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We recently have completed the second year of the project. Implementing our idea of an ultra high resolution interactive television service of the future makes good progress. A full system comprising appropriate capturing and analysis technology, networking components and various terminal devices is under development.

The highlights of the past year were our participation at IBC and receiving The Engineer award. Our booth at IBC featured demonstrations of the real time stitching engine, assembling a 7k by 2k panorama from six HD-streams on the fly, the gesture based interactive interface, tiling and streaming methods for panorama delivery, interactive audio scene rendering, person tracking for automated scripting and the Alexa M camera. We were happy about the constant stream of people stopping by and requesting demonstrations. Another important part of our participation at IBC was the presentation of papers on FascinatE during the conference.

In December we were informed that FascinatE was amongst the finalists for the engineer award organized by The Engineer magazine. Ben Shirley received the first prize in the category consumer technology on behalf of the consortium.

So what of the future? The next steps are to integrate more of the components into an overall system. Different stages of integration will be used to demonstrate the system. The next demonstration will take place in conjunction with a show presented by Berlin Philharmonic Orchestra and the Sasha Waltz dance company in May.

In order to be kept up to-date on the developments of the project please visit [www.fascinate-project.eu](http://www.fascinate-project.eu) or follow us on twitter "@Fascinate\_Prjct".

Georg Thallinger,  
Project Coordinator



## The Engineer Award 2011 - Consumer Products

Special points of interest:

- FascinatE wins The Engineer Award: consumer products category
- Real time stitching of OMNICAM high resolution panoramic video
- FascinatE Editor UI design
- FascinatE Production Scripting Engine
- FascinatE Delivery Network



Figure 1: FascinatE was winner in The Engineer Award 2011 Consumer Products Category

2011 was a busy year for the Fascinate project as project dissemination made real progress.

We were delighted that the Fascinate project was announced as the winner of The Engineer Award 2011 consumer products category in December.

On 2nd of December 2011 around 100 industry professionals attended the awards event where the winners were announced at The Royal Society in London. The awards are intended to celebrate the importance of engineering across a number of categories.

The FascinatE project award was collected by Ben Shirley from University of Salford on behalf of all project partners.

### Real-time Stitching Engine for Multi Layers

One important module of an advanced format-agnostic production framework at production side is the real-time stitching engine. This module allows the warping, stitching and blending of multiple camera views of an omni-directional camera such as the OMNICAM in order to create a full panoramic video. To allow the director at production side to select arbitrary regions out of the panoramic view at desired resolution, a real-time interface has been developed to support the user specific rendering. In addition to that, multiple layers are supported such that different regions can be selected out of the panoramic video at the same time.

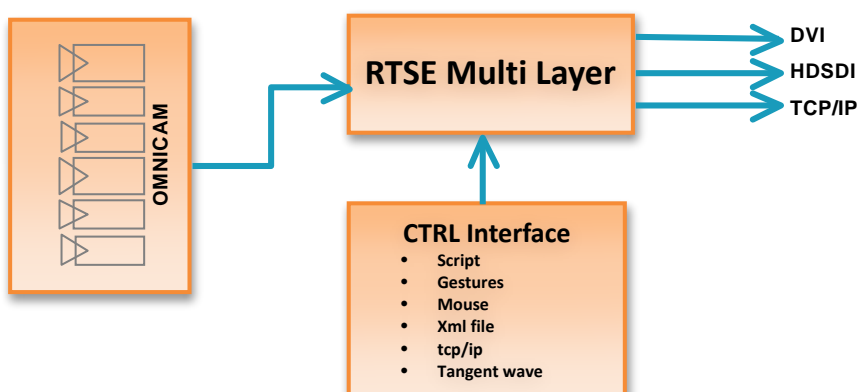


Figure 2: Block diagram of Real-time stitching engine and related input and output

