded ones. He can watch the pictures full screen on his television. Next to this information live information is available on how many people are still participating (U.014b); as said earlier most people are not as fanatic as Luca and start somewhat later, and are also slower than Luca. Luca also follows the rankings of the top 10 riders who got the fastest times. He is still amazed at the average speed these people ride. More interestingly, he can see how fast his friends have gone. The BikeMe app offers a general ranking, including everyone in the community, and a friends ranking (U.010), including only your friends.

Sunday 7th November 2011: Travel Show

While he is watching the rankings, he gets another notification (U.002): tonight on the public broadcaster's travel programme there will be a piece about Houffalize, a place in the Ardennes known for its mountain bike world cup (U.026) U.003). Luca is curious to finally learn something about this place, because a lot of people on the BikeMe online bulletin board are very enthusiastic about this place. Later on in the evening he watches the show and enjoys how the presenters are struggling to get up a steep climb in the middle of the forest. He enjoyed this programme, and is really thinking about going to this place during the next holidays. Luca opens the HBB-NEXT overlay (U.014a) and presses the share button: a list of his friends opens up, and Luca marks Rick, Jamie and Michael. He then presses "share with a message" and types: "something for next vacation?" (U.007)

4.3. Scenario 3: Friends Gathering to Watch a TV Event

4.3.1. Background: Social TV App for being Together

Based on a user-centred approach the following scenario was developed around a group of friends who want to watch a live-TV-event together. With a focus on the broadcast side it involves also additional content and the synchronization of a live-TV-broadcast-stream on second devices within and outside the local network. The whole scenario centres around a fictive social network app called "SocialTV".

Given a rather heterogenous group of friends with diverse social and educational backgrounds its users reflect a typical group of people with an age that could differ between 18 and 50 years with a basic interest in new technologies and media but diverse technical skills.

4.3.2. Personas: Four Friends from Munich

The four friends Peter, Paul, Susanne and Andrew all live in Munich. As a group of young, cosmopolitan people they are very interested in new technologies and media and like to make use of them whenever they seem to make life easier or add new exciting spare time activities. They are not biased against new technologies and have never made bad experiences with security and new media. Therefore they find any application which is directly linked to a trusted application also trustworthy.

Peter is a 33 year old self-employed architect. Due to his work as architect which often implies working with computers and lots of technical instruments, he is quite familiar with all sorts of latest pieces of technology. He owns several of those gadgets and likes spending time with them. On top of his smartphone and modern LED-TV, he owns one of those brand new Set-Top-Boxes. Documentations about arts, music shows and sport-events are best watched at his home cinema where he regularly invites his friends to join him.

Paul is a 30 year old single. He works as salesman at an office for tourism. That job suits perfectly his enthusiasm for travelling. He uses the contacts and good conditions offered through his job to travel all around the globe as often as he can. During his trips, Paul spends quite a lot of time with extreme sports like climbing, rafting and diving. He documents his experiences in a weblog and takes a lot of pictures with his smartphone. Thus, he prefers media devices that are specialized on mobility and robustness. During his trips, he gets to know a lot of people all over the world and communicates with them via several social networks very frequently.

Susanne is a 24 year old biology student. To finance her studies she works as a babysitter and her overall budget is typical for a student. Susanne's parents bought her a tablet to support her studies. While babysitting, Susanne uses her tablet to do researches for biology,

reading and learning. Also the tablet offers some media features to her, so she can get pretty entertained during the sessions.

Andrew is a 28 year old student in his last semester of studying history and philosophy. His interest for technical gadgets is rather low but he uses such gear to make use of the involved social features. His friends in the social networks are well entertained by his daily philosophy quotes. Sometimes, in the evenings he visits his friend Peter to enjoy an after work beer and talk about latest geopolitical struggles. Or they relax , watching TV at Peter's home cinema.

Andrew and Peter Susanne have met during their time in the university sharing a class together. In the same manner Andrew and Susanne have met. During a holiday in Thailand Peter and Paul went diving together. They found out, that they lived in the same city and sharing the interest in new technologies they spent some time together in Thailand. They have been friends ever since. During Peter's last Birthday Party, Andrew brought Susanne along and the four met as a group for the first time. Since then they have shared some TV-events at Peter's house and also spent some time together going out on the weekends. They all make use of a social network, where they are befriended. They use it to communicate, organise regular gatherings and share content.

