Topic Maps-Driven Semantic Services for National Library of Korea

Presenter: Sam Oh

Presentation Outline

- Research Objectives and Scope
- Understanding FRBR Model
- Converting MARC to FRBR
- Converting FRBR to Topic Maps
- Implementing a TM Prototype Enabling FRBR Model
Research Objectives and Scope

- Establishing resource description structure based on international standard
- Making resource management smart and systematic
- Towards semantic DL service via user participation

The FRBR model is revolutionary. The (computer) catalogue is not seen as a sequence of bibliographic records and a replica of the traditional card catalogue, but rather as a network of connected data, enabling the user to perform seamlessly all the necessary functions.

Dr. Maja Žumer. National and University Library, Ljubljana, Slovenia
FRBR Model...

- FRBR = Functional Requirements for Bibliographic Records
- Developed by cataloging experts working under the auspices of IFLA (International Federation of Library Associations and Institutions)
- FRBR is a conceptual model (not a standard!)
  - FRBR systematically models the bibliographic universe

Impetus: a changing environment

- Automated systems for creation & processing of bibliographic data
- Growth of large-scale databases (national & international)
- Shared cataloging programs
- Economic pressure to reduce cataloging costs
- Adapting practice to accommodate new formats & a networked environment
- Changing user expectations and needs
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**Value of FRBR**

- **FRBR study process and report:**
  - Fresh look at what functions bibliographic records perform
  - FRBR systematically models the bibliographic universe

- **Helps us answer important questions:**
  - What information is of the most value to users of the catalog?
  - How can that most valuable information be used more effectively?

- **Promises to inspire next generation catalogs and DL systems.**
  - Illuminates user tasks
  - Clarifies how catalogs and DLs should function

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**FRBR Study**

**Primary objectives of the FRBR study:**

- Provide a clearly defined, structured framework for relating bibliographic data to user needs
- Recommend a basic level of functionality for records created by national bibliographic agencies

**Modeling the bibliographic universe:**

- Utilizes an entity-relationship framework:
  - Entities (a class of things)
  - Relationships (associations among entities)
  - Attributes (characteristics of the entities)
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Four User Tasks:
- **Find** entities that match the search criteria
- **Identify** entities (confirm that the user has found what they were looking for)
- **Select** an entity that matches the user’s criteria
- **Obtain** access to the entity through purchase, loan, or through electronic remote access

And, maybe a fifth:
- **Navigate**

FRBR 3 Groups of Entities

- **Group 1**
  - products of intellectual or artistic endeavor that are named of described in bibliographic records
    - work, expression, manifestation, item
- **Group 2**
  - entities responsible for the intellectual or artistic content, the physical production and dissemination, or the custodianship of such products
    - person, corporate body
- **Group 3**
  - entities that serve as the subjects of intellectual or artistic endeavor
    - concept, object, event, place
- Work
  - A distinct intellectual or artistic creation
- Expression
  - The intellectual or artistic realization of a work
- Manifestation
  - The physical embodiment of an expression of a work
- Item
  - A single example of a manifestation
FRBR Entity Levels

Group 1

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Work: The Novel The Movie
Manifestation: Paper PDF HTML

From: Tillett, Barbara "AACR2's Strategic Plan and IFLA Work towards an International Cataloguing Code" (2002)

SAM OH

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4-level FRBR Model

Shakespeare's Hamlet

Is Realized Through

German translation by Ferdinand Jacob
French translation by André Gide

Is Embodied In

Hamburg, 1834
Paris, 1946
Neuchâtel, 1949

Is Exemplified By

Library: PR2779.77
Library: PR2779.77
Library: PR2779.77
Library: PR2779
Library: S22.35
Library: PR2779.48

WORK EXPRESSION MANIFESTATION ITEM
Group 1

From: Tilliet, Barbara "AACR2's Strategic Plan and RILA Work towards an International Cataloguing Code" (2002)

Group 1 Attributes

- Work
  - Work title, form or genre, date, performance medium, intended audience
- Expression
  - Expression title, form of the expression, language of the expression, type of score, scale of a map
- Manifestation
  - Manifestation title, publisher, date of publication, form of carrier, dimensions, manifestation identifier (e.g. ISBN), terms of availability
- Item
  - Location or call number, barcode, provenance, condition, access restrictions on an item
Group 2 – Responsible Entities

- Entities responsible for the intellectual or artistic content, the physical production and dissemination, or the custodianship of such products

