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Metadata Framework for Manga: A Multi-paradigm Metadata Description Framework for Digital Comics

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Abstract

Manga—a Japanese word meaning comics, cartoons and graphic novels—is very popular in Japan and has been gaining broader recognition in the world. Digital publishing via the Internet and mobile phone networks is gaining wider acceptance, which means both providers and readers of manga need good network-based environments to provide, access and read manga. From this viewpoint, this paper discusses a metadata framework of manga to find, access, use and reuse manga in the networked digital environment.

The metadata framework for manga proposed in this paper is defined from three aspects—bibliographic description, structural description, and intellectual entities contained in the manga. We use the Functional Requirements for Bibliographic Records (FRBR) and TV-Anytime as the base schemes for bibliographic description and structural description, respectively. We examine authority and dictionary description schemes for the third aspect. This paper integrates these three base schemes as the metadata schema model for manga. The model proposed in this paper is primarily designed for digital manga because printed manga can be defined as a subset of digital manga.

Keywords: manga, comic, digital publishing, bibliographic metadata, Functional Requirements for Bibliographic Records (FRBR), structural metadata, TV-Anytime, multi-paradigm metadata.

1. Introduction

Manga—a Japanese term which means comics, cartoons and graphic novels—is a very popular media not only for children but also for adults in Japan. Manga has a fairly long history in Japan and has developed a very large market since the 1950's. Manga has been gaining broader acceptance and large markets in other countries too. Advanced digital technologies and the pervasive information networks have brought a big change to manga not only in the creation and authoring processes but also in the publishing. Digital authoring and editing tools are commonly used to create manga, and the commercial publication of online digital manga is growing.

Currently, most digital manga that are commercially published in Japan are reproduced from those already published in a print format. On the other hand, increasingly, manga is born in a digital format. We can create digital manga in different ways – born digital, turned digital and their combination. For example, a simple way to create a digital a manga is to digitize a manga originally published in a print format. In this case, the fundamental difference between the original and digitized manga is only in their physical media. A technique frequently used to commercially publish digital manga for mobile phones is to scan print manga into a digital image and edit the digital image for browsing on the small screens of mobile phones.

Digital manga is different from conventional manga in a print format in various ways, e.g., the design of pages, the use of visual, sound and motion effects, and the user environments. Functional requirements for metadata in digital and network-based environments are different from those for the traditional print-centric environments because we can use sophisticated functions for searching, accessing and browsing digital manga and also because we need to combine these functions seamlessly with other functions in users' reading environments. This

difference implies that we need to design a new metadata model based on the functional requirements to use digital manga.

In order to design the new metadata model, this paper proposes to integrate metadata schemes of different paradigms into a single framework. Bibliographic description, structural description and vocabularies to describe intellectual entities, which are common and basic aspects for metadata description, are used as the base schemes in this study. In other words, integrating these metadata schemes into a single framework is to clarify the general architecture of manga. The integrated metadata framework is useful to realize the sophisticated publishing and reading environments for manga where digital contents are directly and/or indirectly linked to other contents to allow users to access resources seamlessly across resource types.

For bibliographic descriptions, we use IFLA's Functional Requirements for Bibliographic Records (FRBR) (FRBR, 1998) as the base model for the entities that constitute manga. In the traditional publishing system, a single manga is published in a few different media. A typical case is that the manga is first published in a magazine, and then it is re-published as (a part of) a comic book. It could be reproduced in a digital format. Thus, a single manga work could have a number of different manifestations, which fits the FRBR model.

With respect to structural description, manga is represented as a series of frames on a page which is printed on a paper or displayed on a browser. The frames are ordered according to the story line of the manga following the grammatical rules of manga. This means that a story line is a logical time line for reading the manga. Because these graphical and story-oriented characteristics are similar to the characteristics of video programs, we propose to use a video metadata framework as a structural description framework for manga. In this study, we use TV-Anytime, which is based on MPEG7, as our base framework.

The third aspect is the intellectual content. There are a number of entities that characterize the intellectual content of manga, e.g., leading characters, genres, audience, creators, etc. The bibliographic description and structural description are primarily for description about some particular manga. On the other hand, the intellectual contents are not necessarily unique to a particular manga but useful to characterize it. The entities that represent the intellectual contents should be described using a well-defined description scheme. Dictionaries, thesauri and authority files are good examples of descriptions of intellectual entities. Controlled vocabularies to express genres are good examples as well. We consider that description schemes for intellectual entities should be able to be integrated with the bibliographic and structural metadata. In this study, we examined the description framework of Wikipedia as a base model of a description scheme for intellectual entities.

