PERSONALIZATION OF NETWORKED VIDEO - 1

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Commercial Object Library

A *placeholder ("#")* is marked during the production of the source video. A selected object (independent of the source video production) is to be transmitted simultaneous to playout to the viewer and will be inserted into the placeholder at the viewer end.

Sports Cars
Mercedes
Audi
Aston Martin
Porsche

Personalized Product Placement
... and more

A project has been instigated which aims to deliver personalized broadcast video over all standard distribution networks. Playout source streams are to be personalized with objects (selected in accordance with viewer profiles) inserted into the stream. A typical scenario would be for personalized (targeted) product placement, where products are selected based on individual viewer's profile and/or by agencies bidding to have their clients' products inserted into a specific user's stream.

Individual viewers will see streams personalized to their profiles for advertising, cultural, training or other entertainment activities

The project aims to demonstrate the video placement and also the commercial platform to support the brokerage of the selected objects to be inserted. Although the project is currently in early planning stages, various aspects have been already covered. See page two for further details of partners and research consortium building.

Personalization also includes the adaptation of media to user devices and interfaces (see below). The project aims to extend the media brokerage concept to support user-generated content in social network / TV hybrid productions and the personalized selection of media clips to form a personalized programme, *e.g.* integrating personalized *hyperlocal* content into a national playout.

An essential requirement for media personalization and adaptation is the authoring and production workflow. Consequently, the project will include authoring of adaptive hypermedia and adaptive workflows (see below).

Media can be produced to maintain topicality and preserve its shelf life

Personalization of video has a wide range of applications including training and education (to adapt content to a user's developing attainment levels), culturally sensitive content, etc.