### Second FascinatE Test Shoot in Berlin

The FascinatE project has the opportunity to perform its second test shoot at a premiere cultural event in Berlin. On 24th until 26th of May 2012, the Berlin Philharmonic Orchestra conducted by Sir Simon Rattle and the Sasha Waltz Dance Compagnie are performing the Carmen-Suite by Rodion Shchedrin in the big concert hall "Arena". The combination of dance performance and high quality classical music offers the consortium a new and completely different scenario compared to the football match at Chelsea at the first test shoot in 2010. Again, the full set of audio-video acquisition will be installed to get test data for further research and development. The

OMNICAM and a number of broadcast cameras will be installed for video capture. Around 30 microphones are installed in the orchestra to capture the classical music sound. In addition, soundfield microphones and an Eigenmike will be installed for 3D sound acquisition. This year, the OMNICAM will be equipped with the new ARRI Alexa M cameras to capture high-quality high-dynamic-range video at 60 frames per second.

## FascinatE Demonstrations at IBC 2011

The FascinatE project exhibited at IBC 2011 in Amsterdam generating considerable interest at the event. Demonstrations were given by the project team of live real-time OMNICAM

stitching, gesture interaction, in combination with the FascinatE video renderer, 3D audio reproduction, network and delivery of FascinatE content, real-time person tracking and



Figure 3: Members of the project team demonstrating aspects of the FascinatE project to visitors to our stand at IBC 2011



Figure 4: In test content from a soccer match, Technicolor's FRN renderer visualizes shot candidates as computed by the Production Scripting Engine as coloured overlay rectangles.

The Production Scripting Engine (PSE) is a software component responsible for decision making on content selection. It decides what is visible and audible on each playout device. The key feature is to automatically frame moving virtual cameras within the high-resolution OMNICAM panorama image, in addition to cuts to human operated broadcast cameras. Selection behavior is based on pragmatic (covering most interesting actions) and cinematographic (ensure basic aesthetic principles) rules. In order to take reasonable decisions, the engine needs knowledge about what is currently happening in the scene and which camera streams are capturing that action.

The FascinatE system is format agnostic which means it

*"The PSE's camera framing behavior aims to ensure that actions of a high priority are overruling specific user preferences to the benefit of the viewer experience."*

produces live content streams for different playout device types in parallel, effectively enabling new forms of content consumption while reducing production cost. In contrast to classic TV, every viewer can watch different parts of the scene framed in the style of her or his choice. As a human production

team could not cater for a large audience in parallel, the PSE is needed to automate content selection.

It changes the requirements for the production team – no director is needed to take every decision manually, but professionals have to make sure the PSE is fed with knowledge about the current actions. Manual live annotation enriches what is extracted by automatic content analysis. Software that aims to automate the tasks of the production team is often referred to as a Virtual Director. It reasons for different viewer groups in parallel. There is at least one such group per playout device type, and many more derived by the options available in the viewer interface.

One feature example is the ability to closely follow an object or a person, or to follow groups such as athletes from a certain country in a track and field meeting. The PSE's camera framing behavior aims to ensure that actions of a high priority are overruling specific user preferences to the benefit of the viewer experience. As an example, in a football situation where a goal (high priority event) is likely to happen next, the PSE can overrule a previous preferred view to make sure the viewer doesn't miss the more important action.

This can be implemented by sophisticated reasoning including basic prediction based on spatiotemporal event patterns. JOANNEUM RESEARCH is leading research to investigate different technical approaches to that problem. The challenge is to model the automatic behaviour in a way that the sum and interplay of its aspects/principles leads to joyful and fascinating viewer experience. We utilize a declarative rule-based approach and for sub-processes also evaluate the applicability of algorithms based on Machine Learning and Description Logics.

As FascinatE is broadcasting live events, there are strong computational constraints of what can be processed within real-time constraints. The PSE is consuming real-time low-level event streams as extracted by AV content analysis and generated manual annotations. Low-level means that the information bits are per se not directly usable for the decision making process, as they are very narrow facts/statements about details of the scene. What the PSE really needs to have in order to take quality scripting decisions is a more abstract understanding of the current situation, though. As an example, a sequence of coordinates of players and a ball are relatively meaningless. However, a certain constellation might indicate a very high probability that a basket/goal is to be scored in the upcoming seconds, and the PSE might want to react to such a situation in a specific way.