Group 2 entities:
- Person
- Corporate Body

And perhaps a third …
- Family

Group 2 Attributes

- Person
  - Names, dates, titles or other designations

- Corporate body
  - Name, number, place, date, other designation
- Entities that serve as the subjects of intellectual or artistic endeavor

Group 3 entities:
- Concept: topical subject heading
- Object: name for an object
- Event: name for an event
- Place: name for a place
- Plus the Group 1 and 2 Entities:
  - Works about Works/Expressions/Manifestations/Items
  - Works about Persons and/or Corporate Entities

- Attributes of Group 3 entities:
  - Concept
    - term
  - Object
    - term
  - Event
    - term
  - Place
    - term
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**Relationships**

- Link entities to one another
  - Entities of different groups (person and work)
  - Entities of the same group (work and expression)
- Collocation and navigation

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**Relationships Between FRBR Groups**

- Work ⇔ Person
  - Created by
- Expression ⇔ Person
  - Translated by
- Manifestation ⇔ Corporate body
  - Produced by
- Item ⇔ Corporate body
  - Owned by
- Concept ⇔ Work
  - Is subject of
- 22 -

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- 23 -

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➢ Work to work
  ■ Successor
  ■ Supplement
  ■ Complement
  ■ Summarization
  ■ Adaptation
  ■ Transformation
  ■ Imitation
  ■ Whole/part

Scenario A (Now)
Incorporating the concepts of the FRBR model in systems:

- Superior presentation of search results
  - Esp. in large files – more intuitive clustering
- May help streamline library cataloging
  - Reduces repeated keying of work-related info
- Bibliographic & management intelligence
  - New insights into works (e.g., OCLC’s 1000 list)
  - Libraries can operate at workset level (e.g., ILL)
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Show & Tell

- OCLC Research:
  - Top 1000 titles [http://www.oclc.org/research/top1000](http://www.oclc.org/research/top1000)

- OCLC production services
  - Open WorldCat [http://www.oclc.org/worldcat/open](http://www.oclc.org/worldcat/open)
  - FRBR-inspired FirstSearch WorldCat (coming soon)

Mapping Between FRBR Attributes & MARC21 Elements

<table>
<thead>
<tr>
<th>Entities</th>
<th>Attributes</th>
<th>MARC21 Elements</th>
<th>MARC21 Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work</td>
<td>created by</td>
<td>100/110/111</td>
<td>person/corporate body</td>
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<tr>
<td></td>
<td></td>
<td>700/710/711</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>$a,$n,$p,5p,5f,$k,$s,$m,$r,$f,$o,$h</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Title of work</td>
<td>130 $a,$n,$p</td>
<td>Uniform title</td>
</tr>
<tr>
<td></td>
<td></td>
<td>240/243/245 $a,$n,$p</td>
<td>Collective uniform title</td>
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<tr>
<td></td>
<td>Date of work</td>
<td>130 $d$</td>
<td>Title statement</td>
</tr>
<tr>
<td></td>
<td></td>
<td>240/243 $d$</td>
<td>Date of treaty signing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>245 $g$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Form of work</td>
<td>130 $k$</td>
<td>Form subheading</td>
</tr>
<tr>
<td></td>
<td></td>
<td>240/243/245 $k$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Medium of performance</td>
<td>130 $m$</td>
<td>Medium of performance for music</td>
</tr>
<tr>
<td></td>
<td></td>
<td>240/243 $m$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Key</td>
<td>130 $r$</td>
<td>Key of music</td>
</tr>
<tr>
<td></td>
<td></td>
<td>240/243 $r$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Coordinates</td>
<td>255 $c$</td>
<td>Statement of coordinates</td>
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</table>
### Mapping Between FRBR Attributes & MARC21 Elements

<table>
<thead>
<tr>
<th>Entities</th>
<th>Attributes</th>
<th>MARC21 Elements</th>
<th>MARC21 Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Expression</strong></td>
<td>Form of expression</td>
<td>leader/06</td>
<td>Type of record</td>
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<td>Language of expression</td>
<td>130 $l</td>
<td>Language of a work</td>
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<tr>
<td></td>
<td></td>
<td>240/243 $l</td>
<td>language</td>
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<td></td>
<td></td>
<td>008/35-37</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other distinguishing characteristic</td>
<td>130 $o</td>
<td>Arranged statement</td>
</tr>
<tr>
<td></td>
<td></td>
<td>240/243 $o</td>
<td>for music</td>
</tr>
<tr>
<td></td>
<td></td>
<td>245 $s</td>
<td>Revision</td>
</tr>
<tr>
<td></td>
<td>Type of score</td>
<td>254 $a</td>
<td>Musical presentation</td>
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<tr>
<td></td>
<td></td>
<td>Music 008/20</td>
<td>statement</td>
</tr>
<tr>
<td></td>
<td>Scale</td>
<td>255 $a</td>
<td>Format of music</td>
</tr>
<tr>
<td></td>
<td></td>
<td>034 $b,$c,$d,$h</td>
<td></td>
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### Manifestation