4.3.3. Detailed Description/Story: Saturday Night – TV Time, Lets watch together!

Joining the Multi-Screen SocialTV App

Tonight the annual European Song Contest live event is broadcast and Peter and his friends planned to watch it together. Peter (A.001) and Paul (A.001) are sitting on Peter's couch, checking today's TV guide (U.026). Peter has one of those recent HBB-NEXT STBs, which offers him personalized TV guide functionality, combined with social networking support. Paul brought his new smartphone. The STB automatically detects the new device (U.022) and he get's a notification (U.002) that he can download the "SocialTV"-app to connect the phone to the STB.

Figure 11: Devices recognition (U.022), Notification (U.002)

He decides to download it (U.027) from his trusted "app-store", he then connects to Peter's STB (U.025, U.028) and joins the group. Peter's personal-EPG application detects the connected device (U.022) not belonging to Peter, so it asks (U.038) Peter whether it should try to build a personalized EPG that matches both user profiles (U.033), Peter's and Paul's. The "SocialTV"-app asks Paul (U.038) whether he is willing to share his profile information with the EPG app running on Peter's STB, and Paul accepts (U.038b) – now, the STB shows (U.029) a personalized EPG that matches both user profiles (U.005). Additionally, Paul marks Peter's STB as "trusted device" (U.030). The STB offers an easy usable interface for managing privileges for connected devices. Peter then selects a policy preset that will automatically be applied by the STB when Paul connects to the STB again (U.036, U.015).

Linking the EPG with the Social Network

They browse through the recommendations given by the EPG app (U.010, U.005, U.014, U.025), when the "Eurovision Song Contest" is about to start. Peter marks the event, and decides to recommend it to his and Paul's friends through the social network integration functionality of his STB (U.007), of which the EPG-app makes use. As this is the first time he is using this functionality from his EPG, he is asked if the EPG app is allowed to post messages and recommendation (U.038) on behalf of Peter for his friends in the social network and if it can do it in the future without asking again. He trusts this app and confirms it (U.031, U.038b). Additionally, he sets his status to "soon watching Eurovision Song Contest", and adds a small comment (U.007) that he is curious whether Germany is going to

make it once more to the top. Therefore, his friends get notifications (U.007, U.002) of the song contest, and get to know that Peter and Paul are about to watch the event.

Being apart, yet watching together

Susanne (A.001), who is one of their friends via the social network, receives the notification via her tablet (U.002, U.007, U.025), which she uses while babysitting. Since she already has the "SocialTV"-app installed, she decides to also enjoy the song contest by watching a live stream from the internet. She asks Peter and Paul via the app whether they would like to watch the event together (U.038), and they welcome her via their webcam being connected to Peter's STB (U.039, U.009), and accept her request (U.038b). Once the event will start, their TV streams automatically will be synchronized (U.042, U.042a), and they will be able to chat and discuss about the event and also rate the individual performances in parallel, making use of their webcams, smartphones and tablets (U.039, U.023).

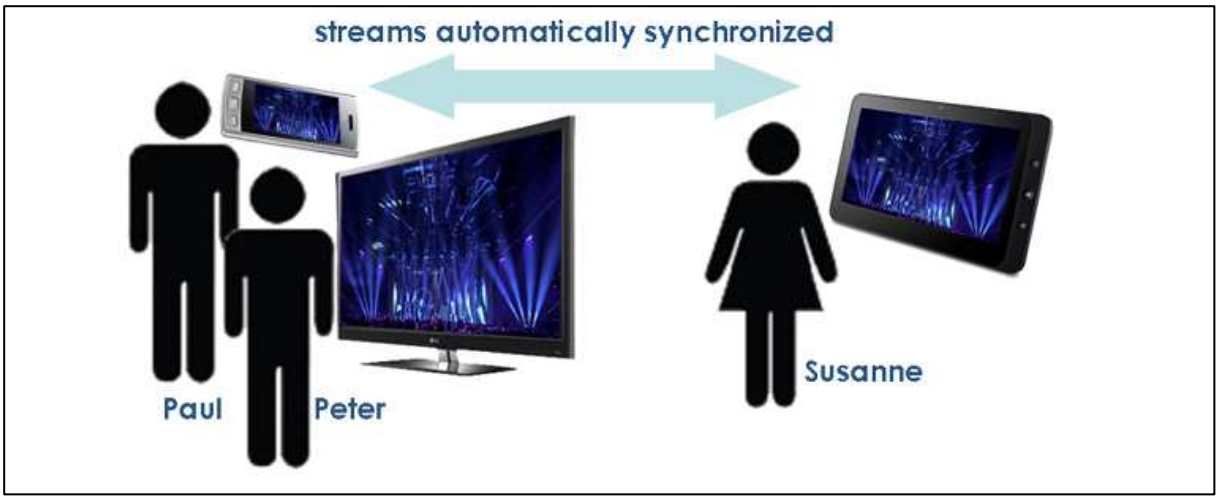


Figure 12: Send Request (U.038), Live Social Interaction (U.039), Joining/leaving session (U.009), Answer request (U.038b), Broadcast/IP TV – managed content (U.008a), User input – additional device (U.023)

