

D1.1 - Use cases and demonstrator definition – year 1

MOS2S

Media Orchestration from Screen to Screen

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Project key data

ACRONYM and full-length title

15022	MOS2S
Program Call	ITEA 3 Call 2
Full-length Title	Media Orchestration - Sensor to Screen
Roadmap Challenge	Urbanisation

Description

Novel and ubiquitous consumer-priced audiovisual sensors and data in particular, represent an important aspect of the Smart City environment, enabling a variety of applications for citizen information, participation, entertainment, experience, safety and security. Every user becomes a potential source of information, either directly or through social media buzz and its discovery. Audiovisual media provide citizens with Smart City data readily accessible to human senses. With the MOS2S project (Media Orchestration from Sensor to Screen), an international consortium of partners will develop and test audiovisual Smart City technologies and solutions in the context of citizen needs, and embed these solutions within the Smart City Playground.

Project duration & size

Size	Effort: 133.67 PY	Costs: 13.9 M€
Time frame	Start: 2016-04-10	End: 2019-04-30 (37 months)

Coordinator

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Consortium

Belgium	Nokia, iMinds, Kiswe Mobile, VRT*
Korea, Republic of	ETRI*, Mooovr
Netherlands	Amsterdam ArenA*, Bosch Security Systems B.V., Game On, Inmotio Object Tracking BV, Koninklijke KPN NV, TNO
Turkey	Bor Software inc. *, DİA Yazılım San. ve Tic. A.Ş., KoçSistem, TMOB BİLİŞİM

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Project acronyms

3DoF	3 degrees of freedom
BE	Belgium
CPA	Conformance Points A
CPB	Conformance Points B
DVB	Digital Video Broadcasting
IM	Instant Messaging
IT	Italy
KR	Republic of Korea
MOS2S	Media Orchestration Sensor To Screen
NL	(The) Netherlands
OB	Outside Broadcasting
PTZ	Pan-Tilt-Zoom
TR	Turkey
UHD	Ultra-High Definition
VR	Virtual Reality

1. Introduction

In Deliverable D1.1, the MOS2S consortium partners provide use case descriptions and demonstrator definitions for the 1st year milestone. D1.1 is the first deliverable from WP1, in which we explore relevant use cases and usage scenarios for MOS2S from the point of platform functionality and valorisation potential, so that from these use cases the design requirements can be distilled for the design tasks listed under WP2. Initially the envisaged use cases are Crowd Journalism, Live Events (e.g. sports, music) and Smart Venues and Habitats. The process used in WP1 ensures that all stakeholders have a clear view of the usage scenarios for the MOS2S platform, and come to a common understanding of the requested functionality, and the requirements should clearly map to individual architectural blocks or interfaces, capturing both what needs to be designed and how this should be tested.

The use case descriptions in D1.1 focus on live events in a Smart City context, and the associated demonstrator definition is led by the national consortium from The Netherlands. The initial use case description from the MOS2S Full project Proposal reads as follows:

*Live sport and music events attract a huge amount of city and venue visitors. This use case involves both **professional dashboards** as well as **end-user applications** for enhanced **citizen entertainment** and **experiences**. Through the venue-based integration of **ultra-high resolution cameras, interactive video streaming and real-time data tracking technologies**, this use case will drive application development for **professional sports coaches** and **sports and music fans**. They will be able to enjoy **augmented data overlays** and **interact with video** to provide a more enriched and personalized experience.*

In this deliverable, we further outline this use case description, derive user requirements from it, and present an associated demonstrator definition to showcase the R&D efforts from the MOS2S consortium partners in the 1st project year.

2. Use Case Descriptions

In the 1st project year, we focus on a live sport event use case. We define multiple usage scenarios around a live sport game in a smart venue, that help steer out technology developments and guide our demonstrator concepts.

2.1. NL usage scenario - the amateur analyst

This usage scenario details the scenario for displaying and interacting with high quality live content on primary home TV screen and secondary companion screens, e.g. smartphones or tablets. The principal focus is on efficient distribution of high quality multimedia streams, advanced rendering of navigable video and interactive data overlays. A concept called “de thuis analist”, or amateur analyst, enhances both in-venue and in-home fan experiences with a dedicated data-integrated interactive video application, featuring navigable 360/UHD video and accurate player and game data and statistics (see Figure 1). The amateur analyst application bridges the gap between professional coaches and amateur enthusiasts. As this usage scenario involves delivery to residential end-points, it is reasonable to assume that the consumer has a fixed and therefore relatively stable network connection to the content producer/distributor, and that this connection is sufficiently capacitated in terms of network bandwidth to guarantee the streaming of the audiovisual content in maximal quality. There is no pre/post-game experience, the main differentiation is made between viewers in the stadium, and viewers at home.

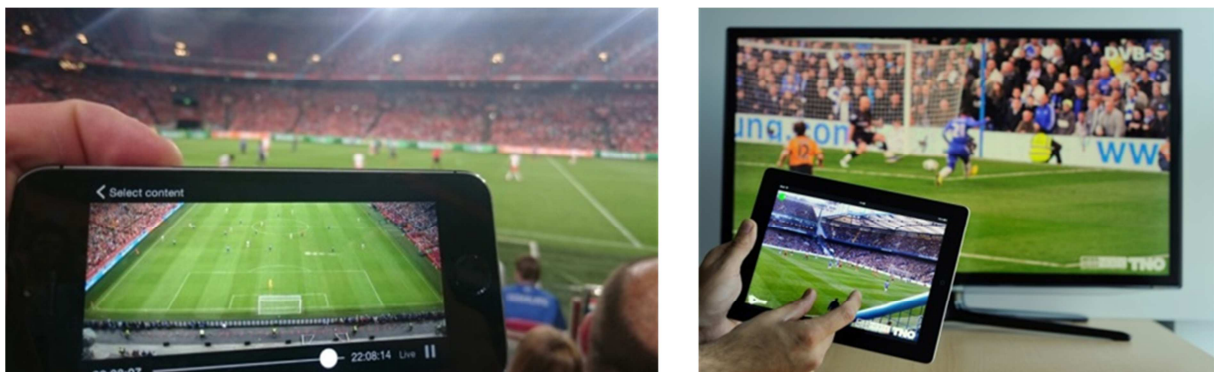


Figure 1: watching a live sports game on smartphone in the stadium (left) and on TV and tablet at home (right).

Today, the national football teams of *Kees* and *Matteo* will play against each other in Amsterdam Arena. Kees will follow the game in the Amsterdam Arena, since he bought tickets to the event a few weeks ago. He brings his smartphone (**UC NL.g.1**), to watch highlights and replays in the stadium during the game. (**UC NL.s.1**). *Matteo* watches the game at home on his TV (**UC NL.g.1**), in marvellous 4K and 5.1 audio (**UC NL.h.1**). He also takes his tablet (**UC NL.g.1**) so he can see game statistics and real-time player data (**UC NL.h.2**), and interact with the video on the tablet (**UC NL.h.3**).

At home

Matteo is enjoying the game at home, watching his TV from his couch. The TV is showing the official game broadcast, delivered by KPN to his set-top box. On his tablet, he opens the “amateur analyst” application, to receive more details about the ongoing game.

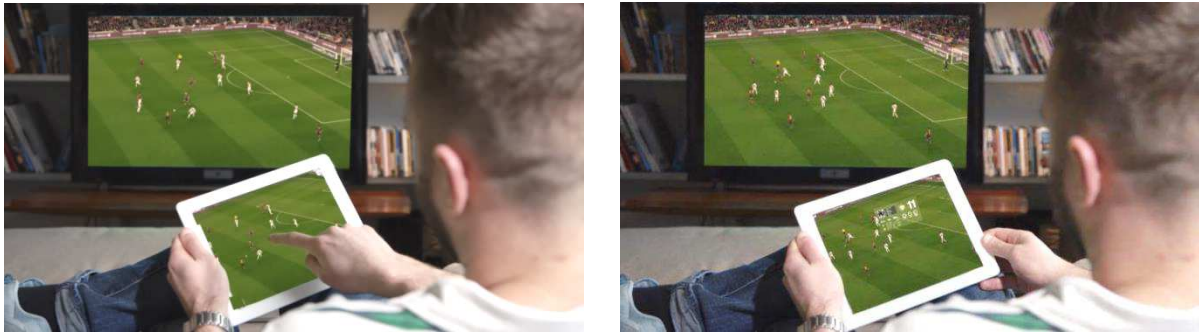


Figure 2: interaction with video on a companion screen; tapping on a player (left) to see a data overlay with real-time player data (right).