<table>
<thead>
<tr>
<th>Entity</th>
<th>Attribute</th>
<th>MARC21 Elements</th>
<th>MARC21 Description</th>
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</thead>
<tbody>
<tr>
<td><strong>Manifestation</strong></td>
<td>Title of manifestation</td>
<td>245 5a,$n,$p</td>
<td>Title</td>
</tr>
<tr>
<td></td>
<td></td>
<td>242 5a,$n,$p</td>
<td>Number of part</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Name of part</td>
</tr>
<tr>
<td></td>
<td>Statement of responsibility</td>
<td>245 5c</td>
<td>Statement of responsibility</td>
</tr>
<tr>
<td></td>
<td></td>
<td>242 5c</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Edition/issue designation</td>
<td>250 5a,$b</td>
<td>Edition statement</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Remainder of edition</td>
</tr>
<tr>
<td></td>
<td>Numbering</td>
<td>362 $a</td>
<td>Dates of publication</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>and sequential</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>designation</td>
</tr>
<tr>
<td></td>
<td>Publisher/distributor</td>
<td>260 5b,$l</td>
<td>Name of publisher,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>533 5c</td>
<td>distributor</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Agency responsible for</td>
</tr>
<tr>
<td></td>
<td>Date of publication/distribution</td>
<td>260 5c,$d</td>
<td>Date of publication,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>533 5d</td>
<td>distribution</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Date of reproduction</td>
</tr>
</tbody>
</table>
### Mapping Between FRBR Attributes & MARC21 Elements

<table>
<thead>
<tr>
<th>Entity</th>
<th>Attribute</th>
<th>MARC21 Elements</th>
<th>MARC21 Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manifestation</td>
<td>Form of carrier, extent of carrier</td>
<td>300 $a 533 $e</td>
<td>Extent of physical description of reproduction</td>
</tr>
<tr>
<td></td>
<td>Dimensions of carrier</td>
<td>300 $c 533 $e</td>
<td>Dimensions of physical description of reproduction</td>
</tr>
<tr>
<td></td>
<td>Physical medium, capture mode, playing speed, groove width, kind of cutting, tape configuration, kind of sound, special reproduction characteristics, color, polarity, presentation format, file characteristics</td>
<td>300 $b 533 $e</td>
<td>Other physical details</td>
</tr>
<tr>
<td></td>
<td>Reduction ratio</td>
<td>340 $f 533 $e</td>
<td>Production rate/ratio of physical description of reproduction</td>
</tr>
</tbody>
</table>

### Algorithm to Convert MARC to FRBR

**Begin**

1. **MARC Reading**
   - **Bib Record Control Field**
     - 008/35-37 언어표기, 041 $a Leader/06 자료유형
   - 245 $a, 74X $a 표목예)
   - 260 $b 출판사항 008/07-10, 260 $c 발행언
   - 300 $a 형태사항
   - 020 $a, 022 $a ISBN, 024 $a, 028 $a, 074t Form of musical composition code
   - 340 $f 533 $e Production ratio/ rate
   - 049 $l 등록번호/ 복본예)

2. **Expression**
   - **245 Title?**
     - yes: Work Candidate
     - no: Work Confirmed
   - **008 Language?**
     - yes: Item
     - no: Manifestation

3. **Item**
   - **088/07-10 Publication Date?**
     - yes: Leader/06
     - no: 245 $b Medium?
   - **Item check?**
     - yes: End
     - no: Manifestation

4. **Manifestation**
   - **300 $a 533 $e Date of publication**
   - **345 $b Medium?**
     - yes: End
     - no: Leader/06
An Algorithm to Convert MARC21 to FRBR

1. Read MARC record one by one.
2. Read 1XXtag about author and apply normalization rules. ($abcdq$ extract text)
3. If the author already exists in the DB, extract the title. If not, that becomes a new candidate for a new work.
4. In the 245tag $a$, extract the title and compare it to see whether it matches one of works in the DB.
   1) Apply normalization rules to extracted title.
   2) If the title in 245tag does not match, extract the text from 740tag $a$ or 507tag $t$ and compare it with the existing works.
   3) When you find a title that matches a work, extract the text in 245tag $a$ as an expression of the work and move to the expression routine.
   4) Fix the author and title as work, then move to expression module.