Additional Info on the Smartphone

Andrew (A.001), who lives close to Peter, also receives the link via his STB (U.007), and decides to walk on over to him and join the song contest viewing. Andrew arrives at Peter's house (U.009), and since Andrew is already known to Peter's STB (U.015, U.033) and also connected to it via his smartphone (0.028), Peter's STB detects and recognizes his? (U.022), and transfers the personalized EPG (which now reflects the likes of all three user profiles) to

his smartphone (U.026, U.010). The TV station presenting the song contest provides an application with a lot of context information about the artists, their countries and the latest highlights of this show (U.034), which Andrew is keen on as he missed some stuff while he walked over to Peter. However, his friends want to continue with the live show… Andrew decides to run the HBB-NEXT app with the background stuff on his smartphone instead so the others can continue with the live stream (U.025).

Taking TV along

Andrew and Paul announce that they are getting hungry, so Peter, being a good host, grabs his tablet PC and leaves for the kitchen (U.009). As his tablet, unlike Susanne's, is not capable of decoding full HD video content, his "SocialTV"-app offers to make use of the "smart media cloud" tool, which transcodes the full HD content (U.035, U.035c) to video content which can be rendered on his tablet. Being now able to continue watching the event in the kitchen (U.041, U.041a, U.025), he starts preparing some sandwiches for his guests. Once finished, he returns to the living room (U.009), and shares food and drinks with his friends, continuing to watch the event on the TV again.

Sharing User Generated Content in the Cloud

In the meantime, Andrew browsed through some recommendations which were offered to him via the "SocialTV"-app on his smartphone (U.005, U.025, U.034), which include some user generated content coming live from the Eurovision song contest. He checks out a few of the videos and pictures (U.014), and selects two nice pictures and a video taken from "Lena Meyer-Landrut", the German performer at the contest, and transfers them to the STB (U.041b). The STB renders them picture in picture (U.014, U.035, U.035d), and Paul decides to share one of the pictures and the video via his social TV app (U.007). Susanne sees the notification (U.002), and receives the picture in picture version of the live stream and photos via the "smart media cloud" tool (U.042a, U.035), since her tablet is not capable of rendering two videos in parallel.

After each artist has had his turn but before the announcement of the winner, Peter wants to bet on who everyone thinks will win. He sets up a "just for fun"-bet through the "SocialTV"-app and they all place their bets (U.025).

Purchasing a DVD on TV

The Eurovision Song Contest has finished, and surprisingly, Lena did not win once more – but at least, they enjoyed the SocialTV experience. Andrew won the bet. The "SocialTV"-app informs the other participants about their loss (U.002, U.025). The Broadcaster's app recommends a live DVD / Blu-Ray (U.034) from the song contest, coming along with a group discount, which can be made use of via the "SocialTV"-app. Peter and Andrew decide to go for it, and since Peter is already signed in (U.015), the app makes use of the User Identity and Security mechanisms of the STB in order to receive shipping and payment information for both DVDs (U.032). Andrew indicates that he wants one DVD to be shipped somewhere else, and Peter clicks onto the "add secondary shipping address" button. The STB asks whether the second address can be taken from a known user account (U.038), and Peter accepts (U.029) and selects Andrews account (U.033). The STB automatically asks Andrew's smartphone for the shipping address. Although they have already established a trusted relationship (U.015), Andrew is asked if he really wants to allow it (U.038).

5. Use cases

The scenarios developed in Chapters 3, 4 and 5 of this document are the basis for extracting high-level use cases presented in this Chapter. These use cases will be subsequently used as the starting point for extracting detailed system requirements for deliverable D2.2.

Use cases describe the interaction between a user and the system in order to implement a certain service or task. They break down the scenario description of a service into clearly defined interactions between the user and the system. Users are one type of "actors" in a use case analysis. A further classification of human actors is also possible. In our use case analysis we define 4 different types of actors corresponding to human users, as described in Section 5.2.

The use cases appear in the description of the scenarios and need to be extracted from the scenario text. In this document we focus our efforts on identifying several high level use cases from scenarios and making a list of these high level use cases for subsequent requirements extraction. A total of 38 use cases have been extracted from the 3 scenarios. Instead of building an exhaustive list of each use case, we have concentrated our efforts in highlight the use cases that are most related to the set of innovative HBB-NEXT enablers being developed in WP 3, 4 and 5. These enablers are described in Section 5.1.1.