The application allows him to select a player by tapping on him (Figure 2, left) (UC NL.h.4). He selects Wesley Sneijder, and additional player statistics are now shown next to Wesley as an overlay on top of the video (Figure 2, right) (UC NL.h.5).

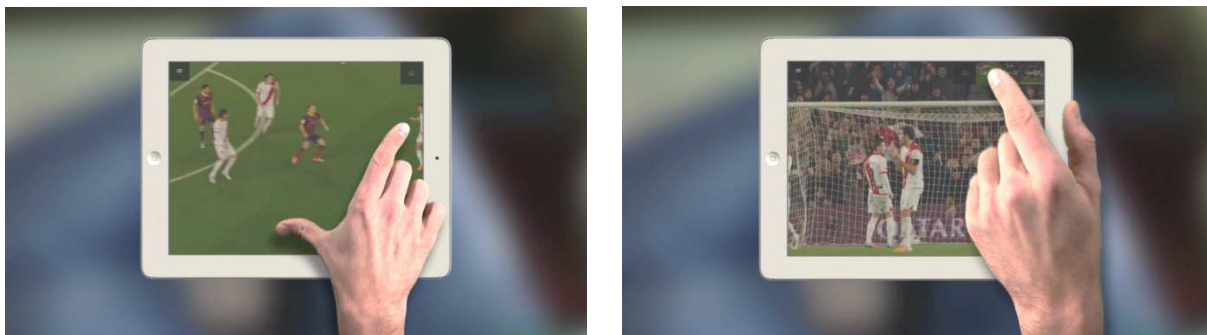


Figure 3: interaction with video on a companion screen; zooming in to video (left) and tapping to see a data overlay with game statistics (right).

The application further allows him zoom in to the video and navigate (Figure 3, left) (UC NL.h.6), giving *Matteo* the feeling that he controls the camera herself. He zooms in to the video, to closely watch a particularly interesting confrontation between Wesley Sneijder and Mattia De Sciglio. De Sciglio commits a foul and receives a yellow card. *Matteo* wants to know how many cards the Dutch and Italian teams have received during their championship games, and he taps the upper corner to see game and team statistics (Figure 3, right) (UC NL.h.7).



Figure 4: interaction with video on a companion screen; advanced analysis and coaching options.

Having all game and team statistics available, *Matteo* now gets more involved with the game and player performances. He uses the tablet application to see real-time player tracking data (Figure 4) (**UC NL.h.8**), and perform his own analysis of player performances. He can select individual players for a virtual PTZ camera view (**UC NL.h.9**), and activate a data overlay showing instantaneous player heart rate, actual level of tiredness and distance covered (**UC NL.h.10**).

During the second half of the match, *Matteo* gets a bit tired of the involved interactions on his tablet. He closes the application, leans back and grabs her remote control. On his set-top box, he opens up the “amateur analyst TV application” and sees a side bar appearing on the TV screen (Figure 5) (**UC NL.h.11**). In the sidebar, he can select multiple custom video channels, such as different camera angles, player tracking cameras, or an analysis-mode view (Figure 5) (**UC NL.h.12**). He selects the player tracking cam option, and a list of different players is shown in the sidebar. He selects Memphis Depay, and sees a video stream in which Memphis is continuously followed (**UC NL.h.9**). Memphis gives some great passes, and *Matteo* is interested in knowing whether he is effective with his passes. He switches back to the initial sidebar selection menu, and selects the analysis mode view (**UC NL.h.12**). He now sees an overview video of the football pitch, with a dynamic graphical overlay (**UC NL.h.7**).



Figure 5: limited interaction with video on the TV; selecting analysis or player cam modes from a side bar menu.

Memphis has the ball again, and in the overlay, his passing options are shown (**UC NL.h.12**). Once Memphis passes the ball to Arjen Robben, the overlay disappears. Arjen performs some great moves, and scores!

In the stadium:

The game has started, and Kees uses his smartphone to look for game highlights and replays (**UC NL.s.1**). In the game application, he finds a lists of automatically generated highlight videos (**UC NL.s.2**), and replay videos where he can interact and navigate (**UC NL.s.3**). In addition, the application allows him to use his smartphone to display analysis data in an augmented / mixed reality mode (**UC NL.s.4**). The analysis data enables Kees to make educated guesses about who will make the next goal; the application allows him to bet on specific players (**UC NL.s.5**). Based on the player parameters, Kees believes that Arjen Robben will make the next goal, and he votes for Robben. When Arjen Robben scores, the stadium lights flash and focus on various in-stadium app users. Then, all lights focus on Kees (**UC NL.s.6**) and he is notified that he will be interviewed during half-time (**UC NL.s.7**), to explain his analysis and vote.

When halftime begins, Kees is invited by one of the stewards to participate in the live show hosted by Kevin (**UC NL.s.8**, see BE use case scenario). Kees can replay the footage of his analysis (**UC NL.s.9**), and explains why he thought Arjen Robben would score the next goal; the live show interview is shown on the public screens in the stadium (**UC NL.s.10**).

2.2. BE usage scenario - enhancing the pre/post-experience

A sports or music event is not just the sports game or music show itself, it is also the ambiance before, during and after the event that makes the experience complete. Capturing and enhancing this fan experience is the goal of the Belgian partners in MOS2S, as well as bringing this experience to the fans at home.

Before the event, fans are excited and eager to see their team deliver a good performance (for a sports event) or to watch their idol sing their favourite song (for a music show). Since everyone is gathered in and around the stadium a unique atmosphere is created where people connect and stories arise. To capture this unique atmosphere, fans will be asked to send photos, movies, ... of their experiences, which will then be featured in a live stream application including a pre-event talk show presented by a host on-site, for example a famous vlogger. This experience is continued during the event with a timeline stream of photos of fans. Through the application people at home can feel a glimpse of the live experiences too and unite with the attendees and their fellow fans. After the event, comments and analysis of fans become the main focus of the application. The integral co-creation experience seamlessly extends (pre- and post-match) and enhances (during the match) the Dutch “home analyst” scenario, by intelligently bridging and complementing both professional and user generated content experiences.

The different aspects of the scenario are discussed in more detail below, based on the reference scenario of a football game in the Amsterdam Arena.

Before the event: the pre-event fan talk show

Today, the national football teams of *Kees* and *Matteo* will play against each other in Amsterdam Arena. Kees and his friends will follow the game in the arena, since they bought tickets to the event a few weeks ago. To make sure they are on time in the Arena, they decide to arrive one hour before the game starts. *Thijs* and his brother *Jason* also love football and are big fans of the national team. Unfortunately, they live at the other side of the country and they were not able to come to the Arena. They will follow the game at home. Editor *Sophie* is at the Arena for work. But unlike her colleagues who will produce the live stream of the game, she is in charge of a separate, more interactive livestream in which crowdsourced content of users on-site can be highlighted during the game. As soon as the fans are flocking around the stadium, she connects to the Kiswe app and starts “*the Stream of Moments*”, next to the professional streams in the application (**UC Be.p.1**).

Also *Kevin*, a famous vlogger, is at the Arena to see the game. Since he likes to combine his love for vlogging and the national football team, he decides to make a live show for all fans of this upcoming game where he discusses the possible strategies of both teams with the fans themselves. He opens the Kiswe App and schedules a new live event that will run from 30 minutes before the game until the game starts (**UC Be.p.2**). He already has a number of followers, including Kees, Matteo and Thijs, who like his show and they receive a notification when his new live event starts (**UC Be.u.1**).

30 minutes before the game, Kevin opens the Kiswe App and start to cast himself. He also takes his tablet and watches his own show so he can see what his viewers are chatting about his show and the upcoming game (**UC Be.p.3**, **UC Be.u.2**). He knows that there is a Stream of Moments with selected photos and short videos of fans that capture the atmosphere of and around the game, and adds this as a second stream to his live event as well (**UC Be.u.3**, **UC Be.p.4**). The whole host setup is shown in Figure 6.

