# A Study on Multilingualization of Multimedia Data Broadcasting Services

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## 1. Introduction

Data broadcasting system is emerging as an important platform to provide multimedia data services for a wide range of multimedia content. At present, this service is offered in Japan only in the Japanese language. Foreign residents and visitors who do not speak or read Japanese cannot access these data services freely due to this linguistic barrier. Content that is only in Japanese limits the multimedia data that can be exported to other countries. Therefore, the multilingualization of data broadcasting services will permit the broadcasting of data content in one language while those who cannot understand that language can watch it freely in another language of their choice. The realization of multilingualization will also facilitate the promotion of multimedia data broadcasting services worldwide.

The multilingualization of data broadcasting services can be divided into two parts: (1) translation of the textual content and (2) translation of the presentation format in the TV receiver.

The former is not a mature technology and therefore is a topic of future work. This study is focused on the latter as the first step toward implementing the language-dependent styling, particularly the visual reordering of the display plane of different Monomedia on the screen.

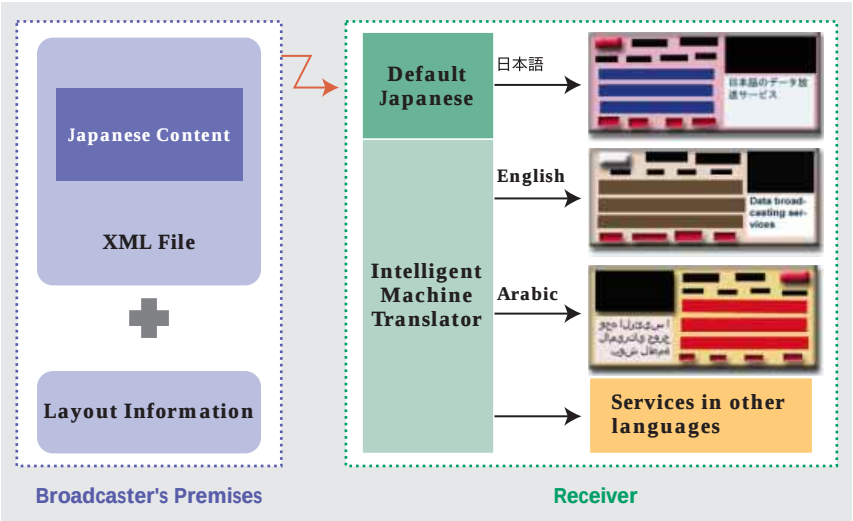



**Figure 1: The multilingual multimedia data broadcasting service model (ultimate goal). In this model, all translation will be done by the receiver.**

## 2. Multilingualization of Multimedia Data Broadcasting Services

The multilingualization of multimedia data broadcasting services is reliant on the development of a receiver. This multilingualization scheme can be characterized as follows:

- Automatic machine translation of textual contents.
- Implementation of a language-specific presentation and encoding scheme.

This system can be visualized by using the model shown in Fig. 1. This figure shows the ultimate goal of multilingual data broadcasting services. In this service model, an XML (eXtensible Markup Language) file will contain the content in one language (e.g., Japanese). This XML file and the layout data (information for each Monomedia on the screen) will be propagated together from the broadcaster. The receiver will render the content in the Japanese language by default. When a TV viewer changes the language option on the receiver it will automatically translate the textual content into the selected language and then apply the language-specific presentation scheme to render the contents on the screen.

The intelligent machine translator has been studied for years and is still an issue. On the other hand, technologies concerned with language-specific presentation and encoding schemes are widely available now. These technologies are being used to deliver multilingual content on HTML (Hyper Text Markup Language)-based Internet platforms.

A lot of the aspects of the multilingualization process depend on the character set encoding scheme and the language-specific presentation schemes, such as 'text direction', 'text justification', 'line breaks', 'word breaks', etc. In particular, text direction ("left to right" or "right to left") is important information to control the visual order needed by a renderer to correctly place components on the screen corresponding to each language.

The W3C (World Wide Web Consortium) standardized the CSS (Cascading Style Sheet) specification for the presentation schemes of international typographies. The Unicode Consortium /ISO introduced Universal Multi Octet Character Code Sets to provide universal character encoding schemes for all of the character sets of the world. These technologies can also be applied to multilingualize multimedia data broadcasting services.

## 3. Multimedia Data Broadcasting Services in Japan

The Association of Radio Industries and Businesses (ARIB) of Japan standardized the Broadcast Markup Language (BML) - an XML based multimedia coding scheme used for data broadcasting services in Japan. BML aims to become the general data services specification for the ISDB (Integrated Services Digital Broadcasting) system being developed in Japan. Since BML is derived from XHTML (eXtensible HTML), it is intrinsically possible to apply W3C and Unicode multilingual specifications. But currently in Japan, BML is operated only in Japanese and the STBs do not provide enough support for other languages. We applied the existing multilingual technologies to data broadcasting contents to evaluate their possibilities and effects in a future multilingualized service.