5.1. Approach

The scenarios descriptions contained in chapters 3, 4 and 5 are annotated with references to the use cases presented in this chapter. The use cases were extracted by carefully reading the scenarios and identifying interactions of users with the HBB-Next system as described in the scenario text. A key observation while collecting the use cases is that several use cases are repeated across the scenarios. Therefore instead of collecting use cases on a per-scenario basis and ending up with duplicate use cases across the different scenarios, we have extracted common use cases that may have appeared in more than one scenario. This approach also ties in with the project philosophy of developing a common HBB-NEXT framework that can support different application scenarios.

The combined list of use cases is presented in the form of a table in Section 5.2.

As a first step of use case analysis, the collected use cases have been classified into 7 (sometimes overlapping) categories. This classification reveals the areas of investigation that will

be undertaken in this project based on the scenarios described in this document. These categories are as follows:

- **Manage user profile and identity**: Use cases under this category are related to creating, accessing and managing user identity, which is the basis of the service personalization features of HBB-NEXT. These use cases are listed in Table 2 below.

- Table 2**Manage trust**: HBB-NEXT users can use different devices to access HBB-NEXT services. HBB-NEXT application developers are free to build different services over HBB-NEXT enablers. Managing trust across different devices and different HBB-NEXT applications is the key theme of this category. These use cases are listed in Table 3 below.
- **Communicate/Notify**: HBB-NEXT scenarios are inherently multi-user, social and community/family driven. Therefore a number of use cases instances of people-to-people communication occur in the scenarios. Moreover, system-to-user notifications are a recurring theme in the scenarios and these use cases are collected in this category. These use cases are listed Table 4 below.
- **Manage devices and sessions**: The HBB-NEXT scenarios refer to situations where users switch devices; TV watching is suspended/resumed later, etc. Use cases referring to such device and session changes are noted in this category. These use cases are listed in Table 5 below.
- **Personalize and recommend content and services**: This set of use cases deals with the ability to personalise and recommend content and services to users based on user profiles, context, etc. These use cases are listed in Table 6 below.
- **Control applications**: Users are provided with several tools and methods to control applications via different input mechanisms as described in these use cases. These use cases are listed in Table 7 below.
- **Control content/media**: These use cases deal with controlling media (e.g. time shifted playback/PVR) and also some of the underlying features to allow broadcast and broadband content mash-ups, for example, media synchronization and cloud offloading. These use cases are listed in Table 8 below.
- **A/V synchronisation**: This set of use cases deals with all different kinds of synchronised content chosen by the user, coming from different domains and net-

works and probably played time-dependent on different devices. These use cases are listed in Table 9 below.

We note that some of the above categories (and therefore, the use-cases contained in these categories) do not correspond to the enablers being developed in work packages 3, 4 and 5. However, they are included here as supporting use cases needed to build the basic functionality to support the scenario descriptions of Chapters 4. For example, the development of a time-shifted/PVR function is not described in the description of work of WPs 3, 4 and 5. However, the corresponding use case occurs in scenarios For completeness, we next described the exact set of enablers being developed in WP 3, 4 and 5.

5.2. Short Description of Enablers

The HBB-NEXT project will develop enablers in the 3 technical work packages (WPs 3, 4, 5) which will provide the innovative underlying technology for HBB-NEXT applications. These set of enablers, also enshrined as a part of objectives of the project's description of work, are briefly described below for completeness.

User identity: These enablers bring functionality to create, store and access user profiles across multiple HBB-NEXT applications in a secure manner, thus achieving a higher service personalization and simpler access.

Content recommendation system for multi-user service personalisation: This set of enablers brings context-aware personalised multi-user content recommendation functionality to HBB-NEXT services. These enablers are based on a content recommendation engine for context-aware personalised multi-user & multi-device-based content recommendation. The enablers provide context-aware recommendation methods, based on users, groups, services and devices, and will be made available to application developers via the HBB-NEXT middleware framework APIs to the Service Personalisation Engine.

A/V content synchronization: These enablers provide the technology and solutions for providing HBB Next services where A/V components from different domains are to be displayed in a synchronised way in a heterogeneous and distributed end-device environment. For example, HBB-NEXT applications should be capable of detecting time-lags in broadcast

or Internet live-streams and adjust the presentation accordingly. Similarly, different user devices need to be synchronized when users switch from viewing video on one device from the other.

