Creating an International Environment for Research in Library Materials

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The National Library of the Czech Republic has been coordinating two nation-wide digitization programmes that are partly supported by the Ministry of Culture. When analysing the research and development capacities and the degree and variety of application of modern communication technologies in the European national libraries[1], it has been found out that the Czech National Library is one of the major digitization players even if there is a substantial gap after the national libraries of Spain (more than 40 million pages) and France (ca. 25 million pages) due to their intensive digitization of newspapers (Spain) and newspapers and monographs (France). However, as to digitization of manuscripts, the Czech National Library is the leader among the national libraries in Europe. It is especially this type of documents on which a lot of research and development activities are concentrated in order to create successively a complex virtual environment for their study. Besides this, the second large digitization stream concentrates in our library on acid-paper materials, especially periodicals and monographs published since 1801.

Building a complex digital library

In 2003, a new digital library called Manuscriptorium (http://www.manuscriptorium.com) was launched. It created a lot of surprise at the very beginning, because due to special materials available, the expectation was to have at maximum fifty parallel users. Immediately after the announcement at a press conference, the number of parallel users grew over several hundreds to several thousands; this growth can happen any time when a special publication of well-known materials is announced. Normally the Manuscriptorium has ca. 30 parallel users in average, while several hundreds are not an exception. Manuscriptorium is a shared catalogue of manuscripts and old printed books of participating institutions. It contains bibliographic data from many Czech institutions, but also the Czech national retrospective bibliography of books printed prior to 1800, and a lot of data from the co-operating foreign institutions. Furthermore it provides access to almost 700,000 digitized pages.

The Manuscriptorium is being built in close co-operation with professionals whose work is historical research in manuscripts and old printed books; therefore, its philosophy is specific and different from general digital library applications. The goal is not only to have a data access tool, but to have an environment that gathers all the necessary information to create a user-friendly and rich virtual research space.

This quality is projected both in data and metadata segments of the digital library. First of all, the digital library builds on a special complex format for electronic access to manuscripts, called MASTER, which is a development of an EU project having the same name. The MASTER schema is the background for the identification part of the Manuscriptorium

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[1] Manžuch, Zinaida – Knoll, Adolf: Analysis of Research Activities of the CENL Members, http://www.telmemor.net/docs/WP1_Board_CYP.ppt

compatible digital document, while the whole digital document follows the so-called Master Plus definition[2] enriched with structural and technical metadata, while the technical metadata follow the NISO Z39.87 standard (Data Dictionary – Technical Metadata for Digital Still Images) and the DIG35 standard[3]. The Master Plus schema was created by the joint effort of the Czech AIP Beroun Ltd. and the National Library of the Czech Republic.

The requirements for detailed technical metadata concerning digital images should enable a platform independent recreation - in display or printing – of the original look of the digitized materials that is very important in the manuscripts area. The two above mentioned standards are combined with special technical metadata whose usage arises from our long-term practical work; they are also combined with the application of ICC profiles. Furthermore, the scanner calibration information and colour target information - both GretagMacbeth and the specialized in-house colour targets - are stored as well. The special Manuscriptorium colour target is scanned together with a page of the original, its digital image is stored as well as the numerical values of the colours.

The Manuscriptorium started with the presentation of digitized pages of historical materials, but recently we have begun to add historical texts structured on a TEI basis[4]. In order to enable the matching of the full text and image representations of pages, a special Manuscriptorium 2 approach has been developed. It has resulted in an internal Manuscriptorium Digital Library format (called KDD – Complex Digital Document) that can be seen as an application of METS.

The structural metadata as well as some additional approaches have been taken from the former work with an in-house SGML application implemented for the first time in 1996 and upgraded in 1998.

A lot of attention was given to the application of imaging technologies. This part of work is stronger at our side than it is usual in other digital library solutions. Many tests and research works were done in order to find the best imaging approaches especially as to the image delivery segment. In the image archiving area, ISO approaches are fully applied and later reduced to the application of the classical JPEG format (DCT compression scheme); nevertheless, we tested the latest wavelet, JBIG2-based, and Mixed Raster Content solutions to see their viability and applicability for digitized library materials. In parallel, classical JPEG optimization tools were developed to be able to establish the acceptable limits of various parameters (mostly resolution and lossy compression ratio) for concrete defined image use areas. The comparison of the optimized classical JPEG images for various types of usage with JPEG2000 was done in 2003 on the sample of ca. 120 digitized manuscripts and the result was that the JPEG2000 wavelet scheme - at subjectively comparable samples - did not prove enough over-performance face to optimized DCT compression combined with suitable resolution. Researchers declared to be disturbed by wavelet artefacts at the files ca. two times smaller than the acceptable DCT output.