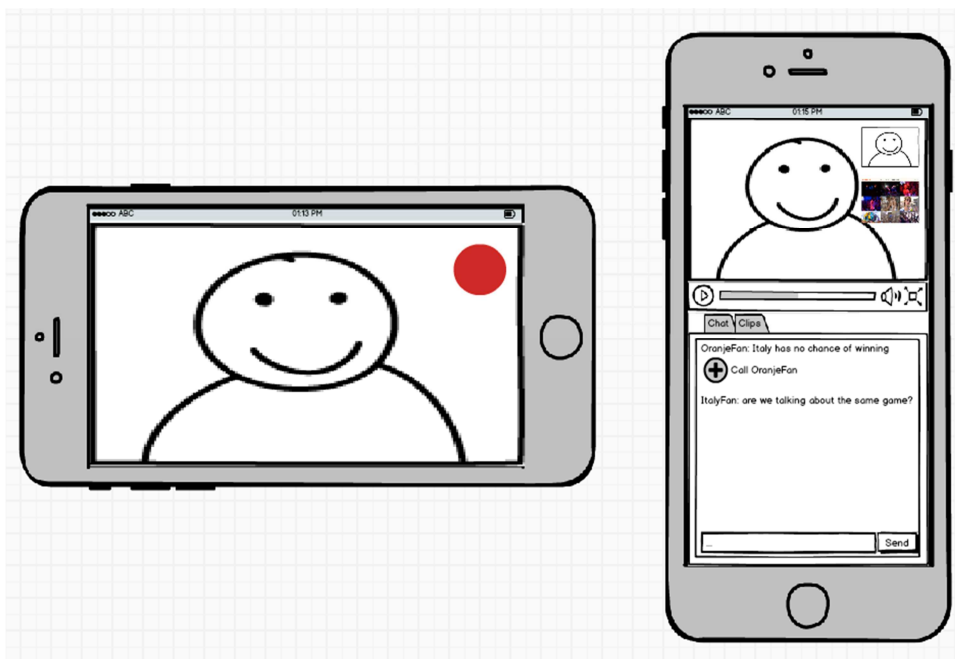


Figure 6: Mock-up of set-up for host of the pre-event fan talk show

Kees, Matteo and their friends are at the Amsterdam Arena now and have received a notification of this live show. They join the show to see what Kevin has to say about the game. They can make clips of the comments Kevin make to share with their friends (**UC Be.u.4**) or chat directly with Kevin and the other viewers. The setup of viewers is shown in Figure 7.

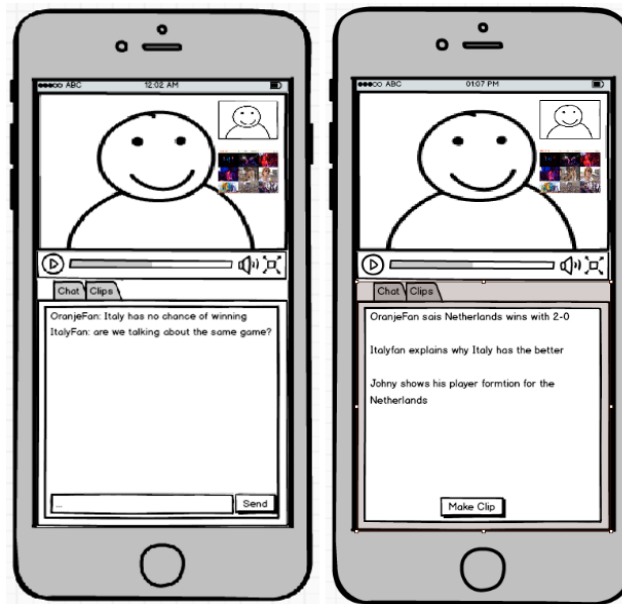


Figure 7: Mock-up of view of end user of the pre-event fan talk show.

Kevin asks his viewers how the atmosphere is in the stadium and who they feel would win the game. Kees responds to this on the chat and tries to call into the show (**UC Be.u.5**). Kevin sees this and clicks on “call Kees” from the chat widget (**UC Be.p.5**). At that point Kees gets a popup to join the conversation which he accepts, shown in Figure 8. Kees now gets into the same casting screen as Kevin has and is now also broadcasting his camera (**UC Be.u.6**). The two of them can now continue their discussion in public by video chatting. The conversation is captured and streamed live to all viewers in the app (**UC Be.u.7**). The viewers can click on the picture in picture of Kevin or Kees to switch between the 2 streams (**UC Be.u.8**).

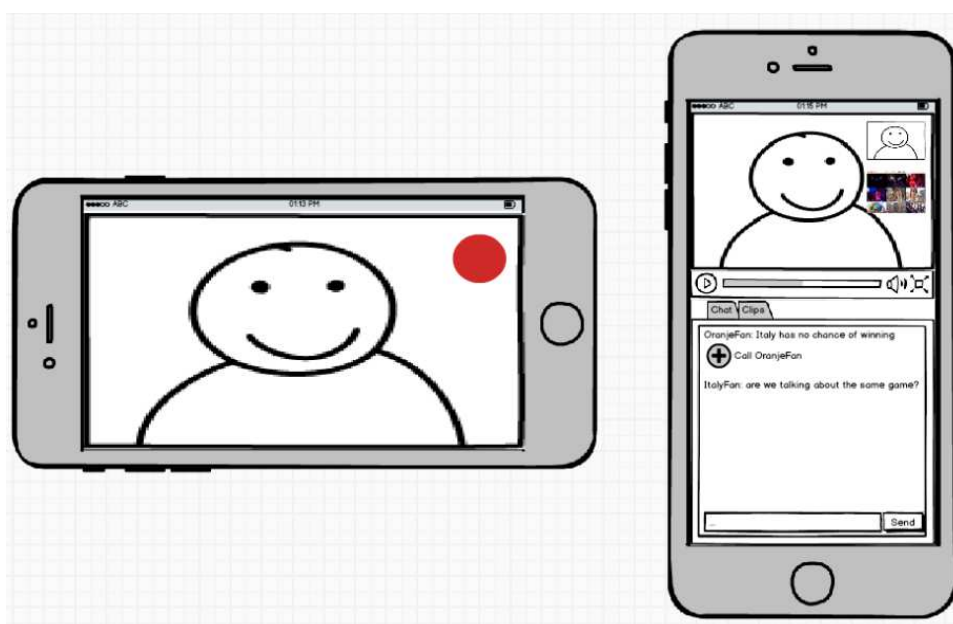


Figure 8: Mock-up of views of a live host/viewer call in fan talk show.

During the event: the stream of moments

The game starts within five minutes, Kees and his friends decide to go to their seats. Also at home, Thijs and his brother raise the volume of their TV to focus more on the game. To keep in touch with the stadium he keeps the Kiswe app open on the Stream of Moments (**UC Be.u.9**).

The tension in the stadium rises. This is a good time to probe for everyone's expectations: what will be the end score? Via the editor application Sophie pushes the question to the users of the application (**UC Be.p.6**). After Kees receives the question, he lets her know he bets it will be 1-0 (**UC Be.u.10**), as shown with a mock-up in Figure 9. At home, Matt and Thijs are less confident on their team, they suggest 1-1 draw results. While the teams enter the Arena, Sophie sees the results coming in (**UC Be.p.7**). In the editor application she can decide on how to visualize these results (**UC Be.p.8**) so the end users (Kees, Thijs, ...) can be informed on the results of the poll as well. The visualization is shown in the Stream of Moments (**UC Be.u.11**), also displaying the forecast of Dutch and Italian fans separately.

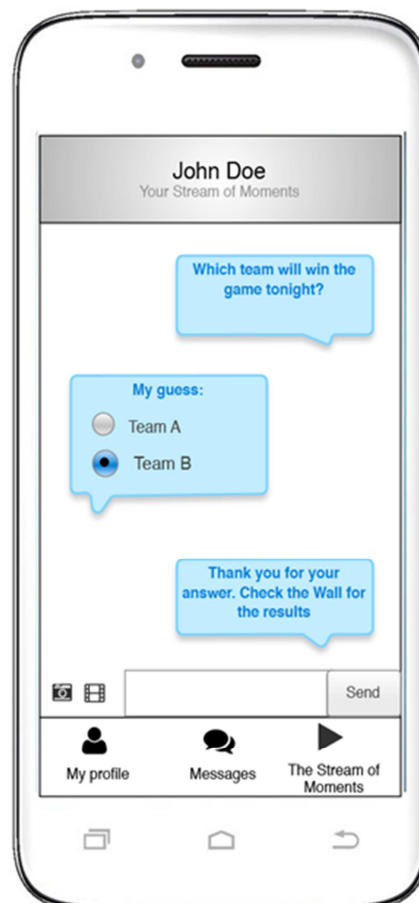


Figure 9: Mock-up of how questions can be pushed to fans.