Video Technologies
Video is authored to allow the insertion of objects at specific points. Objects must match a range of descriptions relevant to the requirements of the production. This is achieved using metadata to match the source video, the viewer profile and the potential objects for selection. The source video is produced using object based techniques, *c.f.* MPEG-4 parts 11, 20 (although other technologies may be used, *e.g.* VP8 on HTML5 platforms). Using a BIFS-type scene graph (or similar techniques), the production can specify placeholders for future object placement, *i.e.* the types of objects required or disallowed. This way, editorial integrity is maintained to prevent unsuitable objects being utilised in future placements (*e.g.* to maintain the integrity of plot-lines) .
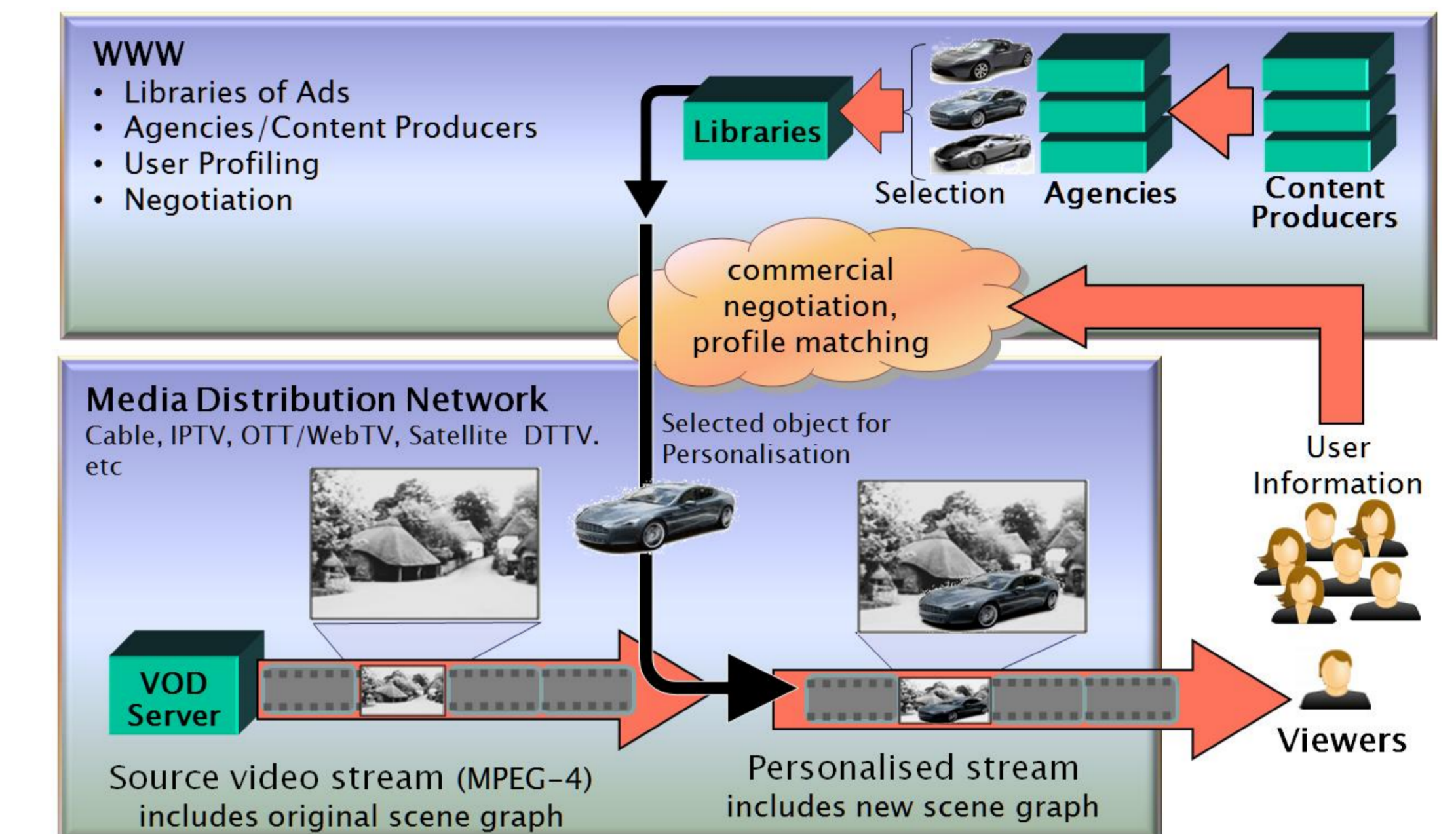
The source video and objects are transmitted to the end-viewer (see the network diagram) along with the updated scene graph. Using these elements, the reception platform (set-top box or similar) integrates and renders the personalized video for the viewer. The objects are transmitted via Web irrespective of the main distribution format. This way, all current distribution formats can be supported with minimal change to the architecture. The resulting solution is similar to a *HbbTV* architecture, but ,in this case, the elements are integrated into the received playout stream.

Objects are located in network libraries (typically third party operated on behalf of, for example, advertising agencies). Object selection may be based on user interaction history, social network usage, context (location, device, relevance within user groups, etc.).

Context and Device Adaptive Media

The project aims to apply personalization of media in the form of adapting the video or audio according to user context, *e.g.* location and mobility factors. Media adaption can also be applied on the basis of input and output devices:
- use of multi-screening – the presentation of personalized content on tabs and phones, synchronised to the main content stream, multi-dimensional presentation.
- sensors: recognition of user situations via Kinect, Glass, haptic sensors, location, etc.
- displays, including the viewpoint of objects in 3D.