This paper first discusses the basic concepts of manga and its metadata and functional requirements for the metadata. After brief descriptions of the base metadata schemes this paper proposes the metadata framework integrated from the base schemes. The authors have experimentally developed a set of metadata elements based on the model but they are not included in this paper mainly because of the limitation of the space and lack of experiments on a practical example. The rest of the paper is organized as follows; Section 2 describes the basic concepts of manga and Section 3 describes the base metadata models, Section 4 shows the proposed metadata framework, and Section 5 presents discussions on the proposed framework and concluding remarks.

2. Manga and Its metadata

2.1. Basic Concepts of Manga

(1) Basic Constructs of Manga

Manga is composed of a series of ordered frames on one or more pages. Each frame has a picture, texts in textboxes, onomatopœia and effect symbols. Ordering of the frames is an important part of design for manga creators. Figure 1 shows basic constructs of manga.

Onomatopoeia and effect symbols are used to express motions, sounds, atmosphere and emotions. Layout of the frames is an important factor of their design. Graphic instances and annotations can be put in the space between frames or overlaid on more than one frame, i.e. non frame objects.

In digital manga, one or more frames can be aligned on a single display page. Visual and sound effects can be used in addition to the conventional graphical constructs, e.g. motion of a character on a picture and sound to express an atmosphere. On the other hand, in general, because the size and resolution of a browser are more restrictive than those of a printed book, display effects such as panning and zooming are used to overcome the restriction. For example, in the case of manga delivered to mobile phones, a display page is often composed of a single frame and panning and zooming are frequently used. As well, page flipping software is sometimes used for page-oriented, book-like browsing of digital manga.
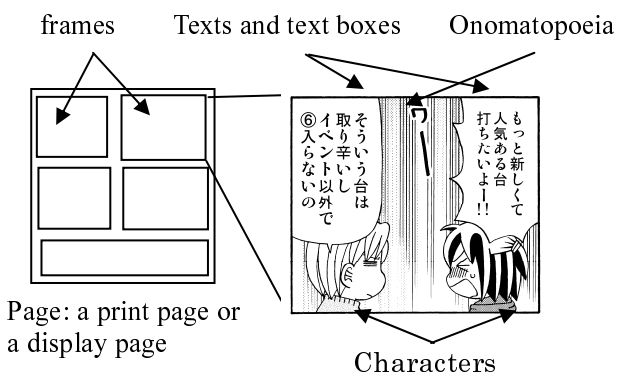
FIG. 1. Basic Constructs of Visual Instances
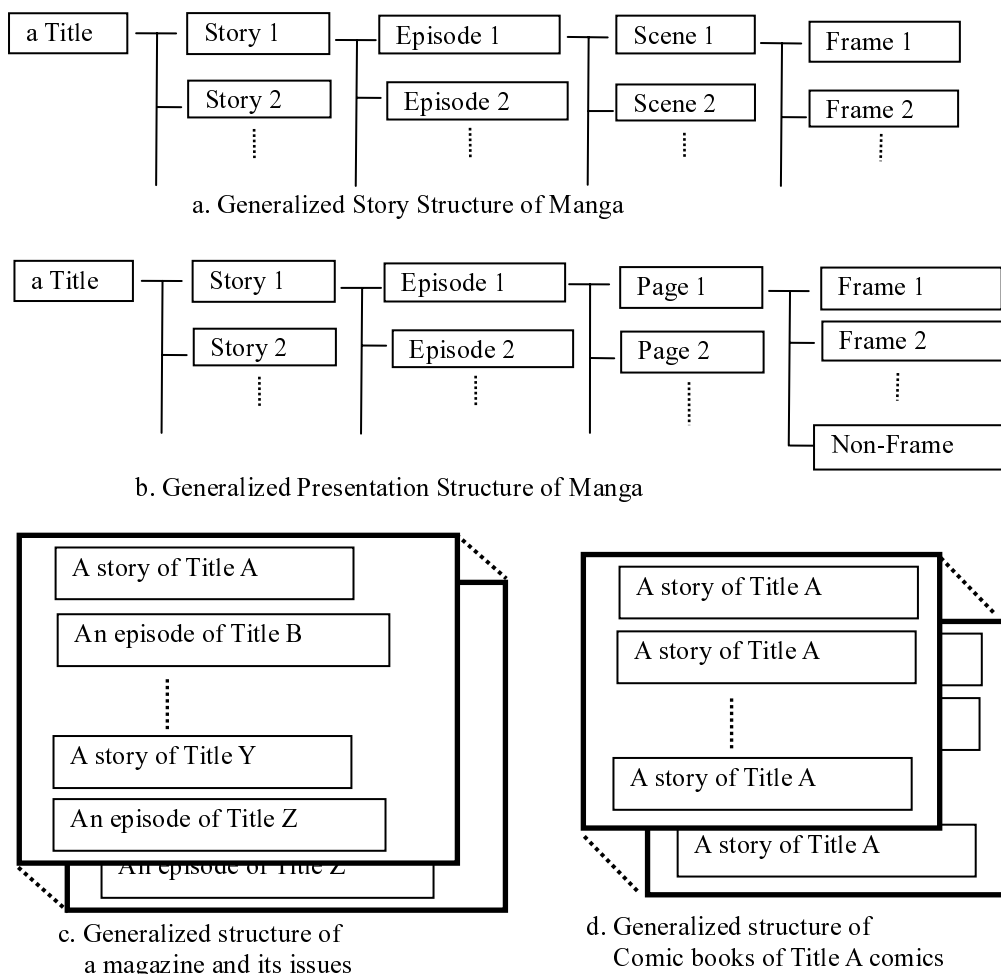(by courtesy of Kaori Kawasaki and Take Shobo Co. Ltd)