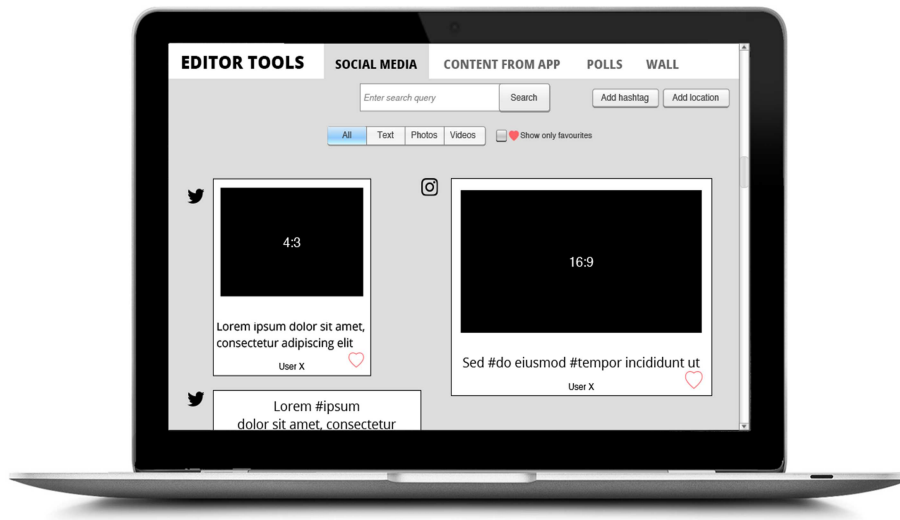


Figure 10: Mock-up of editor view on incoming social media.

The referee blows the whistle and the game starts. The ball goes from one side to the other, all fans - in the stadium and at home - cheer for their team. Kees and his friends even made an encouraging yell. They decide to support their team by filming it and putting it on Instagram. In the production room, Sophie gets an overview of all incoming social media (**UC Be.p.9**), see figure 5. Since she likes Kees' yell so much, she selects his video to be featured on the Stream of Moments (**UC Be.p.10**). That way, when Thijs has a quick look on his phone to feel the ambiance in Arena, he sees his fellows cheering (**UC Be.u.9**). Figure 10 and Figure 11 show how the editor and viewer, respectively, can create and see the Stream of Moments.

The first goal is scored: the stadium explodes. Photos and tweets of happy people, in the stadium and at home, flow into the editor application of Sophie (**UC Be.u.12**, **UC Be.p.9**). She quickly makes a selection to add this moment in the Stream. Furthermore, she can also tag interesting photos, videos or tweets (**UC Be.p.10b**).

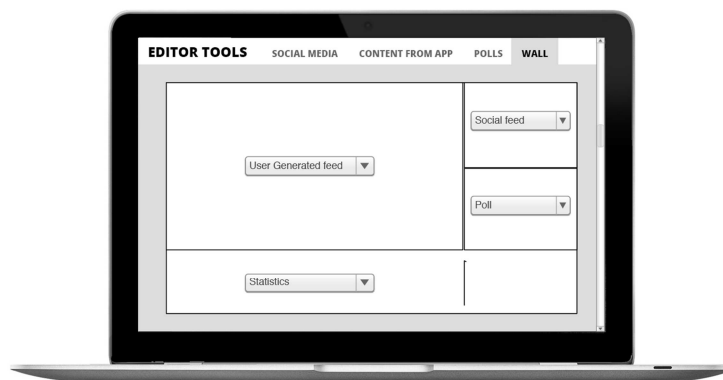


Figure 11: Mock-up of how editor can decide what to show on the Stream of Moments. She can select from social feeds, user generated content, match statistics, ...

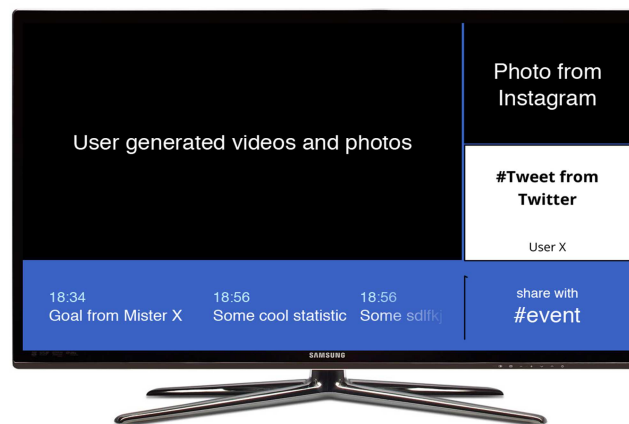


Figure 12: Mock-up of how viewer could see Stream of Moments on screen (public display, tablet or TV at home).

At home, Thijs celebrates together with his fellows on the Stream of Moments. Also Kees is celebrating while watching the Stream which also appears on the screens in the stadium (**UC Be.p.11**). He and his friends are so thrilled, they miss the shortly following goal. To quickly figure out which players were involved in the scoring action, they send the question to the application (**UC Be.u.13**). The question pops up on the screen of the editor. Since Sophie is busy selecting some new photos for the Stream, a predefined bot responds to his question (**UC Be.p.12**). Also, on social media, there is a lot of buzz on the second goal: was it off-side or not? Sophie creates a short clip of the goal, from the professional livestream, with an additional off-side line layer (**UC Be.p.13, UC Be.p.14**), to further animate the discussion.

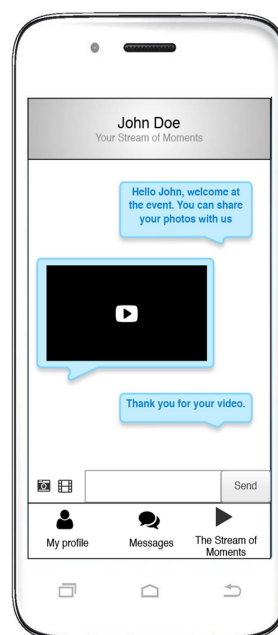


Figure 13: Mock-up of how fans could send videos to the editor.

The game continues, but no additional goals are made. Instead, the Dutch people start entertaining themselves by doing a big wave around the stadium. Sophie sees it in the editor rooms and thinks this is a special moment to be captured. Therefore, she asks a segment of the users, more specifically the ones in the Dutch tribunes, to send in some photos from their view on the wave (**UC Be.p.6b**). Since Kees is there, the question pops up on his smartphone. He immediately takes a picture as an answer to the question (**UC Be.u.12b**), see figure 8. Sophie can now make a grid of different wave photos in the Arena (**UC Be.p.9b**), to be used in the Stream of Moments.

Finally, in the last few minutes of the game, also Matteo can send some cheery pictures to the Stream after a goal of Italy (**UC Be.u.12**).

Post event: the user as home-analyst

When the game has finished, Kevin is happy his team has won and is creating a game analysis post-show as a live stream (**UC Be.p.2**). Similar to the pre-game, the viewers get notified and can join the live stream (**UC Be.u.1**). Now the host is analyzing the game and he uses his tablet and the “home analysis” app to make clips, he can cast this to the end-users by pointing his camera onto the tablet (**UC Be.p.15**). Viewer *Linde* does not agree with Kevins interpretation of the fail by the Dutch Team and clicks on the button in the chat to request to call in the show (**UC Be.u.4**). Kevin accepts this and they discuss this live in the show (**UC Be.p.4**). Linde now takes out her tablet and shows the fail from a different angle and does the same as Kevin and casts her tablet screen. During the discussion, the Stream of Moments, which is also featured on screens in the stadium (**UC Be.p.11**), is showing a combination of social media comments, professional and user clips from during the game (**UC Be.p.16**). Also the goal from Italy which Kevin did not like much, is shown again. Matteo tries to call in to tell his view on this goal and why it was so cool.