Technical Approach
- No additional standards; development of existing standards
- Allow editorial control to remain with producers (when required)

Video
- Based on object based video
  - Initially MPEG-4 + extensions
  - *c.f.* DMB
  - Development required: Codecs

Network
- Network architecture – all existing major distribution networks
  - Cable, Satellite, DTTV, Telco IPTV, OTT
  - *c.f.* Hbb

Content, Personalization and Brokerage
- Content description – assuming MPEG-7 (with user fields)
- Commercial brokerage / acquisition of external content
  - Multi-agent system (MAS)
  - Profiling engine

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WWW
- Libraries of Ads
- Agencies/Content Producers
- User Profiling
- Negotiation

Libraries · Selection · Agencies · Content Producers

commercial negotiation, profile matching

Media Distribution Network
Cable, IPTV, OTT/WebTV, Satellite DTTV. etc

Selected object for Personalisation

User Information

VOD Server

Source video stream (MPEG–4) includes original scene graph

Personalised stream includes new scene graph

Viewers

Above – The general principle of inserting a selected object from a network library into a playout stream; the selected object personalizes the video image for the specific user.
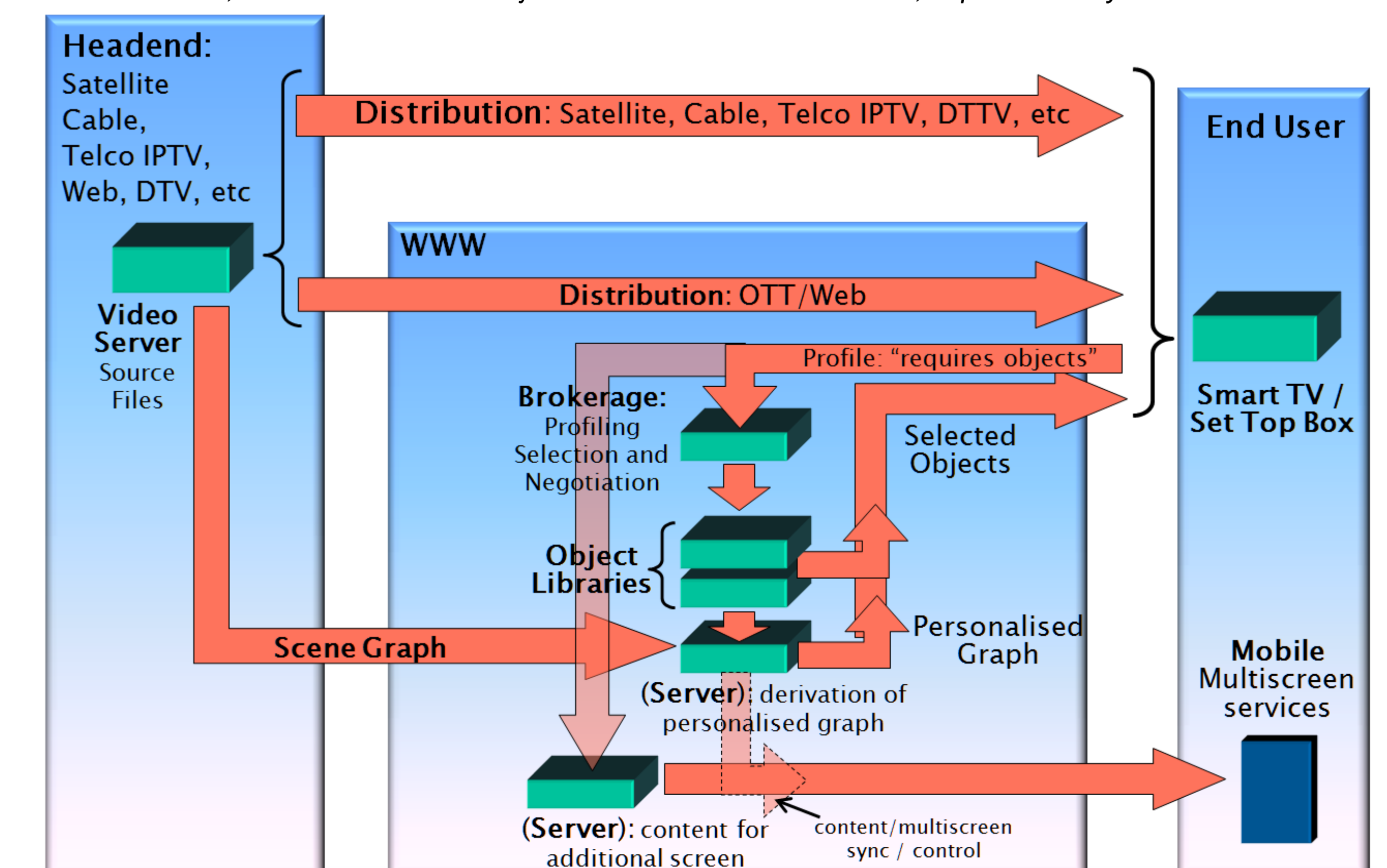
Commercial Media Brokerage