a. Generalized Story Structure of Manga

b. Generalized Presentation Structure of Manga

c. Generalized structure of a magazine and its issues

d. Generalized structure of Comic books of Title A comics

FIG. 2. Generalized structure of manga for commercial publication

(2) Manga Publication Styles

Popular publishing media are magazines and comic books. Manga magazines usually include several manga stories produced by different manga creators in a single issue. A comic book has a story or a set of stories of a single author. Successful manga stories are often combined for publication as a comic book or a series of comic books.

Manga in a single publication of a magazine could be an episode in a longer story, a single story that is part of a series, or one single story for the issue of a magazine. A manga series is often represented by a single title. In this paper, we use the term Title to represent an instance that is a series or aggregation of stories. Figure 2 shows the generalized structures of manga.

(3) Comparing Digital and Print Manga

As mentioned previously, manga is basically a story expressed as a series of pictures with words and symbols drawn in a frame. Manga is published in a magazine, in a monograph comic book, and/or in a digital form. Manga creators can freely design the size, shape and layout of the frames as long as they satisfy the conditions for production and publication.

Digital manga and print manga are significantly different in their physical features—use of sounds and motions, e.g. zooming and panning in a page and/or a frame, motions in a picture. A very simple way to create a digital manga is to scan in a print manga page-by-page and organize the scanned pages as a virtually bundled instance. In this case, there is no difference in the presentation structure between the original and digital copies of the manga. Thus, the structural difference between digital and print manga is not always obvious.

'Page' is an important construct not only in print manga but also digital manga. In print manga, a 'page', which is a very basic unit to design and draw a manga, is an area of a fixed size. In digital manga, a page would not be such an explicit entity as in print manga but is an essential unit to control display of the picture frame(s) because it determines a graphic unit in which one or more frames are located. Thus, we can describe the presentation structures of digital and print manga on the same generalized structure model shown in Figure 2 even if their look-and-feel is significantly different.

(4) Entities of and in Manga

For metadata schema design, it is essential to identify entities that are subject of a metadata description. Figure 2 shows the general manga structures and their components. As a single manga is often published in more than one medium, we can say that a *Work* of manga has one or more *Expressions* and *Manifestations* using terms of FRBR.

Attributes (instances) such as creators, scenario writers, publishers, magazines, and leading characters are key information in a finding aid of manga. Genres of manga and leading characters are also crucial but there are no well-established vocabularies for the genres. From the viewpoint of semantic interoperability of metadata, these instances should be uniquely identifiable and a description should be associated with each instance.