Application trust: These enablers facilitate the development of services guaranteeing a high level of security and trust in the interaction between the end-users and the platform (confidentiality of private and sensitive data, avoidance of fraudulent or untrustworthy applications, etc.). They also provide a robust and automated application verification mechanism that safeguards users while providing developers with a one-stop solution to certify their applications as being trustworthy and not malware.

Cloud service offloading: These enablers will realise mechanisms for a distribution / offloading of application functionality, incorporating cloud computing solutions like, for example, video rendering services or remote transcoding services, which enable low performance video devices to serve all HBB-NEXT features. HBB-NEXT will incorporate intelligent cloud-offloading that will permit users of legacy hardware to enter the HBB-NEXT world of rich and engaging applications. Cloud offloading will provide the possibility to execute TV related applications in a virtual STB running in a cloud environment.

Multi-modal user identification: This set of enablers deal mainly with methods for identification of single user in the room on various level of security e.g. identification based on voice recognition, face recognition, or input of the PIN (can be done securely also via multimodal interface). This unified identity an authorization management approach across all applications and devices will significantly improve the usability.

Multi-modal interface for multi-user service personalisation engine: These enablers provide tools for multi-user (group) identification and personalisation of the service. The multimodal interface in this enabler represents a support for Analysis of Multi-User Context-Aware Value-Added Services, User/Group-Aware Personalisation in a Multi-User Environment and Context-Aware and Multi-User Content Recommendation.

5.3. Use Cases Compilation

Each actor is uniquely identified by a number preceded by the letter "A". For example, A.002 may identify a particular actor. Similarly, each use cases is uniquely identified by a number preceded by the letter “U”, for example, U.012 may be the identifier for a particular use case.

We next present two tables. Table 1 is the list of actors considered in the use cases. A.001, A.002 and A.003 correspond to human actors who are adult users, children, and challenged persons. A.004 corresponds to the service provider. Tables 2-8 describe the list of corresponding use cases. Each table has 5 columns. The leftmost column is the identifier of the use case. Next, columns 2 and 3 contain the title and brief descriptions of the use cases. The notes column is used to describe the relationship of the use case to the scenario (in which scenario it occurs), as well as the actor(s) involved (Table 1). Finally, in column 5 we have alluded to the enablers (described in Section 5.2), which may implement all or part of a use case. We note that not all use cases are linked to an enabler, since these use cases are needed to implement the supporting infrastructure for HBB-NEXT applications.

Table 1: Use Case Actors

ID	Title	Short Description
A.001	Person - adult user	No restrictions or gained limitations
A.002	Person - child	Has restricted access to commercial services and age rated content
A.003	Person - less abled	Is hearing or seeing impaired
A.004	Service provider	Entity that offers services to users

Table 2: Manage user profile and identity

ID	Title	Description	Notes	Linked enablers, if any
U.001	User identification – voice	A user identifies itself to the system by speaking an individual key phrase. System recognises his voice. User profile is loaded.	Appears in: Scenario 1; Involved actors: A.001, A.002, A.003, A.004	Multi-modal User identification

ID	Title	Description	Notes	Linked enablers, if any
U.001 b	User identification - face	A user identifies itself via face recognition. User profile is loaded.	Appears in: Scenario 1; Involved actors: A.003, A.004	Multi-modal User identification
U.011	Age verification	When critical usage/content is anticipated, age must be checked.	Appears in: Scenario 1; Involved actors: A.001, A.002, A.003, A.004	Application Trust
U.010	Updating group profile	Intersection of all loaded profile preferences. Recalculation when single user enters or leaves.	Appears in: Scenario 1, 2, 3; Involved actors: A.001, A.002, A.003, A.004	Content Recommendation system for Multi-user Service Personalisation Engine
U.013	Updating user profile	Adding new / removing user data to the profile.	Appears in: Scenario 1, 2; Involved actors: A.001, A.004	User Identity
U.036	User-Rights-Management	The overview of which viewer or groups of viewers have the right to view which content.	Appears in: Scenario 2, 3; Involved actors: A.001, A.004	Content recommendation system for multi-user service personalisation
U.032	Using User Identity and Security mechanisms	Secure access to user identity data/particulars/payment data.	Appears in: Scenario 2, 3; Involved actors: A.001, A.004	User identity, Application trust
U.015	User activity tracking	The user can interact with the application without repeatedly identifying itself. The system knows who is giving command once everybody has been initially identified.	Appears in: Scenario 1, 3; Involved actors: A.002, A.004	Multi-modal interface for Multi-user Service Personalisation Engine