Objects are commercially acquired from (third-party) libraries populated with objects representing client products. Commercial negotiation between agencies, libraries and service operators allows the contractual selection and usage of objects. This process can take place in near real-time just ahead of playout of that section of the stream.

The commercial trading of objects is to be achieved on an agent-based platform where agents represent the various parties in the process, see below.

Each viewer has a profile which is maintained and allows selection of relevant objects. Again, this process is described below.

Below – The network architecture applies to any standard distribution format – Cable, satellite, DTTV, OTT, Telco IPTV, etc. Personalization objects are delivered over the Web, to produce a hybrid architecture.

Headend:
Satellite Cable, Telco IPTV, Web, DTV, etc

Distribution: Satellite, Cable, Telco IPTV, DTTV, etc

End User

WWW

Distribution: OTT/Web

Video Server Source Files

Profile: "requires objects"

Brokerage: Profiling Selection and Negotiation

Selected Objects

Smart TV / Set Top Box

Object Libraries

Personalised Graph

Scene Graph

(Server): derivation of personalised graph

Mobile Multiscreen services

(Server): content for additional screen

content/multiscreen sync / control

PERSONALIZATION OF NETWORKED VIDEO - 2

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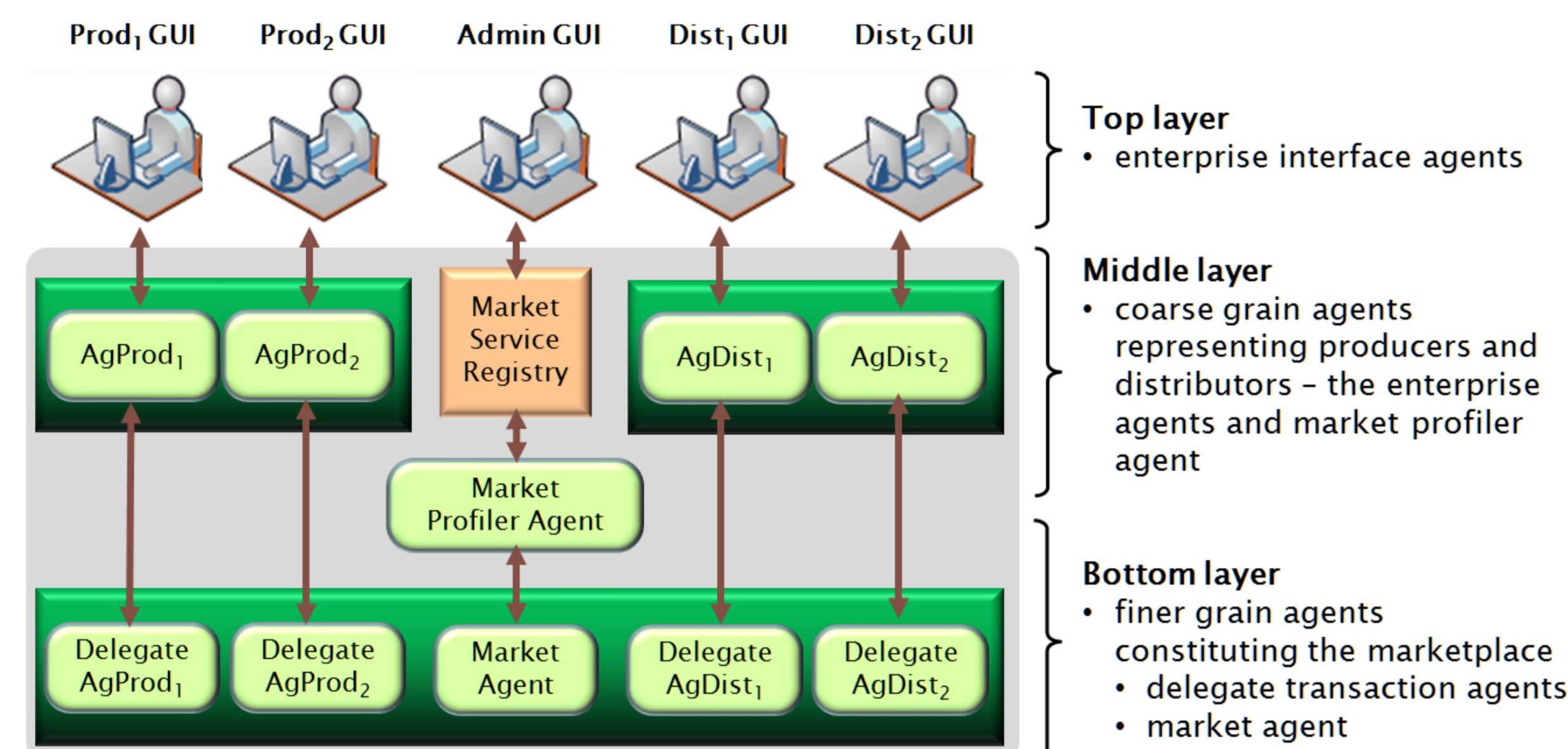Birmingham City University, UK