2.2. Functional Requirements for Manga Metadata

The goal of this paper is to clarify a model of metadata for manga in the digital networked environment. Users search, access and obtain manga via networks regardless of print or digital. In the digital environment, users expect to be able to discover manga in various granularities – ranging from a series of comic books with a single title to a particular episode or a scene in a story. It is convenient for a user to be able to access information resources related to the manga that he/she is reading, e.g. manga dictionaries and encyclopedia and reviews and annotations of the manga. Those information resources should be easily accessible from a browser on which the user is reading the manga, i.e., linked by content.

Manga metadata should be able to describe manga in various granularity levels based on the structural views of manga shown in Figure 2. Bibliographic and structural descriptions should be given in accordance with the required granularity levels given application by application.

Intellectual entities are also crucial metadata components, e.g., manga as an intellectual work, genres, characters, agents, and so on. For example, "Doraemon"—a popular manga for children –is a *Work* in terms of FRBR, and, at the same time, it is a leading character of the story. There are many stories in the series of "Doraemon". All of these instances should be able to be described and identified using Manga metadata.

The basic requirements for manga metadata in our approach are as follows,

(1) Manga should be able to be described in various granularity levels shown in the presentation and story structures in Figure 2, i.e., from title to scene and frame.

(2) Difference between manga as an intellectual entity and its instantiation as a published material should be clearly given.

(3) Intellectual entities associated with manga, e.g., leading characters, agents, concepts, and so on, should be appropriately identified and described in order to use the intellectual entities as an ontological basis for the manga metadata.

We discuss these requirements in the three aspects—Bibliographic, Structural and Ontology description.

(1) Bibliographic description: Bibliographic description is primarily for organizing and accessing resources. Some components of manga shown in Figure 2 naturally fit in a bibliographic description, e.g., title, story, episode, magazine, and comic book. The granularity level of bibliographic description should be determined application by application. The concept of group 1 entities of FRBR is useful to distinguish between manga as an intellectual entity and manga as a published entity.

(2) Structural description: Structural description is required to control the access and display of contents of manga. Because manga is a story-based resource, structural description needs to have a description scheme based on a time-line like the metadata for video programs

(3) Ontology description: Definition of the words and concepts used in a metadata description is crucial for metadata. Controlled vocabularies for classification and authority files for authors, titles and leading characters are required. However, there are no such well-developed resources for manga.

2.3. Related Work—Metadata for Manga

There are a few bibliographic catalogues specializing in manga. Kyoto International Manga Museum (KMM) has a bibliographic database of their collections using four schemes – magazines, comic books, titles, and creators (KMM, 2009). Ohio State University library (OSU) has a large collection of cartoons and has their own cataloging guidelines (OSU Library, 2003). A difficult issue is definition of the genre vocabulary for such catalogues. KMM avoids this issue and OSU use a list of genre terms and LCSH. In this study, we assume that vocabularies for expressing genre and classification of manga will be imported from third party dictionaries or thesauri. Those vocabulary resources need to provide functions to uniquely identify every term included in the vocabulary and to access the description of the term.

Authority description standards such as FRSAR for subject description (FRSAR, 2005) and FRAD for authority records (FRNAR, 2005) are relevant for describing intellectual entities. The authors tested metadata elements to describe intellectual content specific to story-based works, e.g., manga, animation and novels (Morozumi, A. et al, 2008). We extracted and compared descriptive elements from descriptions of manga and novels in the Japanese Wikipedia. In this study, we selected 100 manga instances and 100 novels in the Wikipedia. We extracted and compared elements (i.e., section titles) from templates for the *table-of-contents* and the actual *tables-of-contents* for manga and novels. We found that there is a significant difference between the templates and actual *tables-of-contents*. The elements in actual *tables-of-contents* of both manga and novels are similar but manga descriptions include more elements about characters and fewer elements about stories. From this study, we recommended the following elements for description of intellectual content—*bibliographic information*, *overall description*, *story*

description, *characters*, *evaluation/ratings*, *reviews*, *derived works*, *references*, and *notes*.

OCLC's Fiction Finder provides a FRBR-based function to find resources (OCLC, 2009). It provides services to follow relationship links among Group 1 entities and to find resources using their intellectual content, i.e. Group 3 entities such as genres and characters in a story. Fiction Finder is primarily designed for bibliographic records and does not extend to structural metadata.

