Technische Universität Braunschweig

Institut für Nachrichtentechnik

Extensions of a TV Playout System to Support Dynamic Broadcast

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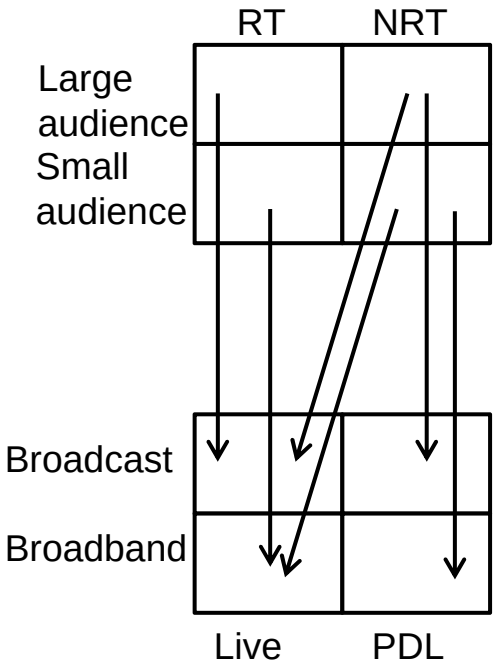
Contents

Delivery of TV programs

- TV programs and their delivery
  - From the perspective of production, the TV events can be categorized in real-time (RT) and non-real-time (NRT)
  - The TV events vary broadly by audience size

- New possibilities provided by advances in consumer TV
  - Additional Internet connections through broadband network at data rates above 20 Mbit/s
    - A return channel from viewer to broadcaster
    - A secondary delivery channel for TV program with broadcast-type QoS. We can deliver TV programs with relatively small audience over broadband and save cost/energy on the broadcast network
  - Built-in storage with capacities above 1 TeraByte. Some NRT content can be pre-downloaded (PDL) since some of it can be stored in advance for re-play. Efficiency of the spectrum usage can be improved by pre-download in low-traffic hours



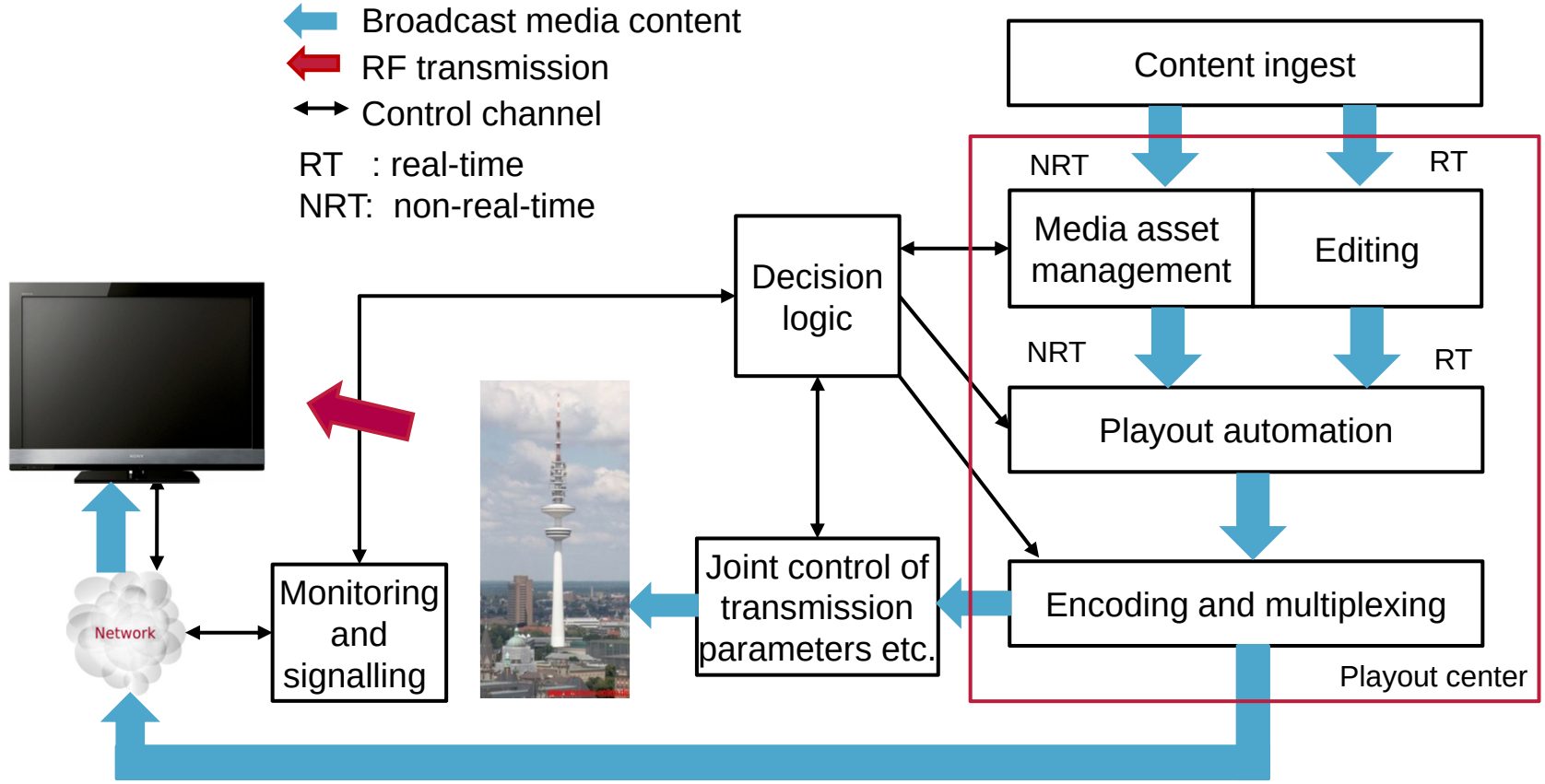
Flexible delivery of TV programs in Dynamic Broadcast