6. Check the language, 008tag / 35-37, if that is a new one, register it as a new expression.
   - If 041tag exists, separate the text from $a$ and $bch$, the $bch$ becomes an expression.
7. Describe expression concept as author, title, language, and type.
8. After you went through work and expression steps, check manifestation items.
   - After you extract a publisher info from 260tag $b$, apply normalization rules, then check whether it matches existing ones.
   - Extract publication date from 008tag / 07-10 and check it matches with others.
   - Treat the value of leader/06-07 as upper classification category, if 245tag $h$ exists, separate resource type from it and check whether it matches with others.
9. Registration of a manifestation will be done per record and manifestation. If that is an item of manifestation, it should be excluded.
10. Extract holding information from items and register it.
Connecting FRBR with Cataloging Items

Form: text - English

<table>
<thead>
<tr>
<th>Title</th>
<th>The Heart of Midlothian</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statement of responsibility: Sir Walter Scott.</td>
<td></td>
</tr>
<tr>
<td>Editor</td>
<td>The heart of Midlothian</td>
</tr>
<tr>
<td>Oxford University Press, 1999</td>
<td></td>
</tr>
<tr>
<td>385 p. : ill. ; 20 cm</td>
<td></td>
</tr>
<tr>
<td>ISBN: 01928565X</td>
<td></td>
</tr>
</tbody>
</table>

Form: text - Russian

<table>
<thead>
<tr>
<th>Title</th>
<th>Edifiborgsalta termina</th>
</tr>
</thead>
<tbody>
<tr>
<td>Editor</td>
<td>Edifiborgsalta termina</td>
</tr>
<tr>
<td>Penguin Books, 1994</td>
<td></td>
</tr>
<tr>
<td>385 p. : ill. ; 20 cm</td>
<td></td>
</tr>
<tr>
<td>ISBN: 01928565X</td>
<td></td>
</tr>
</tbody>
</table>

Input (marc reading)
Advantages of Topic Maps in Providing Semantic Services

- Provides excellent collocation capability – Katz’s second purpose of cataloging
- TM implementation is relatively easy compared with RDF/OWL so one can expect a better return on investment.
- Excellent candidate in modeling FRBR-based data and provides great interoperability with other semantic data.
- You can easily change your ontology schema without modifying applications, which offers excellent advantage in terms of management cost.
- Provides flexible ways to model ontology.
- Provides flexible ways to convert any structure data, which makes it easy to utilize legacy data.
- Integrating TM with Web2.0 technology is easy and natural.

Refining MARC-Ontology Using Topic Maps

1. Topic Types
   - Among FRBR entities from group 1,2,3 and MARC metadata elements, select the elements that can create “useful” collocation, assign them as topic types.
   - Map FRBR model entities into MARC metadata elements and establish them as topic types.

2. Association Types
   - Establish association types between topic types.
   - Apply FRBR relationships as TM associations between topics and also establish associations between metadata elements.

3. Occurrence Types
   - Except for MARC metadata elements that were converted as topic types, the remaining MARC elements will be defined as TM occurrence types.
   - Classify occurrence types based on element values of FRBR model and assign them to appropriate topic types.
   - Since MARC records are usually based on manifestation, most MARC metadata elements and other occurrence types are assigned to manifestation.
Defining Topic Types

<table>
<thead>
<tr>
<th>Topic Types</th>
<th>FRBR Group &amp; MARC Element</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work/Expression</td>
<td>FRBR Group 1, MARC Title</td>
</tr>
<tr>
<td>Manifestation/Item</td>
<td></td>
</tr>
<tr>
<td>Person / Corporate Body</td>
<td>FRBR Group 2, MARC Personal name, Corporate Name</td>
</tr>
<tr>
<td>Object / Event / Place</td>
<td>FRBR Group 3</td>
</tr>
<tr>
<td>Country / Genre</td>
<td>MARC Subject (KORMARC 650tag)</td>
</tr>
<tr>
<td>Type</td>
<td>MARC leader’s type of record (Expression Criterion)</td>
</tr>
<tr>
<td>Format</td>
<td>MARC Medium (245 $h, Manifestation Criterion)</td>
</tr>
<tr>
<td>Language</td>
<td>MARC Language statement (Expression Criterion)</td>
</tr>
<tr>
<td>Classification</td>
<td>MARC KDC classification number</td>
</tr>
<tr>
<td>Context</td>
<td>FRBR Model구체적 속성정보</td>
</tr>
<tr>
<td>Publisher, Date</td>
<td>MARC publication</td>
</tr>
<tr>
<td>Audience</td>
<td>MARC Target audience / User tagging info</td>
</tr>
<tr>
<td>Subject</td>
<td>User subject tagging info</td>
</tr>
</tbody>
</table>