A key objective of FascinatE is to support the delivery of ultra high-definition audiovisual content to a large range of interactive end-devices. These devices may range from high-end theater or home set-up with fiber connectivity, to low-power mobile devices, hence with large variations in terms of bandwidth and processing horsepower. However, with the current FascinatE audio/video test material requiring an uncompressed data rate above 15 Gbps, the live transmission of the FascinatE Layered Scene Representation represents a major challenge, which cannot be solved with current end-to-end broadcasting technologies.

In order to build a delivery platform that can scale to that sheer amount of data, to the diversity of end-devices and to end-user interactivity requests, Alcatel-Lucent and TNO's research has focused so far on some particular delivery mechanisms, that can be grouped in three key sets of functions that are responsible for processing and forwarding the content: an A/V Ingest, intermediate A/V Relays and finally A/V Proxies are the main pillars of the FascinatE delivery network architecture. (see Figure 5)

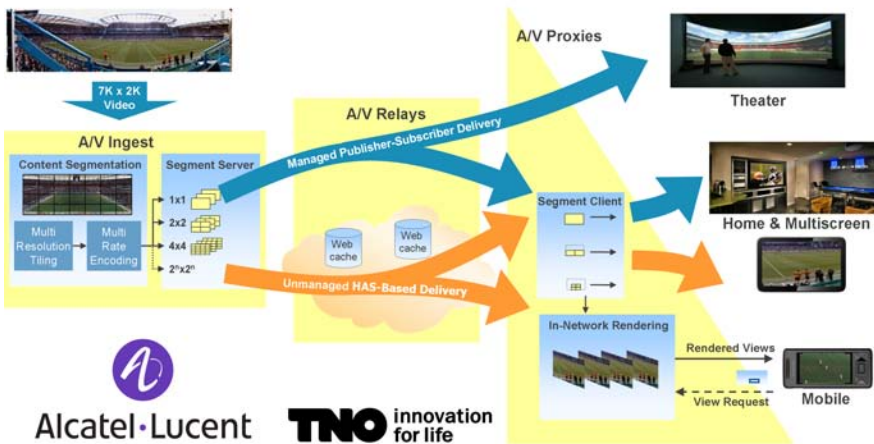


Figure 5: High-level representation of the FascinatE delivery network architecture.

For supporting a flexible transport of the A/V data, a tiled streaming mechanism is employed to package the A/V data at the network ingest point, using various schemes for temporal and spatial segmentation of the OMNICAM video. Starting from the same segment-based representation, the project is considering several deployment scenarios for supporting interactive A/V delivery.

A first track evaluates how existing HTTP-based Adaptive Streaming (HAS) technologies can be extended to flexibly transport spatially segmented content. Such an approach may advantageously benefit from current Web caching/proxying nodes, that can act as intermediate Relays in order to scale to many interactive clients for near-live and time-shifted scenarios. In the current HAS prototype, (see Figure 6), only those segments that correspond to the region of interest as requested by the end-user are transported, which results in significant bandwidth reductions. Full pan-tilt-zoom interaction is offered via additional zoom layers, which correspond to lower-resolution versions of the original

OMNICAM content. A demonstration video of this prototype can be found on the FascinatE Vimeo channel.

A second track investigates new transport techniques for the next generation of managed delivery network. Using a Publisher/Subscriber transport pattern, this approach



Figure 6: prototype of a delivery network based on spatially segmented content, that allows for second-screen pan/tilt/zoom interaction.

allows us to optimally combine the underlying transport technologies used in IPTV systems for supporting large-scale deployment of low-latency interactive video delivery, both for live and on-demand scenarios. Current results focus on how the segmented content can be efficiently transported and filtered under constrained bandwidth resources.