Table 3: Manage trust

ID	Title	Description	Notes	Linked enablers, if any
U.030	Mark device as trusted	User makes device known to the service. Content can be transferred to and from.	Appears in: Scenario 3; Involved actors: A.001, A.004	Application trust
U.031	Mark app as trusted	User allows the app to access and forward critical user data. Trust state will be stored.	Appears in: Scenario 3; Involved actors: A.001, A.004	Application trust

Table 4: Communicate/Notify

ID	Title	Description	Notes	Linked enablers, if any
U.002	Notification	An overlay graphics informs the user about important service changes.	Appears in: Scenario 1, 2, 3; Involved actors: A.001, A.002, A.003, A.004	
U.007	Accessing/using/sharing content in social networks	Connecting to social networks and using defined functions of social network APIs.	Appears in: Scenario 1, 2, 3; Involved actors: A.001, A.002, A.004	User Identity
U.037	Send Invitation	Invite absent HBB-NEXT user to a defined HBB-NEXT programme/service.	Appears in: Scenario 2; Involved actors: A.001, A.004	
U.038	Send Request	A user/app/device sends a request to another user, or an entire group/community	Appears in: Scenario 2, 3; Involved actors: A.001, A.004	User identity
U.038 b	Answer request	A user answers a request of another user	Appears in: Scenario 2, 3; Involved actors: A.001, A.004	User identity
U.039	Live Social Interaction (ex. chat)	User interaction and communication features built in HBB-NEXT.	Appears in: Scenario 1, 2; Involved actors: A.001, A.002, A004	User identity

ID	Title	Description	Notes	Linked enablers, if any
U.029	Confirm request answer	A requesting user confirms the received answer.	Appears in: Scenario 2, 3; Involved actors: A.001, A.004	User identity
U.024	Programme source interaction	Establishing a virtual return channel in order to provide input for the actual service data/composition.	Appears in: Scenario 1, 2; Involved actors: A.001, A.004	
U.023	User input – additional device	For interacting with the service making available the hardware resources of a trusted device.	Appears in: Scenario 1; Involved actors: A.001, A.004	Application trust, User identity
U.016	Internet browser	A web browser running on a HBB-NEXT device	Appears in: Scenario 1; Involved actors: A.001, A.004	

Table 5: Manage Devices and Sessions

ID	Title	Description	Notes	Linked enablers, if any
U.008	Re-routing synchronized content device-to-device	Synchronised content is being transferred or shared from one device to another within a LAN or WAN	Appears in: Scenario 1, 2, 3; Involved actors: A.001, A.002, A.003, A.004	A/V Content Synchronisation
U.009	Joining/leaving session	A person/group of people joins another person/group	Appears in: Scenario 1, 2, 3; Involved actors: A.001, A.002, A.003, A.004	Multi-modal User identification??
U.022	Devices recognition	A device is detected and recognized by another device	Appears in: Scenario 1, 2, 3; Involved actors: A.001, A.004	
U.033	Link device to profile	A recognized device is being linked to a user profile	Appears in: Scenario 2, 3; Involved actors: A.001, A.004	

U.028	Connect device-to-device	A device is directly connected to another device thus enabling them to communicate	Appears in: Scenario 2, 3; Involved actors: A.001, A.004	

Table 6: Personalize and recommend content and services

ID	Title	Description	Notes	Linked enablers, if any
U.003	Community-based recommendation	A group of people gets a recommendation based on all their interests	Appears in: Scenario 1, 2, 3; Involved actors: A.001, A.002, A.003, A.004	Content Recommendation system for Multi-user Service Personalisation Engine
U.004	Rating content items	A user rates content	Appears in: Scenario 1, 2; Involved actors: A.001, A.002, A.004	Multi-modal interface for Multi-user Service Personalisation Engine??
U.005	Profile-based recommendation	A user gets recommendation based on the interest stored in his profile	Appears in: Scenario 1, 2, 3; Involved actors: A.001, A.002, A.003, A.004	User Identity
U.034	Context-based recommendation	A recommendation based on the context of content which is currently being watched/used	Appears in: Scenario 2, 3; Involved actors: A.001, A.004	Content recommendation system for multi-user service personalisation
U.026	Personalised EPG.	A person uses the (personalised) EPG.	Appears in: Scenario 1, 2, 3; Involved actors: A.001, A.002, A.004	Content recommendation system for multi-user service personalisation

Table 7: Control Applications

ID	Title	Description	Notes	Linked enablers, if any
U.006	Accessing service	The user accesses a specific service offered by the HBB-NEXT application.	Appears in: Scenario 1, 2, 3; Involved actors: A.001, A.002, A.004	