After a small celebration party, Kees gets home alone at his apartment. He is still reminiscing the victory, when a personalized aftermovie of the game comes in (**UC Be.p.17**). Kees can now look back at both the most interesting actions of the game, shot by a professional camera, and the user generated ambiance photos. Also the video of him and his friends yelling their team to victory is incorporated in the video. He sits back and relives the game with great pleasure.

2.3. TR usage scenario - Online debate during the game

The game in the Amsterdam Arena is broadcasted live in Turkey. Rojhan, Burak and Nuriye are watching the game in cafes in different cities together with their friends. There happens an arguable incident in the game between the midfield players of the two sides; they both fall after rising the same ball and hit head to head, both are lying on the ground and referee's decision on the position is foul with a yellow card penalty to the player of the team which Kees supports. Supporters in the Amsterdam Arena are protesting the decision with whistles, Kees does not agree on both decisions of the referee, got a little bit angry and would like to explain his thoughts and feeling about the situation. Kees decides to start a debate on our Online Debate

site, opens the application on his Android tablet, clicks to start a new debate, then sets the category as Football, and the topic as "was the referee's decision on the yellow card correct?", also puts the screenshot of the position as the debate background and started to wait for the other three participants.

Meanwhile, a new debate indication is sent to the moderators of the football category, after receiving it one of the available Moderators accepted the invitation after his acceptance the debate is indicated as in "waiting for the participants" state on our Online Debate site.

Rojhan who is supporting the same team which Kees supports has also opened the Online Debate application on his Android mobile phone and decided to join the debate that Kees opened, then selected the debate, indicated his status as pros or cons, and started to wait for the debate starts. At around the same time from different cities Burak and Nuriye also joined the same debate from their mobile phones.

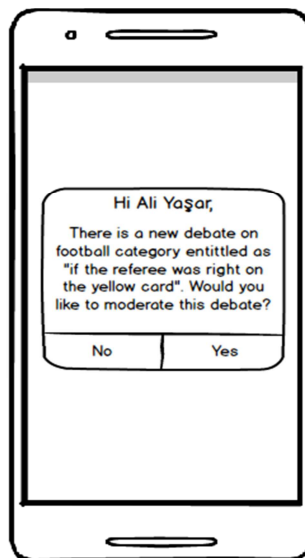


Figure 14: Moderator screen when the alert is received.

The Moderator announces the debate will start in 30 seconds, and the system informed the participants with a pop-up text; there will be 2 turns, and in each turn each participant has 2 minutes to explain their thoughts, however offending any party in the debate in anyhow will be penalized with exclusion of the offender from the debate.

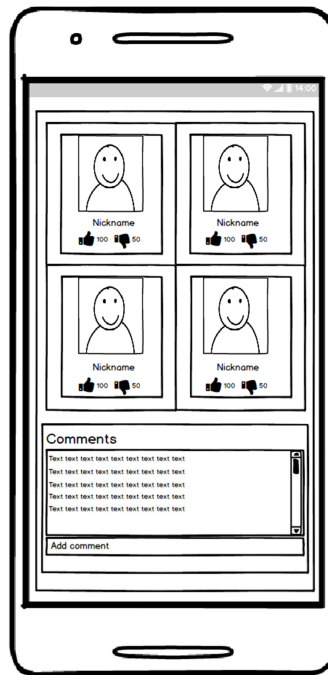


Figure 15: Android tablet application of Online Debate; while a debate is running.

The Debate starts and the participants explain their thoughts about the arguable position and the referee's decision in their turns within 2 minutes time limit, each participant can watch the other three on the same screen simultaneously. After Kees' first talk, Rojhan decides to send a question, "if the time limit can be extended from 2 minutes to 3 minutes", to the moderator, writes it as a text message on the Instant Messaging (IM) tab of the application and sends it to the moderator, but he instantly gets the reply that it is not possible. While the debate is ongoing, Abdurrahman who is an Erasmus program student in abroad, makes a break to his study for the final exams starting tomorrow, he is also a very strong supporter of the team that Kees support, while having rest and spending his free time he starts to surf on the web, has a look at the Online Debate site, and remembers that there is a game tonight, while searching for it he finds out that there is a debate about the game and sees the title "if the referee was right on the yellow card", clicked on and promptly started to watch the debate, four debaters are online and can be seen simultaneously, he could only watch half of the first and second turns and thought that Burak provides the most valuable insights to the situation, he then clicks the Like button on Burak's frame. After the debate timeouts, the whole content is made accessible from the same site through the History tab. There is still a chance for the visitors to explain their thoughts below the debate page as comments.

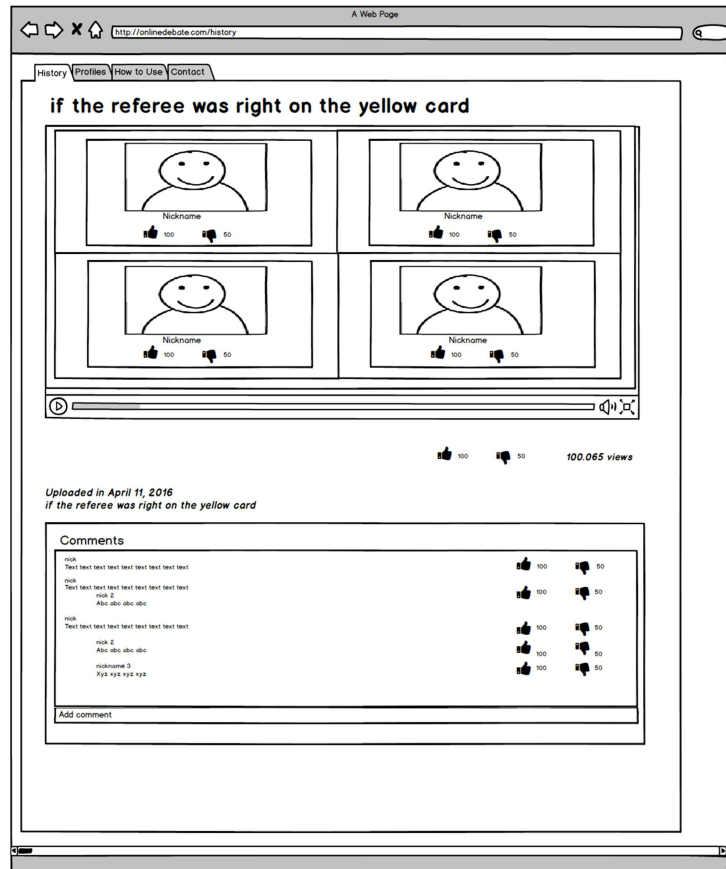


Figure 16: Online Debate website; browsing debate history.

2.4. KR usage scenario - UltraWideView capture of a live sports game

To enhance the live event experiences, an approach with wide viewing angle video such as 360VR or panoramic video can be a good candidate. However, when a user feels such uncomfortable things from motion sickness, colour difference or any technological immaturity, it is no longer useful. Therefore, monitoring the input feeds in real-time and 3D is very important to prevent any unexpected problems.



Figure 17: UltraWideView capture and monitoring of a live sports game.

During the event: Real-time monitoring

Today, the main director of a broadcasting service, Cameron, is in charge of broadcasting the national football match. In an OB van, he sees the live feeds from a set of multiple cameras which are stuck in a 360 rig (**UC KR.p.1**). When he needs to see the game from various positions, he can enlarge and navigate in 3D domain (**UC KR.p.2**).

3. User Requirements

This chapter describes user requirements, derived from the usage scenarios in chapter 2. Both end-user and professional requirements are captured.

3.1. NL use case requirements

UC NL.g.x: Dutch generic use case requirement - number x

UC NL.h.x: Dutch use case requirement for the home viewer side - number x

UC NL.s.x: Dutch use case requirement for the stadium visitor - number x

Overall

- **UC NL.g.1** – user applications must work on multiple screens, e.g. TV, tablet, smartphone
 - **UC NL.g.1-a** – user applications may work on head-mounted displays, e.g. VR goggles.