KORMARC Elements and TM Occurrence Types

<table>
<thead>
<tr>
<th>KORMARC Elements</th>
<th>Topic Maps Occurrence Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title and related fields (1XX/24X/4XX/7XX)</td>
<td>Other words associated with a name, Remainder of title, Parallel title, Original title, series statement, uniform title</td>
</tr>
<tr>
<td>Publication (26X)</td>
<td>Edition statement, Place of publication, Frequency, Regularity</td>
</tr>
<tr>
<td>Physical description (3XX)</td>
<td>Extent, Other physical details, Dimensions, Accompanying materials, size of unit</td>
</tr>
<tr>
<td>Note (5XX), Subject(653)</td>
<td>Contents note, Restrictions on access, Immediate source of acquisition, keyword</td>
</tr>
<tr>
<td>Non-book bibliographic Note(5XX)</td>
<td>System details note, Music format, Participant or performer note, Exhibitions note, Date/time and place of an event note, Creation/production credits note, scale note</td>
</tr>
<tr>
<td>Control field (0XX)</td>
<td>DDC, KDC, ISBN, Price, Korean National Library call number, identifier number, language note</td>
</tr>
<tr>
<td>Other service Note</td>
<td>URL, book review, status of book circulation, abstract, image of title</td>
</tr>
</tbody>
</table>
### Occurrence Types by Topic Types

<table>
<thead>
<tr>
<th>Topic Type</th>
<th>Occurrence Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work</td>
<td>uniform title</td>
</tr>
<tr>
<td>Expression</td>
<td>Original title, language note, Frequency, Regularity, Restrictions on access</td>
</tr>
<tr>
<td>Manifestation</td>
<td>Contents note, Immediate source of acquisition, Extent, Other physical details, Dimensions, Accompanying materials, size of unit, Edition statement, System details note, Music format, Participant or performer note, Exhibitions note, Date/time and place of an event note, Creations/production credits note, scale note, Other words associated with a name, Remainder of title, Parallel title, DDC, KDC, ISBN, Price,</td>
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<tr>
<td>Item</td>
<td>Korean National Library call number, identifier number</td>
</tr>
<tr>
<td>Publisher</td>
<td>Place of publication,</td>
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<tr>
<td>Classification</td>
<td>KDC, DDC</td>
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<tr>
<td>Subject</td>
<td>keyword</td>
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### Defining Association Types

<table>
<thead>
<tr>
<th>Topic Type</th>
<th>Association Type</th>
<th>Topic Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work</td>
<td>Work form</td>
<td>Genre</td>
</tr>
<tr>
<td></td>
<td>Realized Through</td>
<td>Expression</td>
</tr>
<tr>
<td></td>
<td>Created by</td>
<td>Person/Corporate Body</td>
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<tr>
<td></td>
<td>Context for</td>
<td>Context</td>
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<tr>
<td></td>
<td>Work classified</td>
<td>Classification</td>
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### Defining Association Types

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<th>Topic Type</th>
<th>Association Type</th>
<th>Topic Type</th>
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<tr>
<td>Expression</td>
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<td>Manifestation</td>
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### Defining Association Types

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Topic Maps-Driven Semantic Services
For National Library of Korea

Topic Map Modeling of FRBR

Topic Maps-Driven Semantic Services
For National Library of Korea

Graphical TM View of MARC
Topic Maps-Driven Semantic Services
For National Library of Korea

OCLC Fiction Finder

Gone with the Wind
Mitchell, Margaret, 1897-1986

Summary: A romantic novel. Description: A novel to be read by the

Genres: Historical fiction | War stories | Love stories | Epic fiction

Characters: Scarlett O'Hara (Female character)

Settings: 1861-1940 | United States (Country) | Georgia | 1861-1895 | females

Subjects: African American literature | Women | War

Main Screen

NLK Prototype System

Welcome

Main Screen

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Work list & expression, manifestation count

Arranged by Genre

Display of Authors

manifestation list by authors
Future Research Project Agenda

- National Library of Korea
  - Designing Semantic Digital Library Architecture
- National Archives of Korea
  - Designing Semantic Archiving Retrieval System
- National Assembly Library
  - Designing Smart and Interoperable Metadata System