ID	Title	Description	Notes	Linked enablers, if any
U.027	Download app from app-store	The user downloads an HBBNEXT App from an App store.	Appears in: Scenario 2, 3; Involved actors: A.001, A.004	Application trust
U.014a	HBB-NEXT application	The user opens an HBBNEXT application	Appears in: Scenario 1, 2, 3; Involved actors: A.001, A.002, A.003, A.004	
U.025	Run/ use application	An app (TV, STB, table, smartphone) is (automatically/manually) started/used	Appears in: Scenario 1, 2, 3; Involved actors: A.001, A.004	
U.018	User input – IR controller	The user interacts with the application via IR.	Appears in: Scenario 1, 2; Involved actors: A.001, A.003, A.004	
U.019	User input – gesture	The user interacts with the application via gestures.	Appears in: Scenario 1, 2; Involved actors: A.001, A.003, A.004	Multi-modal User identification
U.012	User input – voice	The user interacts with the application voice recognition.	Appears in: Scenario 1; Involved actors: A.001, A.002, A.004	Multi-modal User identification
U.014b	IP content	IP content is requested or used in the HBBNEXT application.	Appears in: Scenario 1; Involved actors: A.003, A.004	

Table 8: Control content/media

ID	Title	Description	Notes	Linked enablers, if any
U.008d	Access DVB tuner	An event (e.g. an user action) tunes the DVB channel of the TV set	Appears in: Scenario 1; Involved actors: A.001, A.004	A/V content synchronisation
U.026	Check EPG guide	A user checks the EPG guide.	Appears in: Scenario 1, 2, 3; Involved actors: A.001, A.002, A.004	
U.014	Content control (adding, removing, adapting)	The user controls the content in an HBBNEXT application by adding content, removing or adapting content (streaming, download, static).	Appears in: Scenario 1, 2, 3; Involved actors: A.001, A.002, A.003, A.004	
U.020	Session playback management (start, pause, stop, save, PVR)	The HBB-NEXT applications can transfer media sessions between devices and in a time-shifted manner if needed. The ability to time-shift videos is becoming a standard feature in modern set top boxes; however, the ability to manage stored sessions, across devices, including session transfer and bookmarking, is a novel aspect of session playback management considered here.	Appears in: Scenario 1, 2; Involved actors: A.001, A.002, A.003, A.004	A/V content synchronisation

ID	Title	Description	Notes	Linked enablers, if any
U.035	Cloud offloading: Pre-render/transcode/mix video content	The user is able to offload computationally intensive tasks to the cloud. Sophisticated media processing is usually computationally intensive, making it unsuitable for limited CPU and battery operated devices. These are instances where some of the computational heavy-lifting will be offloaded to the cloud instead of the end devices. These use case(s) will also cover any services that are centralized by nature, for example, content transcoding for subsequent distribution to mobile devices.	Appears in: Scenario 1, 2, 3; Involved actors: A.001, A.003, A.004	Cloud service offloading
U.035a	Cloud processing for real-time in-video subtitling	The video stream is decoded, and video titles are overlaid into the video stream within the cloud; subsequently this composite stream is re-encoded and sent to the recipient client. The cloud scales up its processing capability automatically to undertake increased processing tasks, and subsequently scales down.	Appears in: Scenario 1; Involved actors: A.003, A.004	Cloud service offloading
U.035b	Cloud assisted picture rendering for scaled-down slideshows	The operation of downsizing images comprising a slideshow is offloaded to the cloud instead of the client. The cloud scales up its processing capability automatically to undertake increased processing tasks, and subsequently scales down.	Appears in: Scenario 1; Involved actors: A.001, A.004	Cloud service offloading

ID	Title	Description	Notes	Linked enablers, if any
U.035c	Cloud assisted video transcoding	The cloud scales down HD content into a resolution that is appropriate for a particular end-device or network connection using appropriate media processing components and codecs based on the target device capabilities. The cloud scales up its processing capability automatically to undertake increased processing tasks, and subsequently scales down.	Appears in: Scenarios 2, 3; Involved actors: A.001, A.004	Cloud service offloading
U.035d	Cloud-assisted picture in picture composition	For devices that cannot compose two video streams into a picture and picture, this mixing can be undertaken in the cloud and one single stream can be sent to the device. For example, many tablets only support the decoding and rendering of 1 video stream (e.g. current iPads) and no more. Here the cloud can do the picture and picture composition and send only 1 stream to the tablet. The cloud scales up its processing capability automatically to undertake increased processing tasks, and subsequently scales down	Appears in: Scenarios 3; Involved actors: A.001, A.004	Cloud service offloading