At home

- **UC NL.h.1** – when at home, users can use their TV to see UHD video and surround audio.
 - **UC NL.h.1-a** – the TV and/or set-top box must support DVB UHD-1 Phase 1
 - **UC NL.h.1-b** – the TV and/or set-top box may support DVB UHD-1 Phase 2 CPA and CPB
- **UC NL.h.2** – users can use their tablet to see game statistics and real-time player data.
- **UC NL.h.3** – users can use their tablet to interact with the video.
- **UC NL.h.4** – users can select a player by tapping on him.
- **UC NL.h.5** – player statistics can be shown as a data overlay in the video.
- **UC NL.h.6** – users can use their tablet to zoom in/out and navigate in the video.
- **UC NL.h.7** – game statistics and team data can be shown as a data overlay in the video.
- **UC NL.h.8** – real-time player tracking data can be shown as a data overlay in the video.
- **UC NL.h.9** – users can select individual players for a virtual PTZ camera view.
- **UC NL.h.10** – player biometric data, such as instantaneous player heart rate, actual level of tiredness and distance covered, can be shown as a data overlay in the video.
- **UC NL.h.11** – TV interaction is performed using a side bar menu
- **UC NL.h.12** – The TV side bar menu shows available options to select, such as different camera angles, player tracking cameras, or an analysis-mode view.

In the stadium

- **UC NL.s.1** – when in the stadium, users can use their mobile devices to see highlight and replay videos.

- **UC NL.s.2** – during live game events, replay highlight videos are automatically generated.
- **UC NL.s.3** – during live game events, navigable replay videos are automatically generated.
- **UC NL.s.4** – when in the stadium, users can use a mobile application to see a data overlay on top of the videos.
- **UC NL.s.5** – when in the stadium, users can use a mobile application to bet on / vote for game events and results, and player performances.
- **UC NL.s.6** – when in the stadium, the stadium lights can be controlled by external sensor data, e.g. sensors vests or mobile device coordinates.
- **UC NL.s.7** – when in the stadium, users can be notified of events via a mobile application.
- **UC NL.s.8** – when in the stadium, users can participate in live event fan shows.
- **UC NL.s.9** – when participating in a live fan show in the stadium, users can use a mobile application to record and replay their analysis video.
- **UC NL.s.10** – when participating in a live fan show in the stadium, the live show footage can be shown on public screens.

3.2. BE use case requirements

UC Be.p.x: Belgian use case requirement for the professional side - number x

UC Be.u.x: Belgian use case requirement for the user side - number x

pre-event

- **UC Be.p.1** - an editor can start a crowdsourced livestream
- **UC Be.p.2** - a host is able to create a live streaming show
- **UC Be.p.3** - a host is able to chat with his viewers
- **UC Be.p.4** - a host can include a Stream of Moments in his stream
- **UC Be.p.5** - a host can call a fan after the fan requests to join the show

- **UC Be.u.1** - followers of a show get a notification that the event is live
- **UC Be.u.2** - a viewer is able to chat with the host
- **UC Be.u.3** - a viewer can switch to the stream with the Stream of Moments
- **UC Be.u.4** - a viewer is able to make clips of the live show to share with his friends
- **UC Be.u.5** - a viewer is able to request to call into the show
- **UC Be.u.6** - a viewer is able to cast himself while communicating with the host
- **UC Be.u.7** - a viewer is able to see and hear both the host and a fan who called in
- **UC Be.u.8** - a viewer can switch between the camera of the host and the called in fan while still be able to listen to the conversation

during event

- **UC Be.p.6** - an editor can push questions, ... to the user application
 - **UC Be.p.6-b**: an editor can push questions, ... to segments of users of the application
- **UC Be.p.7** - an editor can see responses of users on questions
- **UC Be.p.8** - an editor can make visualisations of the responses on simple questions
- **UC Be.p.9** - an editor can get a comprehensive overview of the incoming photos, ... and activities on social media
 - **UC Be.p.9b** - an editor get a comprehensive overview of the incoming photos, ... as response to a question in a separate editor screen
- **UC Be.p.10** - an editor can select and push photos, videos, social media, results of questions to the livestream
 - **UC Be.p.10b** - an editor can tag interesting photos, videos, social media, for later use
- **UC Be.p.11** - an editor can show the crowdsourced livestream on screens on-site
- **UC Be.p.12** - the system allows to forward questions to a bot service, and has a way of taking in the responses of this bot service
- **UC Be.p.13** - an editor can make a clip of the professional content to put it on the crowdsourced livestream
- **UC Be.p.14** - an editor can support simple overlays on video and photo
- **UC Be.u.9** - the user can watch a crowdsourced livestream next to the professional captured streams.
- **UC Be.u.10** - the user can get and answer questions/polls from the editor
- **UC Be.u.11** - the user can see results of questions or polls in livestream
- **UC Be.u.12** - the user can send photos and videos to the editor
 - **UC Be.u.12b** - the user can send photos and videos in response to a question
- **UC Be.u.13** - the user can send questions to the editor

after the event

- *NOTE: the requirements after the event are the same as the pre-game except that we use additional devices to show the clips.*
- **UC Be.p.15** - a host of a fan talk show can cast videos from another device into his talk show live stream
- **UC Be.p.16** - an editor can quickly make a summary of the aggregated experience combining user gen pictures, videos, social media, and professional content clips
- **UC Be.p.17** - the system can make a personalized aftermovie of the event combining professional and crowdsourced content, including the content of the user himself/herself.

3.3. TR use case requirements

UC Tr.p.x: Turkish use case requirement for the professional side number x

UC Tr.u.x: Turkish use case requirement for the user side number x

Pre-event:

- **UC Tr.u.x** - A fan can start a debate on Online Debate site
- **UC Tr.u.x** - Open the application on his Android tablet
- **UC Tr.u.x** - Clicks to start a new debate
- **UC Tr.u.x** - Set the category and the topic
- **UC Tr.u.x** - Put screenshot of the position as the debate background
- **UC Tr.p.x** - An invitation is sent to moderators
- **UC Tr.p.x** - After one of available moderators accepted invitation, debate is indicated as in “waiting for the participants” state
- **UC Tr.u.x** - Other participants can join to the debate on their mobile phones or tablets by selecting the debate
- **UC Tr.u.x** - Start waiting for the beginning of the debate.
- **UC Tr.p.x** - After three participants are joined to debate, Moderator announces debate will start in 30 seconds

During event

- **UC Tr.p.x** - Offending any party in the debate is penalized and the participant who offends is dismissed by moderator
- **UC Tr.u.x** - Each participant can watch others on the same screen simultaneously
- **UC Tr.u.x** - Participants can send text messages on the IM tab of application
- **UC Tr.u.x** - Audience can take a look Online Debate Site on a web browser
- **UC Tr.u.x** - Audience can search if there is any active debate about any game
- **UC Tr.u.x** - Audience can start to watch debate online by clicking debate topic link
- **UC Tr.u.x** – Audience can click “Like” or “Dislike” icon located on the debater’s frame according to their thoughts

After event

- **UC Tr.p.x** – Whole content can be accessible from the same web site through the “History” tab
- **UC Tr.p.x** – All previous debates are listed in the “History” page
- **UC Tr.u.x** – Audience can view details by clicking the link of that debate
- **UC Tr.u.x** – Audience has a chance to watch debate again and to explain her/his thought
- **UC Tr.u.x** – Audience has chance to “Like” or “Dislike” comments of others

Other requirements:

- System informs participants with a pop-up text

- Current and last debates are listed in Online Debate site on web
- Debate consists of 2 turns
- Each participant has 2 minutes to explain her/his thoughts

3.4. KR use case requirements

UC KR.p.x: KR use case requirement for the professional side - number x

during event

- **UC KR.p.1** - Live feeds from a set of multiple camera are rendered in 3D domain with spatial relation of them.
- **UC KR.p.2** - The rendering viewpoint is movable with 3DoF transitions and zoom.

4. Demonstrator Definitions

We aim to organize our first public demonstration of the MOS2S innovations and technologies at or around IBC 2017¹; IBC is the premier annual event centred in the creation, management and delivery of content, and is held in the Amsterdam RAI, September 14-19, 2017. The IBC Future Zone allows participants to show advanced content concepts. We plan to show individual demonstrations of primary parts of the MOS2S system and applications, with a focus on the live sport game scenario.