Jung et al (Jung DK. et al, 2008) reported a software tool that uses MPEG-7 as a base framework to describe the structure of comics. MPEG-7 is a base standard for TV-Anytime. Jung et al's study shows advantages from the use of video metadata frameworks for digital comic books. Comic Book Markup Language (CBML) is an XML vocabulary to markup comic books and graphic novels and is based on the Text Encoding Initiative (TEI) guideline (CBML, 2006). CBML is primarily designed as a markup scheme for digitized comic books. These studies show the importance of the structural description framework for comic books and manga.

In the current networked information environment, users search and access information resources on the Web. In some cases, they pick up a portion of a resource and re-use it. It is crucial to provide users with an integrated environment to find, access, use and reuse information resources. In this process, users need not only conventional bibliographic data but also to know the structure and intellectual content of the resources at various levels of granularity. The primary goal of this study is to build an integrated metadata model for manga. In other words, the integrated model should reflect the architecture of manga.

3. Base Metadata Schemes

This section gives brief descriptions of the base metadata frameworks used to define the manga metadata framework proposed in this paper.

3.1. Bibliographic Metadata - Functional Requirements for Bibliographic Records

Functional Requirements for Bibliographic Description (FRBR) is a very well-known framework for bibliographic description. It defines three groups of entities for bibliographic description. Group 1 entities are objective resources for metadata description defined in four classes—*Work*, *Expression*, *Manifestation* and *Item*. In the rest of this paper, we do not use *Item* because description about a specific item is not discussed here and also because it is beyond the scope of this paper to discuss the applicability of the Group 1 entities to digital resources in detail. In this paper, a *Work* means a manga as an intellectual entity, an *Expression* means a manga as an instance designed dependently or independently of its publication media, and a *Manifestation* means a manga as an instance edited in accordance with its publication media. Group 2 entities are agents who have contributed to an instance of manga in some way and Group 3 entities define things or objects which are described in or are the subject of the manga.

3.2. Video Metadata - TV-Anytime

Video metadata schemas such as MPEG-7 and TV-Anytime (TV-Anytime Forum, 1999) which have visual-based and story-line based structures can be a natural base for manga metadata because of their structural similarity. Video metadata schemas have description schemes for both physical and logical structures. We ignore the schemes for physical structure in this paper and use the logical structure scheme as a base for the structural description of manga. TV-Anytime is defined for server-based broadcasting. The TV-Anytime scheme includes (1) Content description that is general description of video content, (2) Instance description which is description of a specific instance of a video content, and (3) Segment description which is description of a segment of a video instance.

A video content has a hierarchical structure as shown in Figure 3. It is straightforward to match the TV-Anytime components to the components of manga in Figure 2.a.

Program group = Title,   Program = Story/Episode
Segment Group = Scene,   Segment =Frame

3.3. Metadata for Intellectual Entities

Leading characters and some other key objects are essential elements for characterization of manga. Genres and creator names are also important for users discovering the types and styles of manga. Title and story names of manga are often used to refer to a *Work* of manga as an intellectual entity. These instances that are expressed in or related to some manga are called intellectual entities of the manga in this paper. For systematic use of terms that represent intellectual entities, the terms have to be organized as a dictionary, a thesaurus or an authority file in accordance with their usage goals. In our study, we examined the description template for manga items used in the Japanese Wikipedia and also other related schemes. We conclude that every term should be given an identifier usable in the networked environment from the requirements analysis. However, there is no appropriate identification scheme at present.

4. Metadata Framework for Manga

As described previously, we integrate three base frameworks - the descriptive metadata based by FRBR, the description scheme of logical structure of TV-Anytime, and dictionary templates to define terms representing intellectual entities. It is straightforward to integrate these schemes. Figure 4 shows the basic relationships among instances defined in these three schemes.

Components shown in Figure 2 are instances of Group 1 entities, e.g., a description of a *Work* of manga, and a description of a *Manifestation* of a manga as a comic book. Granularity level of a description differs application by application. As described above, the roles of Group 1, 2 and 3 entities are defined in FRBR. On the other hand, every instance of Group 1, 2 and 3 entities represents an intellectual entity.

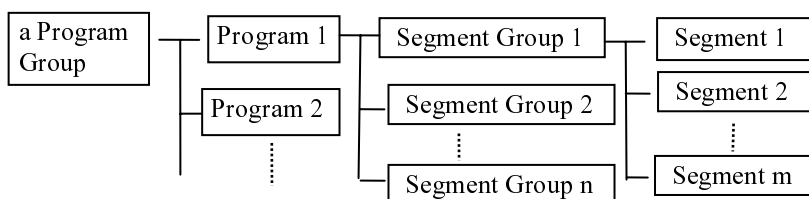Figure 5 shows a generalized matching between manga and a video structure in TV-Anytime.