At the network user-end, A/V Proxy functions are responsible for making the received segments ready for delivery to the end-device. This role can include full in-network video rendering of the views requested by the end-user, e.g. for supporting low-power mobile devices. Such a Video Proxy (shown in Figure 7) has been prototyped so as to allow any thin client device to freely navigate into the 7K x 2K OMNICAM videos. The end-device only has to send its pan-tilt-zoom navigation commands (e.g. from a touch-based user interface) to the proxy and receives back the requested sequence of views, fully pre-rendered by the

network and delivered at a resolution and bandwidth that match the device capabilities. With this approach, Ultra-HD content can be watched interactively in a natural manner, even on a low-power and small-display device.

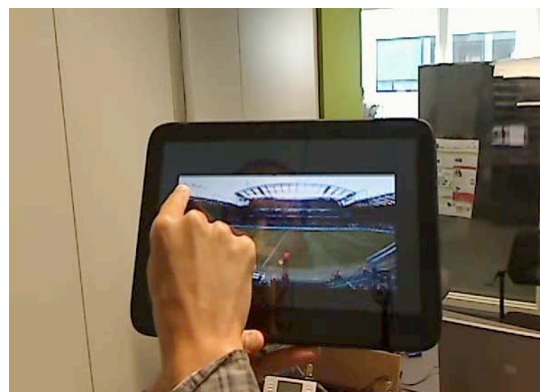


Figure 7: A prototype is shown in which network-based rendering is employed to provide an interactive and personalized view on mobile devices.



Figure 8: Production Control Workspace of the Editor User Interface, including panoramic overview, virtual camera control and high level annotation controls.

The FascinatE Editor User Interface (EUI) is designed to be a professional tool that allows production teams to work with FascinatE's ultra-high-resolution panoramas. It is designed to let the production team interact efficiently with the layered scene representation in a live production, and control the scripting process by professional narration on a high level. The recent project period has seen the finalization of the interaction design brief, describing the detailed functionalities as well as interactional and operational principles for the interface, and the work is now going into implementation.

The Editor User Interface complements the automatic tools, allows annotation of content and helps to define default view options, and is designed to be adaptable both in terms of the size of the production and the functionality needed. The Editor UI is built on a design principle of modularity, where groups of functionalities are arranged in workspaces, which can be configured according to hardware setup, available screen estate and the possibility of multiple FascinatE operators. Customization of workspaces also allows for more lightweight production to take place with the FascinatE system, in use scenarios involving local and semi-professional producers annotating and producing FascinatE

content. With this modularity principle established, the Editor UI design brief's central description is of the core use case of a single operator using a professional grade setup of vision mixing and annotation tools on two screens.

The Editor UI design draws on conventional production studios for broadcast television, but adds a number of FascinatE-specific functionalities and ways of working with panoramic live video. To this end, workshops with BBC producers have been held, in order to inform the design for the Editor UI, as well as production methods in general. The BBC producers provided valuable input on variables to consider in the design, including varying time-criticality of functionalities, perceived added values in production, and the relationship between the envisioned FascinatE operator and traditional production roles and galleries.

The main focus has been on the core functionalities of a production tool using OMNICALM and virtual cameras, i.e. showing the overview and standard broadcast cameras' views, visualization of view options obtained from the PSE, monitoring and management of virtual cameras, real-time annotation of the high-level events/actions, tracking support and the production of the main i.e. linear programme including the switching between different cameras.

FascinatE is an EU-funded project involving a group of 11 partners from across Europe. FascinatE stands for: Format-Agnostic SScript-based INterActive Experience and is looking at broadcasting live events to give the viewer a more interactive experience no matter what device they are using the view the broadcast.

The FascinatE project is developing a system to allow end-users to interactively view and navigate around an ultra-high resolution video panorama showing a live event, with the accompanying audio automatically changing to match the selected view. The output adapts to their particular kind of device, covering anything from a mobile handset to an immersive panoramic display. At the production side, this requires the development of new audio and video capture systems, and scripting systems to control the shot framing options presented to the viewer. Intelligent networks with processing components are needed to repurpose the content to suit different device types and framing selections, and user terminals supporting innovative interaction methods are needed to allow viewers to control and display the content.



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