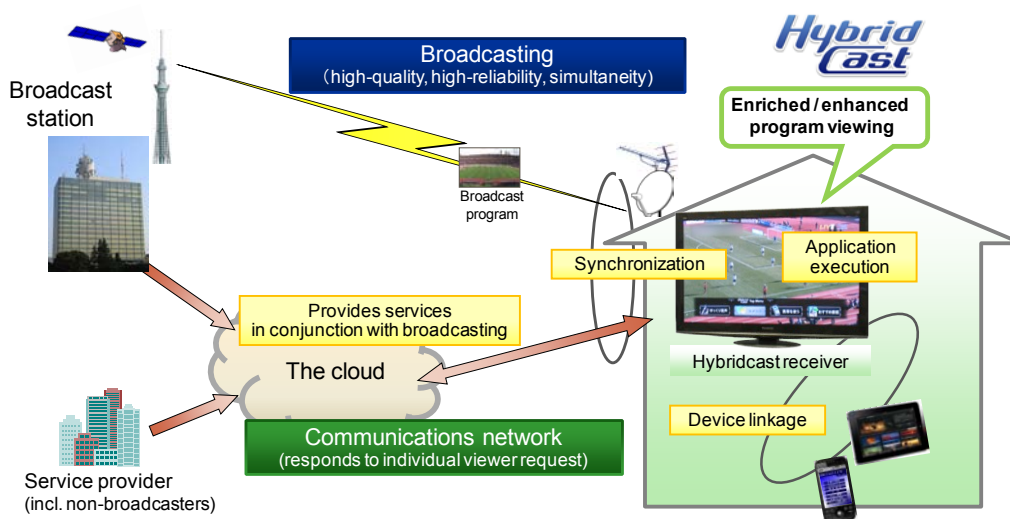


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NHK is developing an advanced hybrid broadcast and broadband system called Hybridcast(see [summary of technical paper of the 2011 NAB Broadcast Engineering Conference](#)). Hybridcast integrates broadband technologies with digital broadcasting, which offers viewers a richer and more enhanced experience in watching broadcasting programs. With Hybridcast, viewers can choose and run an application from Internet servers while watching a TV program, and enjoy various services with them. Figure below shows a brief structure of the Hybridcast system.



Following five use cases are typical ones for Hybridcast services (see appendix). These scenarios illustrate how a hybrid TV set and web applications running on it should behave while a viewer is using Hybridcast services. Also, for each scenario, we raise requirements that are essential to broadcasting and should be taken into account for the use of HTML5 related technologies to these hybrid services. We hope the W3C to bring these topics up for the coming discussions in Web and TV activities.

#### Use case 1: Web content associated with a broadcasting channel

##### <Scenario>

- A viewer starts watching a TV program, selecting the 'channel one' with a remote.
- A web content associated with the broadcasting channel is downloaded from the net and shares the TV screen with the TV program.
- The viewer follows some links from the web content to the other. The presentation (both video and audio) of the TV program is not interrupted while a viewer is surfing the web content.

- The viewer switches to the 'channel two' with the remote. Web content being shown is terminated immediately before the TV tunes to the new channel. Then the new content associated with the 'channel two' is downloaded and displayed.

<Requirement>

- No interruption of presentation of broadcast content.
  - As long as tuning is being kept, video and audio must be presented uninterruptedly even in a time of document transition.
- Presentation control of broadcast video by web content.
  - The document should be able to control a display area of broadcasting video, using a video element and CSS properties.
- Automatic document change in response to channel switching and broadcast signalling.
  - Auto-start when tuned in and auto-terminate when tuned out.
  - Document url is determined and notified by the broadcaster for each channel.
- Operate web content with a remote controller for TV.
  - The user input should be handled to follow context properly. For example, sometimes number keys are used for direct channel selection and sometimes they are used for inputting digits into a form of a document running on a browser.

Use case 2: User-loaded document responds to channel switching

<Scenario>

- While a viewer is watching a broadcast program, the viewer loads web content manually (by means of inputting a url or using a bookmark function).
- Web content is displayed on the same screen with the broadcasting video.
- Web content displays information related to a TV program being shown.
- The viewer flips channel.
- The document retrieves information automatically in accordance with a newly selected channel and displays it.

<Requirement>

- A mechanism to notify the document of channel switching.
- The document should be able to obtain metadata (such as a broadcaster ID and a program ID) contained in a receiving broadcast stream.

### Use case 3: Broadcast related event handling and data access

#### <Scenario>

- A viewer loads web content manually while watching a broadcast program.
- Web content is displayed on the same screen with the broadcast video.
- Scheduled broadcasting program is interrupted and a breaking news starts.
- At the same time, by the signal contained in a broadcast stream, the web content becomes temporarily invisible.
- By a viewer's action or a control signal from the broadcaster, web content becomes visible again.

#### <Requirement>

- A mechanism to immediately notify the document of data changes or event triggers in a broadcast stream (such as SI updates and stream events.)
- A mechanism to notify the document when the browser is forced to change the display area.

### Use case 4: Synchronized presentation of broadcasting content and web content

#### <Scenario>

- A viewer is watching a broadcasting program. Web content associated with the watching channel is being displayed.
- The viewer operates the web content and select "additional caption" (or additional video/audio).
- The web content starts to receive caption data (or video/audio stream) via the Internet and displays it synchronously with the broadcast program.
- The viewer instructs the web content to stop displaying captions.
- The caption stops displaying while presentation of the broadcasting program continues.