Challenges and benefits for broadcasters

- These flexible content delivery approaches suggest that broadcast network structures become “dynamic”, in the sense that some or all of the following parameters will be changed dynamically over time, to assure cost/spectrum-efficiency:
  - Multiplex configurations
  - Channel allocations
  - Transmission parameters

- Benefits for the broadcasters and the broadcast network operators:
  - The overall cost to deliver the TV programs to the users is reduced
  - Through pre-download the spectrum resource in low-traffic hours, e.g. at night, can be utilized.
  - Additional TV programs or data services can be provided without an increase in spectrum demand.
  - By controlling the transmission parameters and transmitter power Dynamic Broadcast manages the availability of TV White Spaces.

Dynamic Broadcast – the broadcaster's perspective



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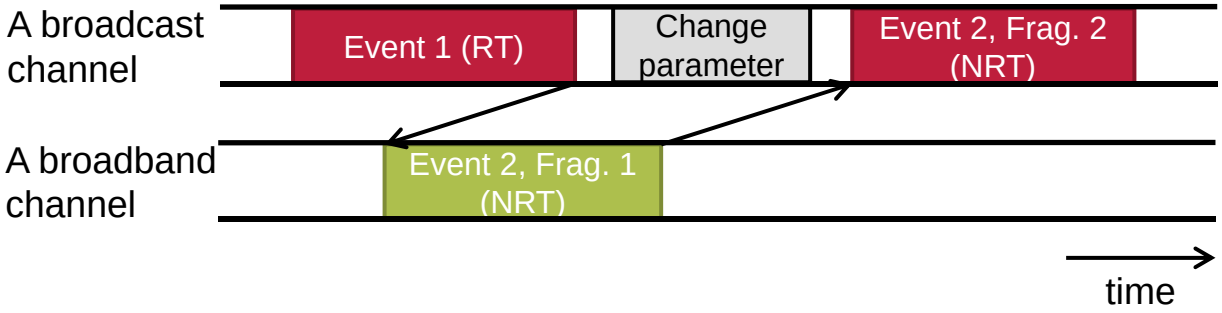
Use case analysis

- The playout system shall support the flexible content delivery introduced by Dynamic Broadcast. Following use cases are identified:
  - Live delivery via either the broadcast or the broadband network
  - Pre-download via either the broadcast or the broadband network
  - Switching between the delivery networks or between the live or pre-downloaded content
  - On-line adaptation of broadcast network parameters
- An example:



- We define a basic use case:
  - The delivery of a TV event or a fragment of it at a pre-defined time with certain quality of service to the user terminals.
  - The other use cases can be built upon it and should not be noticed by the viewers

Requirements regarding the playout system

- Requirements to support the basic use case:
  - Coordination between the system components
  - Content fragmentation and identification
  - Dynamic multiplexing
  - Unified signalling framework

- Requirements to build the complex use cases from the basic use case:
  - Delivery schedule of individual content fragment delivery
  - Distinction between the program schedule and the delivery schedule

- Proposed solutions
  - A centralized management of the content and content fragmentation
  - A central control by the decision logic using an optimized delivery schedule
  - A flexible signalling structure

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1. A short introduction to Dynamic Broadcast
2. Use Cases and Requirements Analysis of the Playout System
3. Proposed Extended Playout System
   - Content Fragmentation and Identification
   - Delivery Schedule
   - Dynamic Multiplexing
   - Signalling Structure
   - Modified workflow
4. Conclusions

Content fragmentation and identification

- In Dynamic Broadcast, the TV programs are temporally fragmented according to
  - Event boundaries
  - Requirements from the decision logic

- Each fragment must be assigned a unique ID.
- Metadata about the content fragments must be created
  - to which TV event they belong
  - the time offset to the start of the TV event
- The changes can be registered directly in the MXF (Material eXchange Format) file by the Media Asset Management (MAM)

- Procedure:
  - The decision logic requires the MAM to fragment the TV programs
  - The MAM executes the fragmentation by updating the metadata
  - At the end, the MAM sends the complete information about the newly generated content fragment to the decision logic.