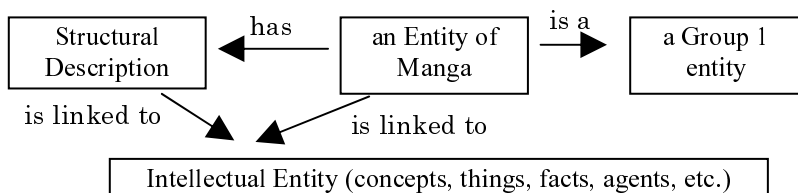FIG. 3. General Structure of a Video (TV-Anytime)

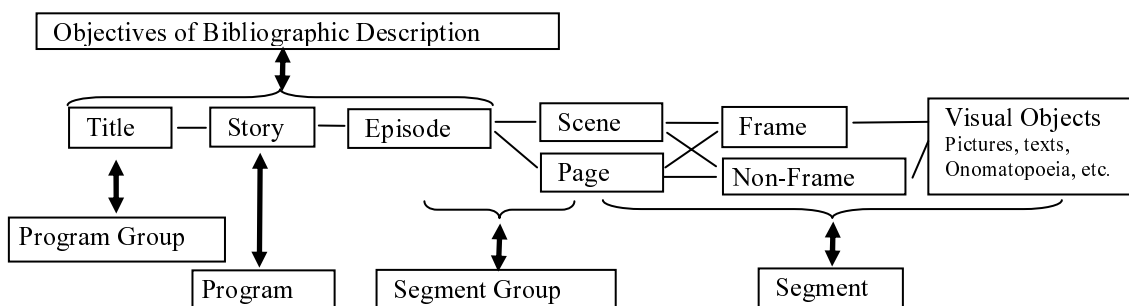FIG. 4. Basic Relationship among the three base schemes

FIG. 5. Generalized Structural Matching between Manga and Video

Story and presentation structure components are included in the figure. In digital manga, visual, audio and motion effects are also included in this class of instances.

Figure 6 summarizes the integrated metadata framework based on the three paradigms. The structure of manga at the center is linked to the structural description scheme based on TV-Anytime (left) and to bibliographic description scheme based on FRBR (right). In this figure, the top three components in the manga structure are mapped to Group 1 entities for bibliographic description.

As described in section 2, a manga instance has a story and presentation structures. Generally speaking, the presentation structure of manga represents a structure of manga instantiated in a specific media but the story structure does not necessarily represent a specific instantiation of manga. In theory, it is possible to create a bibliographic description of the scenes and frames, but those descriptions are too complex in practice. In this study, we assume that bibliographic description is best used for episodes or higher-level instances.

Intellectual entities in the top are linked from the bibliographic and structural descriptions. The intellectual entities include any entities of Group 1, 2 and 3, e.g., titles of manga, leading characters, creators, genres and so forth. As explained in section 3.1, Group 1, 2 and 3 entities of FRBR represent entities of different roles, but these entities can be used to represent a subject of a resource. Therefore, the intellectual entities are linked by "has subject" relation from the Group 1 entities.