Table 9: A/V synchronisation

ID	Title	Description	Notes	Linked enablers, if any

ID	Title	Description	Notes	Linked enablers, if any
U.040	Inter-Media Synchronization	Different kinds of content/media, e.g. video, audio, metadata and pictures are locally synchronized on a single device.	Appears in: Scenario 1; Involved actors: A.002, A.004	A/V content synchronisation
U.040a	DVB+IP subtitles	A very common sample for inter-media synchronization. Subtitles are provided on demand over an IP network and locally synchronized with the DVB video stream.	Appears in: Scenario 1; Involved actors: A.003, A.004	A/V content synchronisation
U.041	Inter-Device Synchronization	Synchronization of one or more kinds of media between different devices in the same local network.	Appears in: Scenario 3; Involved actors: A.001, A.004	A/V content synchronisation
U.041a	DVB+IP Video-streams	The STB transcodes the DVB stream into a IPTV stream and sends it to the tablet over the LAN. Also, the STB maintains synchronization mechanics for parallel playback within the LAN.	Appears in: Scenario 3; Involved actors: A.001, A.004	A/V content synchronisation
U.041b	Continuous IP Video + VOD	A static video file, recommended on a tablet, is getting streamed to the STB and synchronized for playback.	Appears in: Scenario 3; Involved actors: A.001, A.004	A/V content synchronisation
U.041c	Subtitles on TV + Tablet	Multi-Content, Multi device. The IP based subtitles on the tablet get synchronized with the DVB video-stream on the TV in the LAN.	Appears in: Scenario 1; Involved actors: A.001	A/V content synchronisation

ID	Title	Description	Notes	Linked enablers, if any
U.041d	IP Cloud Stream + DVB STB	The cloud offers adding subtitles to the video and send the final stream to the tablet. Thus, the video-stream running on the tablet and the DVB video-stream on the TV need to be synchronized.	Appears in: Scenario 1; Involved actors: A.001, A.004	A/V content synchronisation
U.042	Inter-Destination Synchronization	Inter-device synchronization across geographic distances and WANs.	Appears in: Scenario 3; Involved actors: A.001, A.004	A/V content synchronisation
U.042a	IPTV + DVB	A continuous DVB video-stream and an IPTV stream are getting synchronized although the clients are at seperate places and networks.	Appears in: Scenario 3; Involved actors: A.001, A.004	A/V content synchronisation

6. Outlook

In the course of Task 2.1, the HBB-NEXT partners have defined the process of moving from Task 2.1 Usage scenarios to obtaining the HBB-NEXT requirements in Task 2.2.

The following steps were identified:

The HBB-NEXT usage scenarios and their use cases will be instrumental for elucidating high level functional requirements related to the HBB-NEXT enablers. To this end, Deliverable D2.2 will complement the use case Table contained in this document by listing requirements in direct relation to each use case.

In parallel, Task 2.2 will conduct a **survey of end user and service-related requirements** (K.U.Leuven, two phases, one in November 2011, one in January 2012). It is planned to relate the survey in January 2012 closer to the HBB-NEXT use cases.

Again in parallel, work packages 3, 4, 5 will conduct their **Analyses of the State of the Art.** (D3.1, D4.1, D5.1). This will include checking whether technological "gaps" occurring in their analysis are covered by the use cases of D2.1 and then the requirements of D2.2. The requirements in task 2.2 will be adapted if required.

Finally, a decision will be made about which are the most relevant use cases and therefore the most relevant requirements for HBB-NEXT. The decision will take into consideration all the above factors. The requirements thus defined as mandatory will lead to a selection of the enabling functionalities to be implemented in the technical work packages leading to the HBB-NEXT software components and finally the HBB-NEXT proof-of concept-prototype. The first step of this will be for the work packages 3, 4, 5 to move from the mandatory functional requirements to the fine tuned technical requirements.

7. References

Rosson, M.B. & Carroll, J.M. (2007). Scenario-Based Design. In: Sears, A., & Jacko, J. A. (2007). The Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies and Emerging Applications, Second Edition (2e ed.). CRC Press.

HBB-NEXT DOW - Annex I - "Description of Work", Grant agreement for Collaborative project, FP7-287848, HBB-NEXT "Next-Generation Hybrid Broadcast Broadband", 2011-06-28

HBB-NEXT Deliverable 1.1. Project Management Guidelines, Collaborative project FP7-287848, HBB-NEXT "Next-Generation Hybrid Broadcast Broadband", 2011-10-28