#### <Requirement>

- Clarification of how to handle clock information in a broadcast stream such as mapping of the PCR clock in the MPEG-2 transport stream to the mediatimeline of the corresponding video element.
- A time-offset should be able to be given to adjust synchronizing point of each media.
- Playback rate of synchronized presentation should be independent from stream transfer status. Presentation of broadcasting content should not stop and should keep its original playing speed even in the case that the internet stream stalls.
- A document should be able to detect that synchronization cannot be maintained due to an underflow in any of synchronized streams or any other reasons.

## Use case 5: Mobile device works with a TV program

### <Scenario>

- A viewer is watching a broadcasting program. Web content associated with the watching channel is being displayed on a TV screen.
- The viewer launches an application on his/her tablet device and operates it to let it connect to the web content on the TV.
- The viewer looks up the social network service with the tablet application, and operates it to let his/her friends' comments be displayed on the TV screen.
- The tablet application sends commands to the web content, then the web content on a TV retrieves his/her friends' comments and displays them with broadcasting program.

### <Requirement>

- A document on a TV set should be able to communicate with neighbor devices, which are connected via a LAN or similar network. To do this, the document may be required to be capable to discover and identify such devices as well.

Use cases and requirements described in this position paper are based on the development of Hybridcast at NHK. We believe discussions on these topics will contribute to the success of leveraging WWW technologies for future TV services.

## Appendix: Prototypes of Hybridcast services

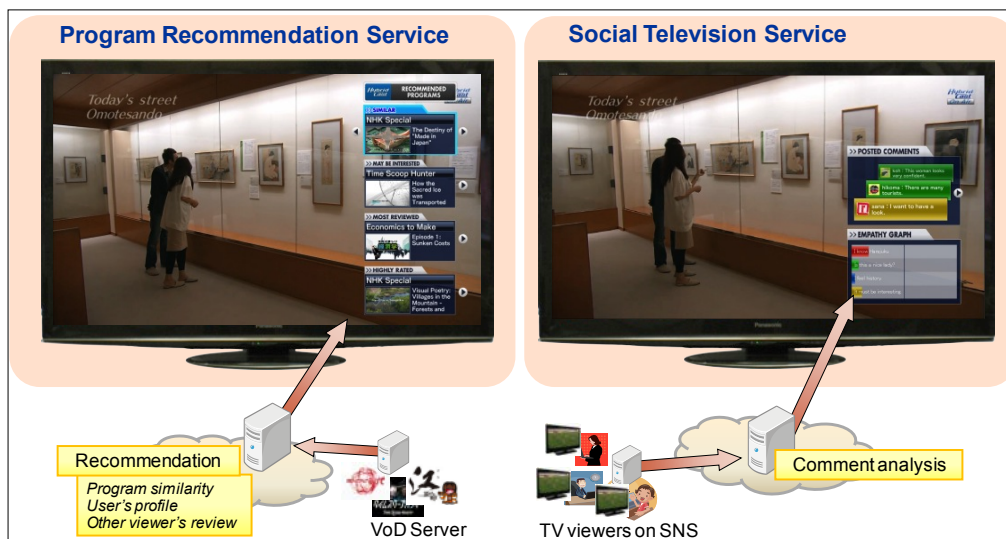


Fig. 1: Prototypes of services corresponding to use case 1 and 2.

(Left) Web content recommends VoD content related to current TV program.

(Right) Web content displays comments on the program from other viewers on SNS.



Fig. 2: Prototypes of services corresponding to use case 4. Additional content delivered via the Internet augments a broadcast program. (Left) Multilingual closed caption (Right) Multiview

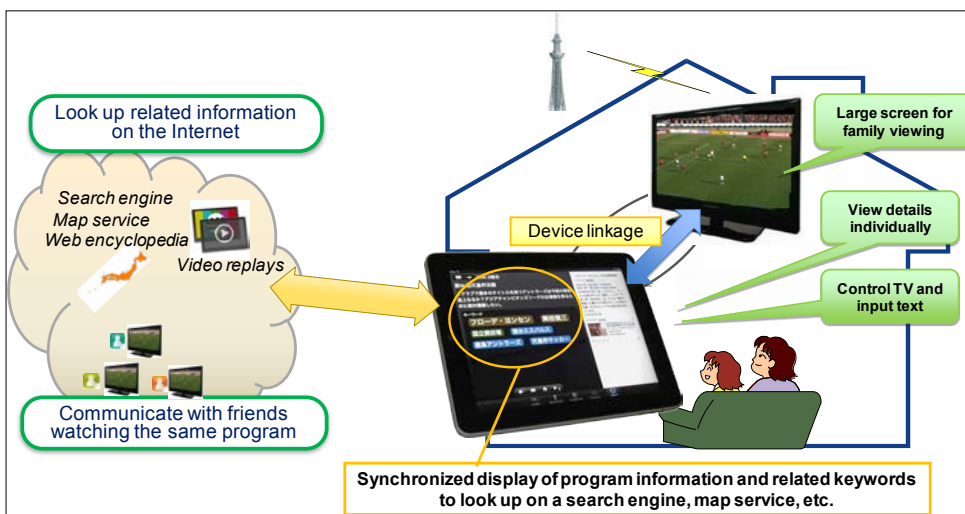


Fig. 3: Prototype of a service corresponding to use case 5. Applications on a tablet and TV set establish communication to work together.