Each intellectual entity should be associated with it's description, i.e., description about itself
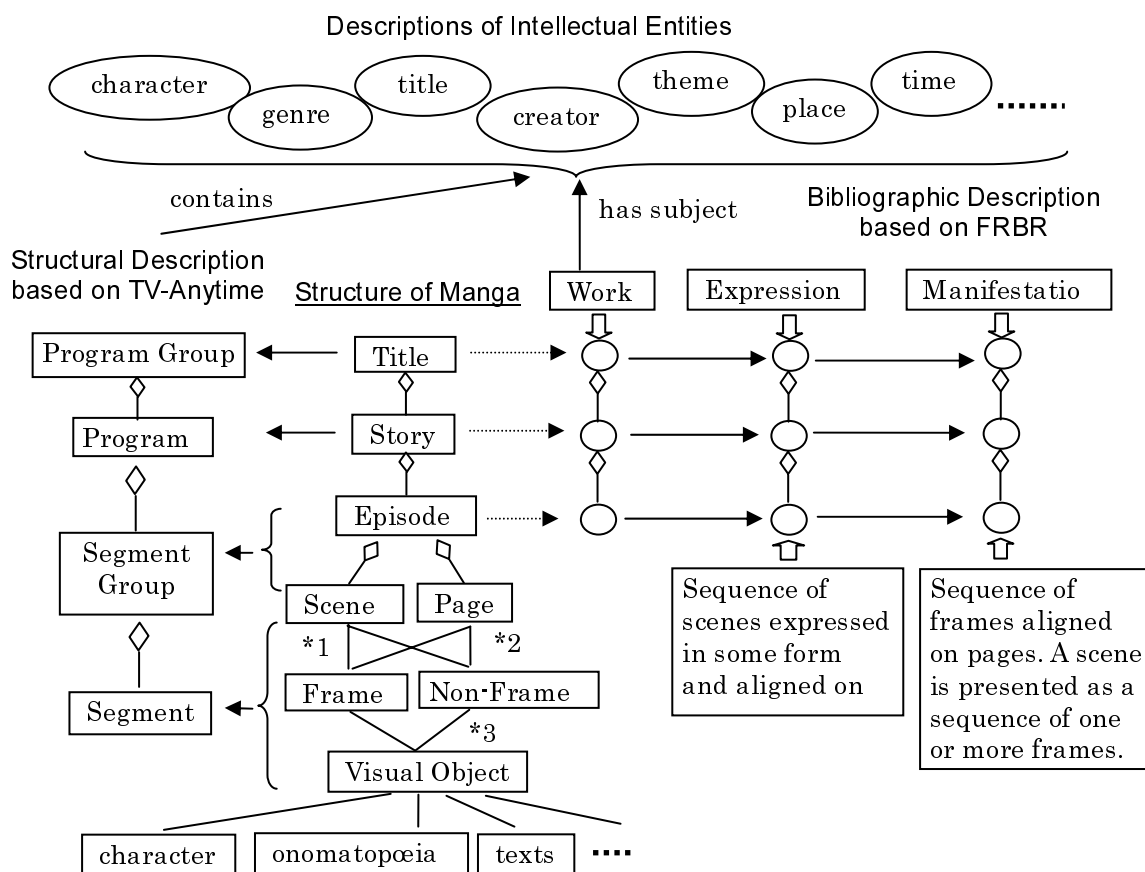
*1. A scene is presented as a sequence of one or more frames (including unframed objects)
*2. A page is composed of one or more frames and could have unframed objects.
*3. A frame and non-frame has visual objects such as characters, onomatopoeia, texts, text boxes,

FIG. 6. Overall Structure of Metadata Framework for Manga

and relationships to other entities. Thus, description scheme for the intellectual entities is required in the framework. The descriptions of these entities are not necessary but better to be given in dictionaries or thesauri, which define the URIs of the entities as well. In this study, we examined Japanese Wikipedia as the base scheme because it contains more than 2400 manga titles and has a description template for manga.

5. Discussion and Concluding Remarks

The authors had an opportunity to watch a classroom activity where four student teams worked on manga in the networked environment. One team among the four created a directory of popular manga and other three teams created digital manga using Flash and Scratch (LKM, 2009). The directory team developed an interesting genre vocabulary which is composed of words expressing impressions. The three digital manga teams first defined their own design concepts and created their manga. The essential feature common to all of the teams was the page design, i.e. layout and control of the frames on a page. Thus, "page" seems an essential unit even in the design of digital manga.

There are software tools to digitally edit manga. However, those tools do not have functions to create structural metadata incorporated within the manga. It is obviously easier to create metadata in the creation process of manga than to create it in a separate process. We are currently working on the development of software tools based on the proposed metadata model.

The study presented in this paper is based on our previous work (Nomura, S., 2009) and an experimentally defined element set for structural metadata (Yokota, A., 2008). We are thinking that the definition of descriptive and structural metadata elements will be straightforward given the base models. Development of the full metadata scheme is left as our future work.

Intellectual entities have to be incorporated in the metadata records, e.g. classification terms, genre terms, character names, and so on. These entities have to be encoded in accordance with a specified encoding scheme. Identification of suitable schemes of intellectual entity vocabularies is a crucial issue for the usability and interoperability of the metadata on the Internet. In our study, we used Wikipedia descriptions as a bank of intellectual entities because they are rich. An important issue is a function to automatically convert the descriptions of the items in Wikipedia into machine understandable format and to give a stable unique identifier to each item. DBpedia seems a useful tool for the conversion task (DBpedia, 2009). The authors hope that dictionaries and thesauri to share the intellectual entities will be developed. We also hope that standardized and stable identifiers for the intellectual entities. These resources and identifiers are a key to fully use the metadata for manga and to link various types of entities in and of manga.