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Brokerage Platform

The commercial brokerage platform is a multi-agent system (MAS) where agents represent the video content producers and distributors. The system is an SOA using Web Service (WS) interfaces compliant with a SaaS cloud computing approach. The MAS implementation is based on the JADE Development Framework, using Web Service Integration Gateway (WSIG) and Web Service Dynamic Client add-ons. UDDI4J API is used for Web Services discovery and interaction.

The platform can be considered as a three tier platform:

Producers and distributors of media content are modelled by Enterprise Agents
Enterprise Agents are controlled by their real world counterparts trough. This ensures the privacy of the company strategic knowledge. They are compatible and interoperable with other components via the WS interface, allowing the creation of loosely coupled enterprise agents.

UDDI service registries hold the descriptions of existing agent services
Producers and distributors can publish, update and remove their service descriptions of metadata of objects they hold or seek to insert in the playout. Any entity can discover, download and interact with any service (agent).
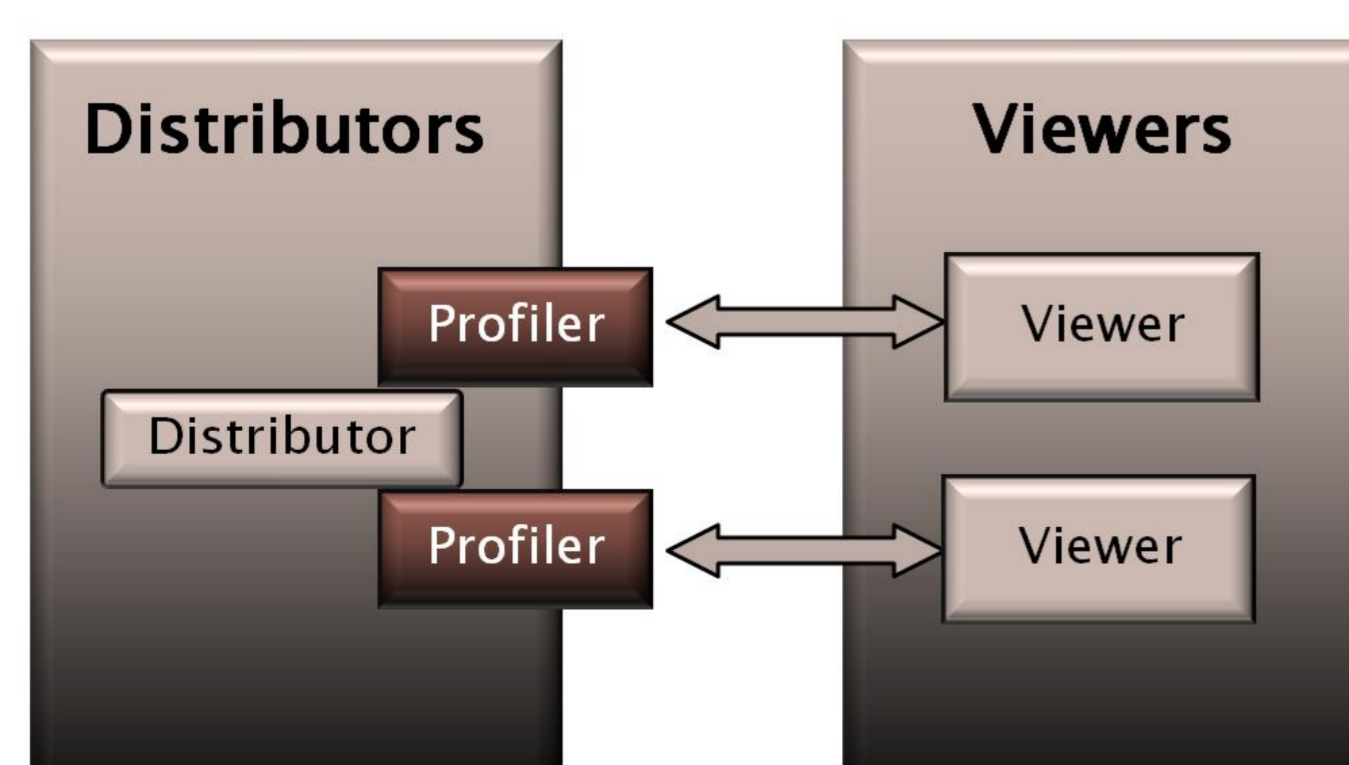
Video objects are MPEG-4 instances which are annotated (in an MPEG-7 based OWL ontology) both for the source video and the external video objects

Profiling

The proposed approach models every viewer as a case-based reasoning (CBR) case that contains all his personal and semantic data together with his tag cloud resulting from his social interactions in the Web site of the content distributor provider or from the previous selection of video streams he/she has done. From all this data, a CBR engine will use classical filtering techniques enhanced with collaborative tagging (CT), *i.e.* folksonomies, to recommend objects for insertion.

Viewer profiling is carried out by profiler agents
Profiler agents create and maintain individual viewer profiles. Their activity is launched by the distributors to monitor all relevant viewer interactions, including selected video streams, internet browsing activity, social networking, etc.