## 4. XML-Based Multilingualization Model for Multimedia Data Services

To study the effect of multilingualization of data contents without a smart machine translator, we propose the interim model shown in Fig. 2. In this model, the textual content is translated by human translators into several languages at the broadcasting station. Then, an XML file containing this translated content with the desired layout information is broadcasted. The language-specific presentation styling will be translated in the receiver.

The proposed multilingual multimedia data broadcasting service model can be implemented by using available technologies. We know that the 'text-direction' plays an important role in the multilingualization process by providing the information necessary to change the visual ordering of the layout plane on the screen. We assessed the model's performance for multilingual multimedia data broadcasting services.

## 5. Computer Simulation

Since no receivers with a BML browser supporting multilingual functionalities are available, we evaluated this model by computer simulation. We made a prototype "Anytime News Service", which was designed to simulate the multilingual news in Japanese, English, and Arabic. These languages are representatives of the three major writing styles, i.e., those of CJK (Chinese, Japanese and Korean), Latin, and Middle Eastern languages. The news service is one of the most important multimedia data services and its visual layout is suitable to demonstrate the impact of changing the ordering of different monomedia components on the screen.

Two approaches were taken in this simulation. One was a DHTML (Dynamic HTML)-based simulation and other was a simulation using Java, a platform-independent programming environment.

### A. Simulations in DHTML

Figure 3 shows the model used in this simulation. At the broadcaster, an XML file containing a translated multilingual news content is packed with the news layout and language-specific presentation information. At the receiver, news is displayed in Japanese, English, or Arabic.

We tested two types of layout algorithm (Table 1) to evaluate the suitability of each algorithm when writing direction changes dynamically. First, the <p> and  tag set were used with "Absolute" layout schemes, where each component element has been assigned a position with absolute coordination. Second, the <table> tag was used with a "Fixed" layout scheme, where the size of each component is specified and the position of a component is affected by other components.

The simulation showed that only the <table> tag demonstrated the ability to transform the visual ordering of all components of the display plane dynamically by changing the value of the 'dir' property as in the following example:

<table dir = "ltr"> or <table dir = "rtl">

For the  & <p> tags, we had to write extra code to relocate the co-

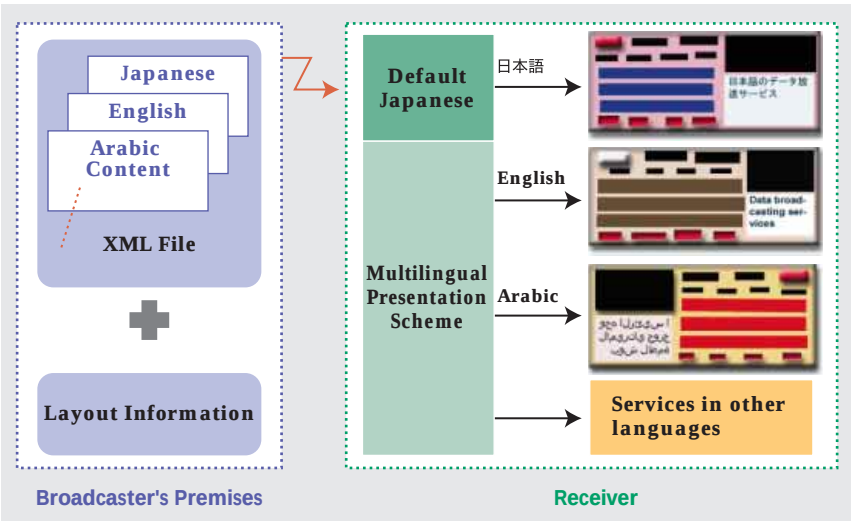



**Figure 2: Multilingual multimedia data broadcasting service model (interim model) where textual content is translated at the broadcasting station.**

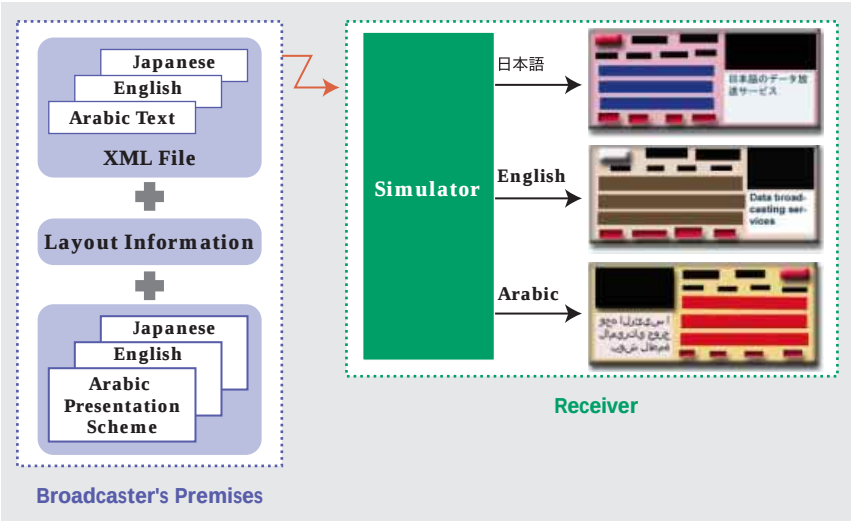
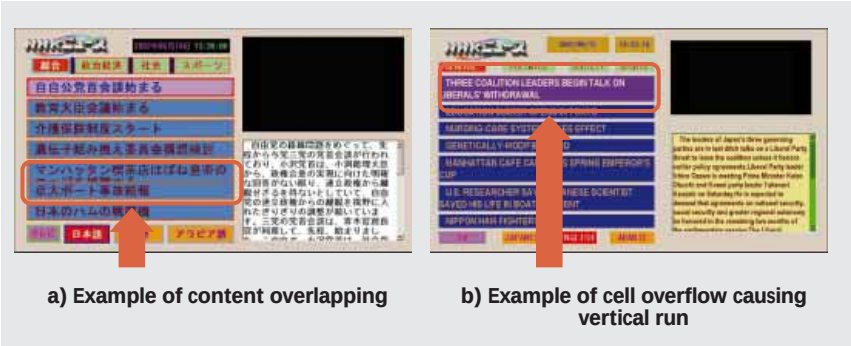