This paper is intended to describe the basic concepts of the integrated metadata model for manga. The model is primarily designed for access and use of manga in a networked digital environment. This paper was aimed to clarify the basic requirements of metadata for manga in the digital networked environment and to build a metadata framework based on the requirements. The proposed metadata framework was integrated from different paradigms—bibliographic description, digital video description, and ontology description. Some lessons we learned in this study are, the concept of Group 1 entities of FRBR can be coupled with the model of TV-Anytime and is useful to identify and locate digital resources, identification schemes of entities are crucial but not well defined yet, and so forth. We are currently working on the development of software tools for this metadata framework. As our next step, we are planning to brush up the model and elaborate the metadata elements.

Publishing manga in a digital environment is a new publishing business. Libraries have a long tradition of bibliographic records for printed materials but these digital materials are still new to the libraries. We think that the integrated metadata framework is crucial for publishers and libraries to well organize their business in the networked information environment, and that it provides users with flexible and seamless access to manga and resources linked from manga.

DC PAPERS

Proc. Int'l Conf. on Dublin Core and Metadata Applications 2009

Acknowledgements

References

CBML. (2006). CBML: Comic Book Markup Language. School of Library and Information Science, Indiana University. http://www.cbml.org/contact.html (accessed August 2009)

DBpedia. (2009). DBpedia, http://dbpedia.org/ (accessed August 2009)

FRBR. (1998). Functional Requirements for Bibliographic Records Final Report, International Federation of Library Associations and Institutions, 1998. http://www.ifla.org/VII/s13/frbr/frbr.pdf (accessed August 2009)

FRNAR. (2005). Working Group on Functional Requirements and Numbering of Authority Records (FRANAR)-IV. Division of Bibliographic Control, International Federation of Library Associations and Institutions. http://archive.ifla.org/VII/d4/wg-franar.htm (accessed August 2009)

FRSAR. (2005). Working Group Functional Requirements for Subject Authority Records (FRSAR). 2005. International Federation of Library Associations and Institutions. http://archive.ifla.org/VII/s29/wgfrsar.htm (accessed August 2009)

Jung, DaeKyu, Hui Yong Kim, Han-Kyu Lee. (2008). A Study of Electronic Comic Services for Personalized and Enriched consumption with MPEG-7 Metadata, pp.1589-1591

KMM. (2009). Kyoto International Manga Museum, http://www.kyotomm.jp/ (accessed August 2009)

LKM (2009). Lifelong Kindergarten Group at MIT Media Laboratory, Scratch Home Imagine, Program, Share, http://scratch.mit.edu/ (accessed August 2009)

Morozumi, Ayako, Mitsuharu Nagamori, and Shigeo Sugimoto. (2008). A Metadata Element Set for Describing intellectual Content of Story- A Proposal Based on Description of Comics and Novels in Wikipedia, Digital Libraries, No.35, pp.3-16 (in Japanese), electronic version available at http://www.dl.slis.tsukuba.ac.jp/DLjournal/No_35/1-morozumi/1-morozumi.pdf (accessed August 2009)

Nomura, Satomi, Ayako Morozumi, Mitsuharu Nagamori, and Shigeo Sugimoto. (2009). Analysis of an Architecture of Manga toward an Integrated Metadata Model for Manga, Digital Libraries, No.36, pp.3-14 (in Japanese) , electronic version available at http://www.dl.slis.tsukuba.ac.jp/DLjournal/No_36/1-nomura/1-nomura.pdf (accessed August 2009)

OCLC Research (2009). OCLC Fiction Finder, http://fictionfinder.oclc.org/ (accessed August 2009)

OSU Library. (2003). CGA/EAS MANGA CATALOGING PROJECT, Cataloging Manual, February, 2003, http://library.osu.edu/sites/scc/locs/mangaprj.php#prep (accessed August 2009)

TV-Anytime Forum. (1999). Welcome to the TV-Anytime website. http://www.tv-anytime.org/ (accessed August 2009)

Yokota, Aran. (2008), Development of a Manga Metadata Schema, Graduation Report, Tsukuba University, 2008 (in Japanese)