The Year1 demonstrator (Q3 2017) is part of T3.3, Demonstrator Design². In this task, first mock-up demonstrations, primarily based on or derived from existing platforms and enabling technologies, will be showcased with a focus on the live event use case. Integration between contributions from the four countries will be demonstrated at a storyline/concept-level.

4.1. NL demonstrator definition

As part of the overall MOS2S demonstrator, the Dutch demonstrator will focus on enhancement of the professional "Match of the Future" experience, based on a data-integrated interactive video application for amateur analyst scenarios with the fan in and around the football stadium and the viewer at home.

The main concepts of the Dutch demonstrator are depicted in Figure 18, with Figure 19 - Figure 21 depicting mock-ups of the various demonstrator applications. Several MOS2S back-end systems will support the demo applications, most notably

- A multi-camera capture system from Bosch, installed in the Amsterdam Arena;
- A player tracking system from Inmotio, deployed in the Amsterdam Arena, with sensor vests;
- A tiled streaming back end from TNO, deployed on Microsoft Azure.
- Three end-user applications, developed by GameOn in cooperation with KPN, deployed on smart phones, tablets and TV set-top boxes.

¹ <http://www.ibc.org/>

² Note that the first year demonstrator is organized in NL, not TR.

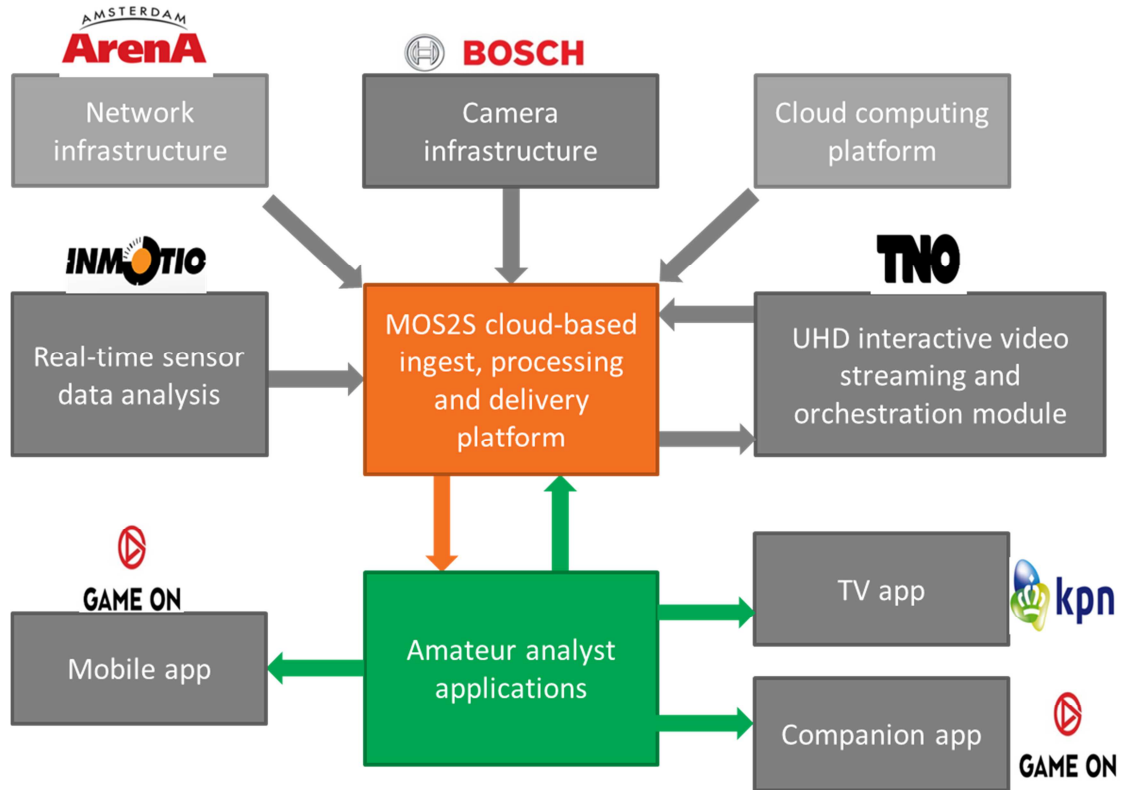


Figure 18: Dutch MOS2S demonstrator (Y1).

1/ Interactive companion screen application



Figure 19: an interactive companion screen application.

The first NL demo consists of an interactive application, running on a tablet, offering advanced interaction options for amateur analysis and coaching, including video navigation, virtual camera selection and graphical data overlays.

2/ Interactive TV screen application



Figure 20: an interactive TV screen application.

The second NL demo consists of an interactive application, running on a set-top box, provisioning for limited interaction based on a side bar menu. Features include multiple custom video channels, such as different camera angles, player tracking cameras, or an analysis-mode view.

3/ Interactive smartphone application

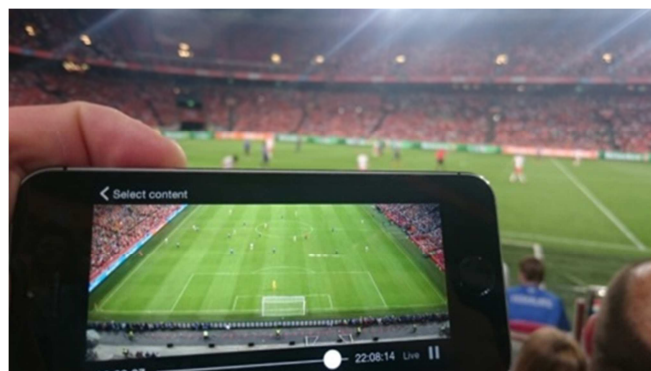


Figure 21: an interactive smartphone application.

The third NL demo consists of an interactive application, running on a smartphone, offering in-stadium interaction and content, such as highlight videos, interactive replay videos and an analysis mode. In addition, voting/betting features are implemented.

4.2. BE demonstrator definition

As part of the overall MOS2S demonstrator, the Flemish demonstrator will focus on extension (pre- and post-event) and enhancement of the professional “Match of the Future” experience, based on live streaming co-creation (Kiswe Live Event Cloud) and editor-driven contribution (MOS2S Editor Dashboard) scenarios with the fan in and around the football stadium and the viewer at home. The main concepts of the Flemish demonstrator are depicted in Figure 22:

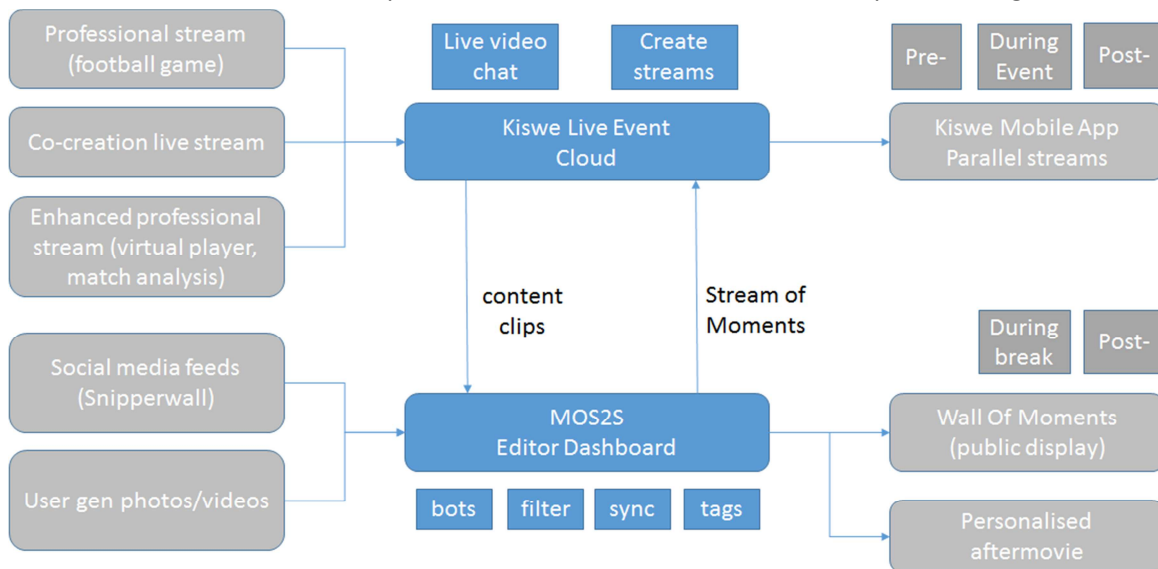


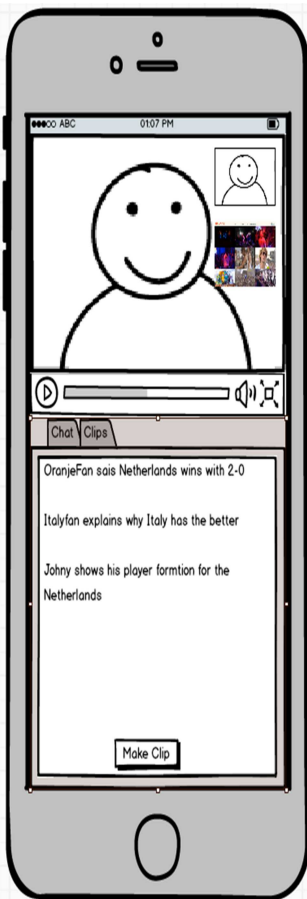
Figure 22: Flemish MOS2S demonstrator (Y1).