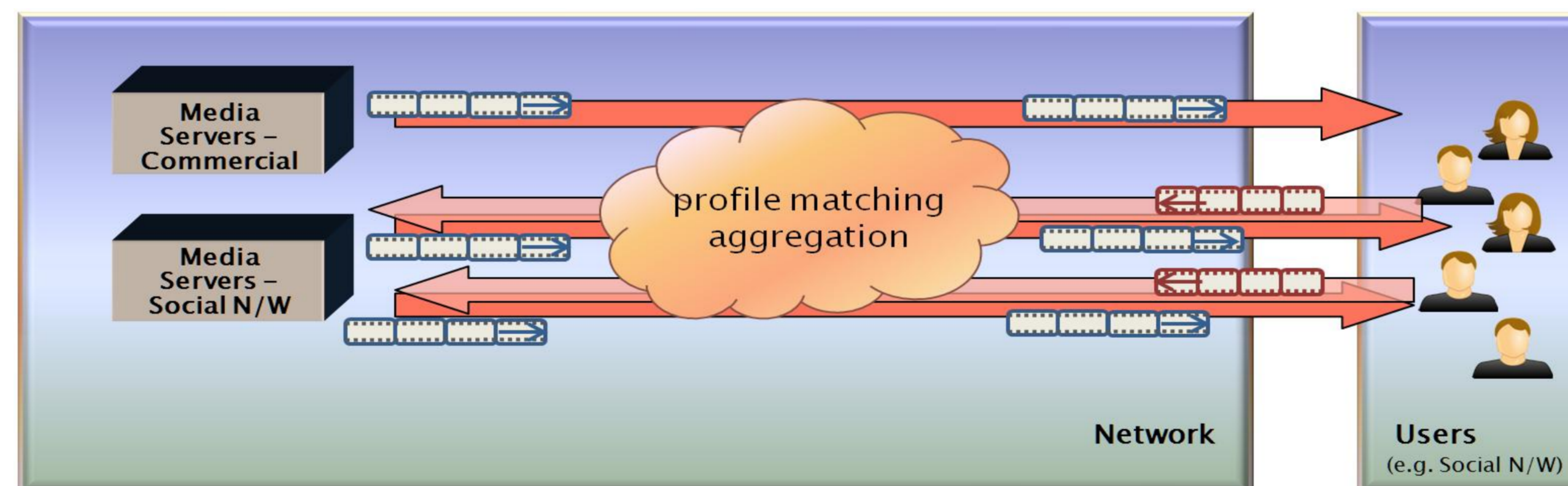## Adaptive Authoring and Workflow...

Making The Producer A Peer Of The Viewer

In this scenario the project aims to integrate user content (*e.g.* from social networks) with broadcast content to produce a personalized programme where each viewer receives a selection of serial clips selected on the basis of the user's profile. An example is the integration of *hyperlocal* content into a national (or regional) network playout to produce a personalized news and current affairs programme.

Content is becoming a collaboration between the viewer and the producer.

Again, content selection is achieved through the content brokerage and personalization (recommendation) methods previously described.

Further to this, user-created media objects can be stored for insertion on a personalized basis either for individual or group (*i.e.* social network) activities.