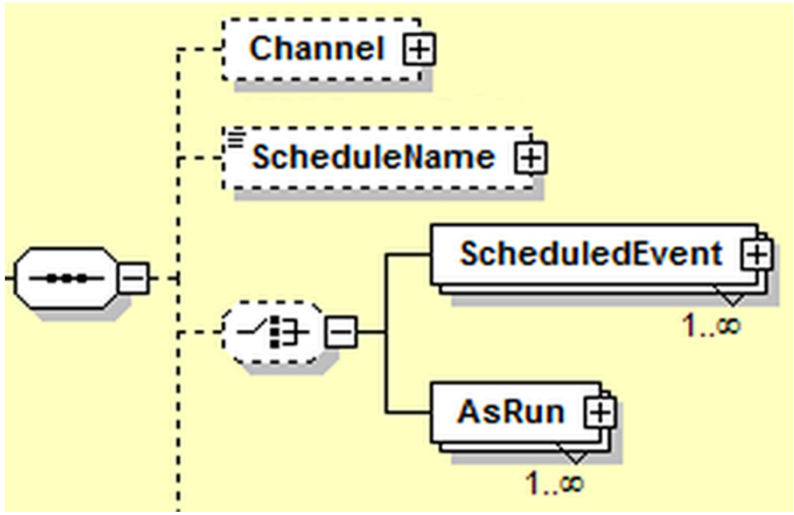
Delivery schedule

- In contrast to a traditional program schedule, which is merely a time plan for TV events in fixed channels, a delivery schedule contains information about:
  - the fragmentation of TV events,
  - the chosen transmission parameters for each time period,
  - the cross-mapping between the content fragments and the transmission source locations

- BXF (Broadcast eXchange Format) messages can be used to represent and exchange the delivery schedules
- Our main adaptations:
  - A separated delivery schedule
  - Definition of a virtual channel, which indicates transmission parameters, such as:

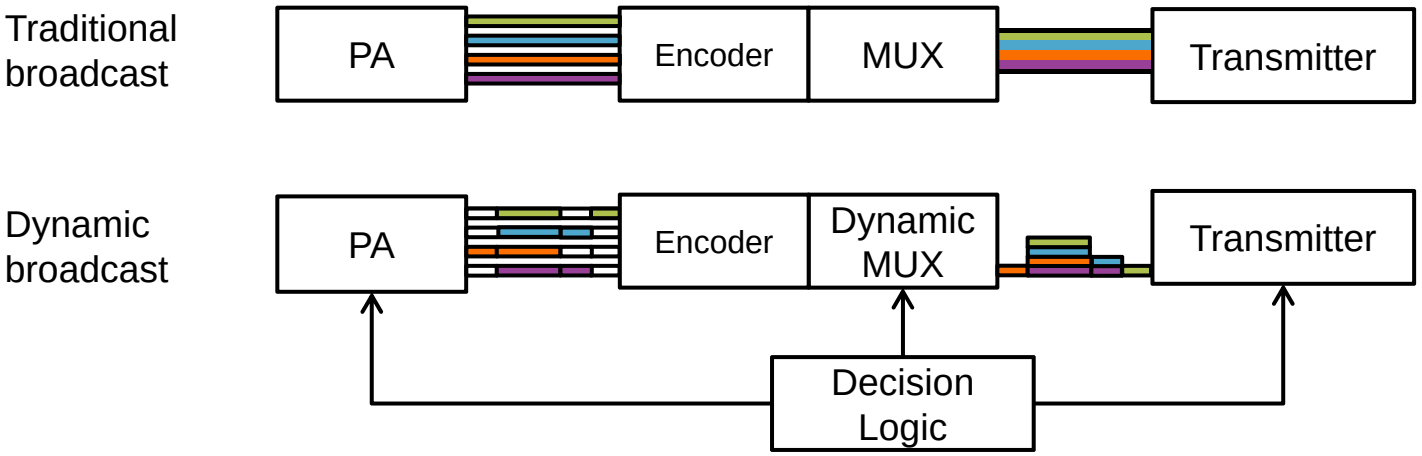
  “virtual channel 1, 594 MHz,16QAM,3/4, etc.”