- a wide variety of input streams (professional and user gen content, social media feeds, game analysis data) are processed and orchestrated into a coherent set of different output fan experiences:
 - **Wall Of Moments** on a set of public displays in and around the stadium; each display can carry specific content.
 - Kiswe Mobile app consisting of several **parallel streams** between which the viewer can switch according to their preference
 - A **personalized aftermovie experience** as a post-event reward for contributors
- new functionality building further upon existing back-end tooling
 - Kiswe Live Event Cloud:
 - live video chat feature for co-creation of live event show by and for fans. The difference with a traditional video chat is that the live captured video is not only available to the contributors, but also streamed to the rest of the world.
 - additional parallel streams (stream of moments, sensor-data enhanced professional content)

- Editor Dashboard: bot functionality (conversation with contributor), syncing of social media messages and user generated photos, creation of Stream of Moments and personalised aftermovies, segmented communication with end users
- conceptual integration of live event cloud-based features and editor dashboard functionality
 - short clips from co-creation and professional streams can be generated and sent from Kiswe cloud to editor dashboard
 - Stream of Moments can be shared from editor dashboard as additional parallel stream in Kiswe Mobile app

Concretely, the demonstrator will show the following applications.

1/ Multi-stream live event experience



The demonstrator will show the resulting pre-, during and post-game event experience, based on the content created during the preparatory test capture event in the Amsterdam Arena (friendly football interland on 28/3/2017). The created event experience will be available as a continuous multi-stream to watch in replay mode and will provide a subset of the interactions of the live event. The different parallel streams in scope are the co-creation live show, the Stream of Moments and (potentially) sensor data-enhanced professional content of the match. The viewer can still see and browse through the conversations, the Stream of Moments, calls and chat from during the event, but cannot call into the event anymore. Switching between the parallel streams can be done and the viewer can still generate clips from the stream and share these clips. In order to show the live video chat feature, we can setup a mini live show at the demonstration venue to demonstrate this by having a host and some viewers communicate in a live stream while the rest of the audience can follow this conversation in the Kiswe app.

Figure 23: Multi-stream event experience

2/ Wall of Moments on public display

The Wall of Moments on public display will show an **aggregate and balanced mix** of social media comments, user gen photos and videos, selected fragments of the co-creation live show and professionally captured game highlights. This fine and coherent selection of *best moments* will

typically be consumed during the break and after the match on public display in and around the stadium.

Whenever possible, the Wall of Moments will take into account:

- synchronisation in time and context between different sources, e.g. a social media message, a user gen photo or video, information on the match. In the resulting Wall Of Moments experience, these matching sources could be combined in one image.
- (auto)tagging of content to link different sources
- (optionally) the nearby presence of a contributor
- the story flow of the match by matching game highlights and peaks in contributions and social media buzz, and reflecting this in the resulting experience

Note that the Stream of Moments is based on the same concept, but is also generated during the match for consumption in the Kiswe app.

In order to generate the Wall of Moments and Stream of Moments, an **editor dashboard tool**, acting as a *content aggregation platform*, shows the various incoming sources and allows the editor to interact with the fan in the stadium and at home and to respond on the different input sources as good as possible. The editor is presented social media feeds that are filtered on relevance; the dashboard shows user gen and professional content in alignment with social buzz based on time, (location) and possibly auto-tagging context. Besides the Wall Of Moments and Stream of Moments, the editor tool also allows to create the and the personalised aftermovie experience, in a semi-automated way.

A conceptual preview of the Wall of Moments is illustrated in Figure 24. Viewers can be further encouraged to share contributions, e.g. by using an #event hashtag.



Figure 24: Wall Of Moments on public display.

4.3. TR demonstrator definition

As a part of the overall MOS2S demonstrator, the Turkish demonstrator will focus on developing “Online Debate” application, based on image equalization and infrastructure components of online debating. This application enables a group of people to meet up online by using their mobile phones or tablets at anywhere for talking about whether the happened position was correctly evaluated or not.

This work requires performing a study on selection, design, development and application of the most appropriate streaming, transcoding and transrating methods in transferring multi-channel video streams with accompanying text content to both mobile and we connected devices which have different processing power and different internet band widths.

- Furthermore, “Online Debate” might evolve to a supporting structure for Crowd Journalism applications.
- Online Debate has some similar features with Kiswe, such as;
 - Easy access; user can easily watch a live debate and also the web site,
 - Multi-stream event experience
 - Variety of events; an audience can select an event depending on her/his concerns.
 - Live video; all debaters can watch each other at same time
 - Live chat; debaters can send text message to moderator of debate
 - End users can create a debate whenever they want
 - Social media contribution; audience can express himself/herself and also can support debater who has similar ideas,
 - Access both live and previously completed debates, and watch their videos on the website
- Online Debate Web site has some similar features with [Balloter](#) and [QualOut](#) websites,
 - Access both live and previously completed debates, and watch their videos on the website

4.4. Test capture event

In order to further outline the technological developments, and build the concrete demonstrators, we are organizing a sensor data and video test capture event. Our plan is to perform such capture during the friendly interland NL-IT, March 28, in Amsterdam ArenA. For this test capture event, we need to ensure that

Sensor data and video test capture at football game during friendly interland NL-IT, March 28 in Amsterdam ArenA.

The NL use case needs are:

- the Dutch football team plays with Inmotio sensors vests, in order to capture sensor data;
- we receive permission to capture data and use the captured data for our demonstration and dissemination events.
- No outside broadcast / streaming at this event.

The BE use case needs are:

- A host presenter and about 5 preselected fans to contribute in pre- and post-event live show (5 people). The live capturing aspect is important in view of creating interesting and genuine content.
- A script for the live show has to be prepared
- An editor to moderate Wall of Moments based contributions in the stadium (5 friendly contributors are prepared to capture user gen content in the stadium). Typically, the editor and host presenter are located next to each other.
- Access to the Snipperwall and/or other social media feeds for post-event processing
- Post-event access to professional content and sensor data-enabled content or information of the game
- A home-alike setting in the neighbourhood of the stadium to simulate the fan experience at home, and capture their live reactions
- Network connectivity and bandwidth available in the neighbourhood of and within the stadium for live streaming and interactions and WoM contributions.
- Simultaneous recording of social media feeds in a window before, during and after the event.

The TR use case needs are:

- One moderator and five fans
- Both mobile and web platforms for serving the Online Debate application

5. Concluding Remarks

This Deliverable D1.1 provides use case descriptions and demonstrator definitions for the 1st year milestone. The document outlines use case descriptions and requirements with a focus on live events in a Smart City context, and clarifies the contributions from the participating countries. Compelling concepts are described, such as the amateur analyst applications, the crowdsourced fan show, the online discussion system and the immersive capture system.

We have selected IBC 2017 as a premier event to showcase initial MOS2S system and application concepts; this requires follow-up with IBC to organize a booth, and discussion on a backup plan, should the IBC organization not grant us a booth at the Future Zone exhibition.

In the period towards the demonstrator (Q3 2017), the MOS2S consortium is dependent on the realization of a test capture event, to generate sufficient data and video content to develop demonstrator concepts. Close monitoring of available events and discussion on backup plans is required.