Figure 3: Multilingual multimedia data broadcasting service model used in computer simulation.

Table 1: Two Transformation Schemes Used in DHTML Environment

| Tagging Schemes | Positioning Schemes (CSS 'position' property) | Parameters for Presentation Control | Layout Control with "dir" Attribute |
|---|---|---|---|
| <p> &  | Absolute | "lang" & "dir" (CSS property) | Not possible |
| <table> | Fixed | | Possible |



a) Example of content overlapping

b) Example of cell overflow causing vertical run

Figure 4: Content overflow / overlap

ordinates of the origin of each component to achieve the desired reordering on the screen for each language.

The simulation also showed that the text's length will vary when it is translated from one language to another. In some cases, the length of text may be longer than the original. If the length of text is slightly longer than the width of the plane area, it can be adjusted by resizing the width of the plane area and the font size. However, if the text is too long to fit the size of its display plane, there will be line wrapping to accommodate the text in the following line. Since a "fixed" layout scheme is used for the table model in which the cells are inter-related, it will cause a cell overflow due to the reduction of the height of the other cells. In the case of  and <p> tags with "absolute" layout schemes, the textual content will overlap and hide behind the following text. Thus, TV viewers will not be able to see the overlapped content. However, cell overflow does not hide the content, as shown in Fig. 4. In the case of excessive cell overflow, the table will force the main screen to scroll vertically, which is not desirable for TV receivers. Therefore, an automatic "font size selection" or "text digesting" function will be needed to avoid the occurrence of this phenomenon.

These differences make it clear that the interrelating layout algorithm like <table> tag should be used for displaying multilingual content of data broadcasting services where dynamic component reordering will occur. Figure 5 shows the visual layout of multilingual news services simulated in DHTML.

### B. Simulations in Java

Regarding the next step in this research, more advanced functionalities such as automatic "text-digesting" and "font-size selection" will be needed to achieve a more mature multilingual environment. Java is more able than HTML to implement such complex functions. Therefore, we also tested Java-based simulations of the same multilingual news services. Here we used an object called "Locale". This object describes the cultural and language-specific properties and can be used to manage language-specific presentations.

We made a comparative study between DHTML and Java-based simulation results, as shown in Table 2.

## 6. Future Studies

- Usage of XML-based multilingual content was found to be a very effective way to deliver multilingual multimedia data services. However, further study is needed to develop multilingual functionalities to solve the remaining problems such as content overlap within the fixed screen area of a TV.
- Java has the ability to manage the layout of screen components in a multilingual environment with, for example, the "Locale" function and "LayoutManager" classes. However, further tests of the suitability and sufficiency of these functions when implemented on the TV screen are needed.
- Technologies like "automatic font selection", "text digesting", etc., will have to be developed as a part of long-term studies.

Table 2: DHTML & Java for Multilingual Multimedia Data Broadcasting Services

| | Visual Ordering (Auto Control) | Multilingual Functionalities | Coding Schemes | Performance |
|---|---|---|---|---|
| DHTML | Possible with Stylesheet ("dir" attribute) | Has no functionalities like "Font size adjustment" | Simple (Markup Tag) | Fast, requires less memory |
| JAVA | Possible with "Locale" object | Enriched with many multilingual functionalities | Powerful but complex | Relatively slow, large memory demand |

a) News service in Japanese　b) News service in English　c) News service in Arabic

Figure 5: "News Service" in three languages. Display components are reordered and resized corresponding to language information.

## 7. Conclusions

Transformation of "text-direction" into the language-specific auto-layout information is possible in DHTML. Java can be used in the future for the same purpose. This finding suggests the possibility of developing new functionalities (like <table> tag in DHTML) to implement auto-layout schemes in the receiver. Java is emerging as a source of powerful multilingual functionalities for solving internationalization issues like "Autolayouting", "language-specific styling" etc. However, compared with DHTML, it is slower and consumes more memory. This suggests that further improvements can be made to BML to enhance its applicability for multilingualization of data broadcasting services.

## 8. Acknowledgements

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