Above – Personalized integration of user generated content with a national playout. Media segments are selected and sequenced by agent-based brokerage
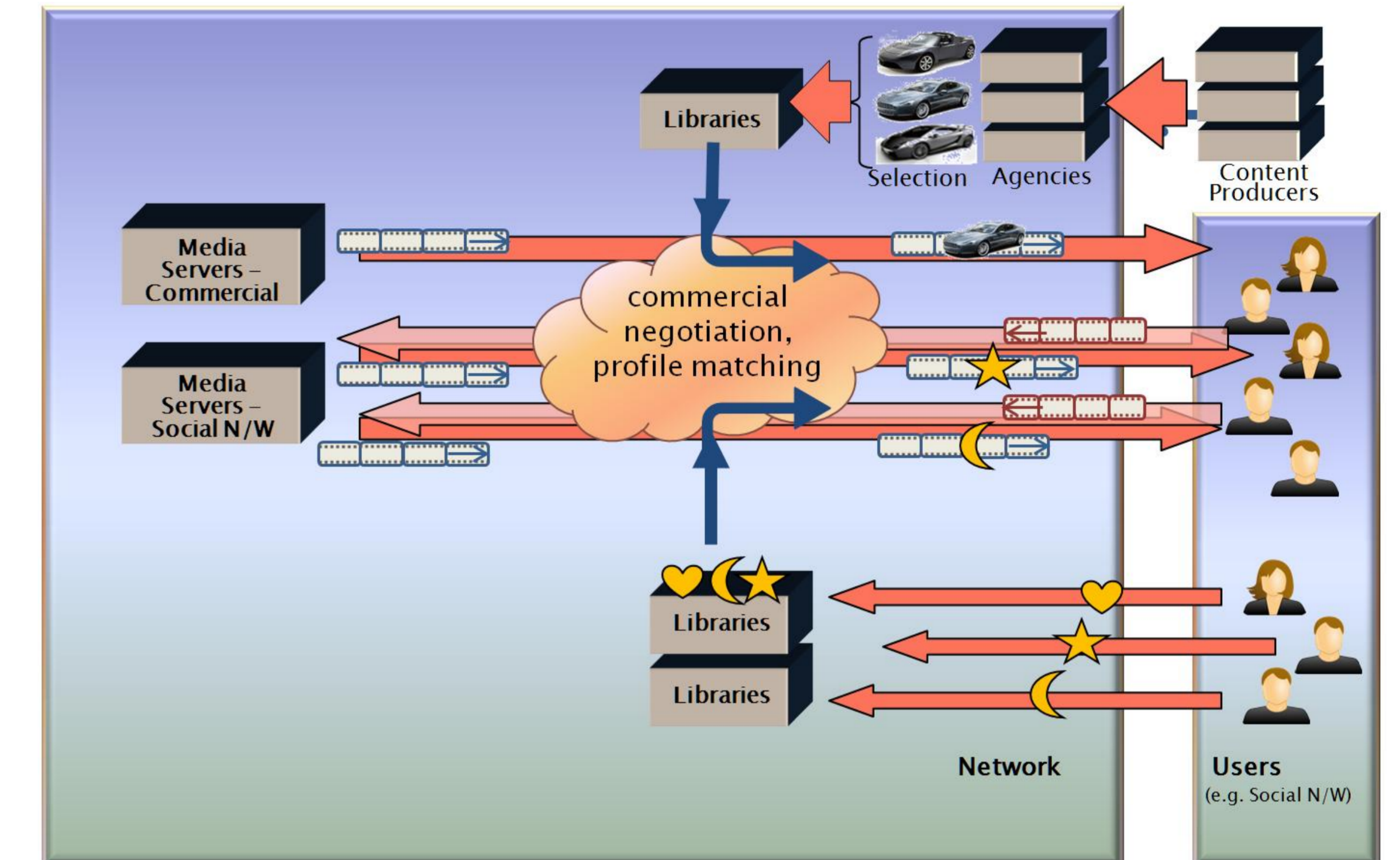
In the proposed project the personalization of media is addressed in two distinct ways:
  • selection and insertion of objects into the video playout.
  • selection and sequencing of media segments to form a personalized programme. These segments are, for example, commercial production, social network output, *hyperlocal* journalism or local talent.

The production of multi-dimensional content in this manner requires production tools – specifically authoring and workflow – to construct variable and personalizable content on the fly. For example, assets derived at playout time need to be managed and selected content may need to be restricted according to editorial prerequisites.

For adaptive authoring of content the project intends to utilise *adaptive hypermedia* authoring tools developed in previous successful projects. Management of content and building the overall **adaptive production** requires an evolved format of workflow where the overall structure allows for imported personalized inserts and segments, *i.e.* **workflow brokerage.** Authoring and personalization of media needs to be context-aware and device-adaptive.

Example: User-Involved Promotion – User involvement allows new paradigms of advertising and promotion. Specifically users can actively participate in product promotion via interactive viral marketing methods.

Above – User generated media objects inserted into playouts for adaptive streams personalized to individuals or groups for group activities

Below – Convergence between Virtual and TV-Worlds: for personalized/shared media; games; education. User virtual world generated objects uploaded and shared with broadcast media; objects from TV playouts downloaded and used in virtual worlds.

Interested in collaborating in a funded research project?

This proposal forms the basis of a project proposal for forthcoming funding. A consortium of partners is currently being assembled, including:

  • Birmingham City University, UK
  • Instituto Superior de Engenharia do Porto, Portugal
  • Universidad de Vigo, Spain
  • Knowledge Media Institute, Open University, UK
  • Technical University Ilmenau, Germany
  • University of Warwick, UK

We need partners in relevant areas of the project and welcome partners from industry in the fields of production, distribution and social networking