  “virtual channel 2, 594 MHz,64QAM,2/3, etc.”
  - Metadata



The schedule type in BXF

Dynamic broadcast multiplexing

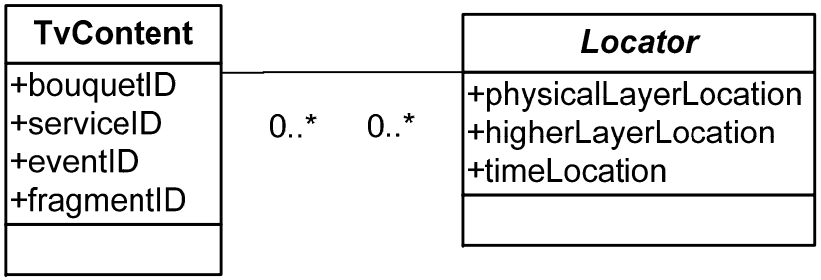


- A dynamic broadcast multiplexer is required to generate a transport stream whose data rate is controlled by the delivery schedule.
- According to the virtual channel ID, the dynamic MUX and transmitter adapts their configurations synchronously
- Content fragment IDs and signalling information shall also be inserted in the Transport Streams

Signalling structure

- The current signalling structure in DVB systems is channel-based. The TV channels are mapped to static network parameters. ➔ Unflexible

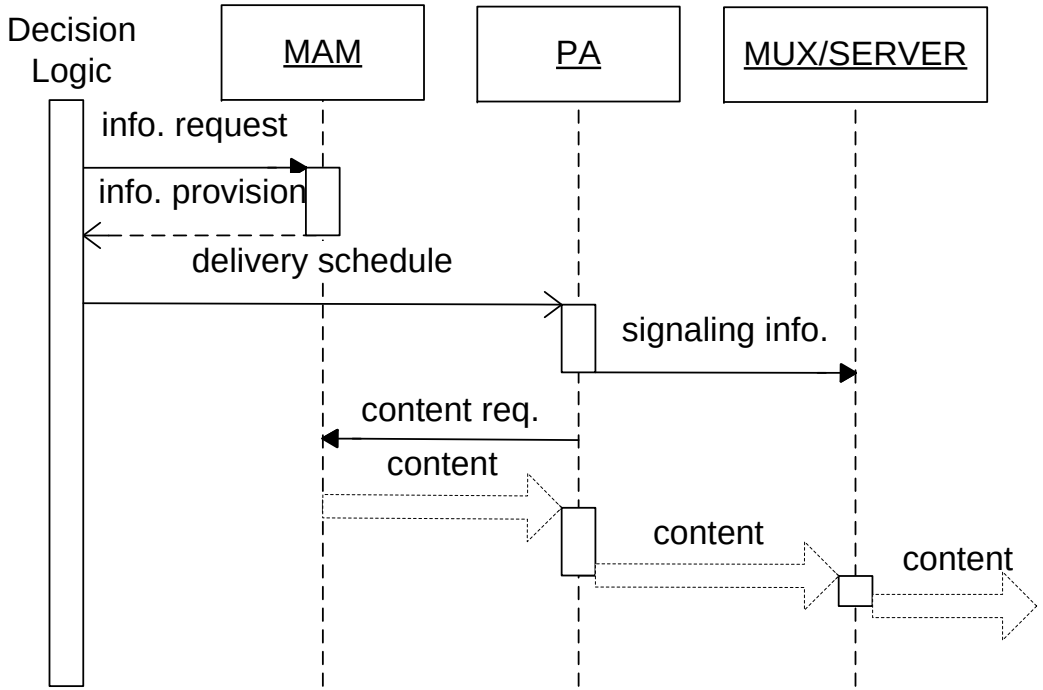
- Dynamic Broadcast requires separating the identifiers of the TV content and the locators clearly. This concept has been adopted in TV-Anytime.



- In addition to the program schedule, the delivery schedule must be encoded as signalling information for the user terminals to discover and receive the TV programs.

- The current event information table (EIT) can be used to carry this information
  - TV event fragments and the locator information as descriptors

Modified workflow in the playout system



MAM: Media Asset Management
MUX: Broadcast Multiplexer
PA: Playout Automation
Server: Broadband Playout Server

Conclusion

- Dynamic Broadcast introduces different flexibilities for the delivery of TV content and improves the efficiency of a broadcast system

- After an analysis of the use cases for the playout system, we found out the complex use cases are built up upon the basic content delivery use case

- To support the use cases, we modified the workflow in the playout system
  - A delivery schedule represented in a modified BXF message structure is used to control the components in the playout system.
  - A controllable multiplexing module is used to create an output stream using a data rate that the momentarily used broadcast parameters support.
  - In the signalling information for the user terminals the content identifier is separated from the locator for reception.

- The concepts of our proposal have been implemented in a demonstrator.

Thank you for your attention.

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