In order to make the wavelet files subjectively acceptable the size difference between the compared files became uninteresting. This was found important for illuminated manuscripts, but it cannot be generalized, as for other types of documents the wavelet processing is highly acceptable (e.g. newspapers, because the goal is good readability and not so much the exact

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[2] http://digit.nkp.cz/MMSB/1.1/msnkaip.xsd
[3] http://www.i3a.org/i_dig35.html
[4] http://digit.nkp.cz/MSSFullText/DTD/1.00/mss-fulltext.dtd

representation of the original look of the material). The wavelet technology is highly efficient especially when it can be combined with the Mixed Raster Content (MRC) approach, as it is now known from such commercial solutions as DjVu or LDF (LuraDocument). The high performance of the MRC approach is seen especially when it is based on implementation of the JBIG2 or JBIG2-like family of compression schemes for the black-and-white (1-bit) segment of the digital image. In our library, the DjVu format is used for user images of newspapers, journals, and acid-paper monographs in the Kramerius Digital Library[5], launched in 2004.

Another domain in which the wavelet technology in our library is applied is the digital representation of historical maps. Here, we have to cope with the image delivery of the files having the resolution 100, 160, or more mega pixels. Even if compressed efficiently in a wavelet format such as JPEG2000 or DjVu (IW44), the files should be rather large to maintain the readability of fine details and after download, for example, a 100 mega pixel image will decompress into a bitmap of 300 MB in true colour. Such an image is difficult to handle in a user-friendly manner on current computers. The solution consists in the application of the multi-resolution image file technology combined with an image server that processes the source image on-the-fly as requested by the user. The Manuscriptorium Digital Library uses the MrSID format and the Lizardtech Express Server: they ensure a seamless delivery of any chunk from the source image, while only the requested portion of data is transferred. Typically eight or nine various resolution levels are available to be exploited by the server, which cuts from the appropriate level the requested area and delivers it over networks. The server can also recalculate the image chunks to any other resolution level if requested. Thus, the image servicing for maps is very fast and efficient, while no unnecessary data transfer takes place.

Interconnecting the digital library

Europe wishes to create its own digital library even if the digitization activities show to be delayed face to India, China, or Korea, but there is a hope that also here more digital content is going to be available. Nevertheless, many digital resources are already here even if rather often the catalogues, true digital libraries, and flatly presented digital collections on the web are taken together and they may just produce an illusion of a great richness of the European digitization scene. However, the truth is rather modest, as there are very few real digital libraries and in plus the remote access to their content is often blocked by copyright regulations. For example, the 40 million pages of the digitized newspapers in the National Library of Spain in Madrid are accessible only locally due to copyright restrictions and a greater part of materials from the Kramerius Digital Library have the same destiny in the Czech Republic.

The first step seems to be the incorporation of various resources into sophisticated information portals. Many libraries declare they operate such portals; almost every national library in Europe states it, but in reality we have counted only six real portal interfaces in the European national libraries that collect the metadata from heterogeneous resources, translate the queries, and deliver merged results under a homogeneous user interface. The major portal is now The European Library (TEL – http://theeuropeanlibrary.org) that is incorporating successively the resources of the European national libraries. TEL is a project of the

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[5] http://kramerius.nkp.cz

Consortium of European National Librarians (CENL) and the provided service is paid by contributions of the participating libraries. The TEL central gateway can communicate via Z39:50, OAI-PMH, and SRU protocols, but the practice clearly shows the fast decrease of importance at Z39:50 and the growth of the role of OAI in the communication between various applications. Another important piece of information is also the fact that due to varieties of resources, the Dublin Core profile, even in its unqualified reduced extent, is a very powerful tool for communication and in most cases it suits the communication goals. This seems to be the opposite side of the rigidness of classical library information systems, because the libraries – if they really wish to be integrated in larger environments and if they wish to integrate a part from the outer world – must overcome the limits of their narrow identification standards and concentrate more seriously on more sophisticated tools that enable a better orientation in the rich and variable world behind their walls than any rigid pre-coordinated systems can.

The OAI-PMH in the Manuscriptorium offers several profiles and thanks to them this digital library has been integrated in large portals such as TEL or the Czech Uniform Information Gateway (http://www.jib.cz) as well as into specialized portals as, for example, the CERL (Consortium of European Research Libraries) portal for manuscripts (CERL MSS - https://diva.ub.uu.se/test/cerl/index.xml) or special gateways of various international projects (e.g. M-CAST – eContent).

In order to enhance the contents of Manuscriptorium, the transformation routines have been written to enable upload of MARC records, but the practice shows that different libraries use MARC (UNIMARC or MARC21) differently for old printed books or manuscripts so that adjustments must be done and a lot of testing as well to have concrete transformations for concrete libraries. The foreign libraries for which we have stable and tuned transformation tools are, for example, the Library of the Lithuanian Academy of Science in Vilnius or the University Library in Wroclaw.

Shared storage and access

Our goal is to provide seamless access to as many resources as possible. We have observed that due to cultural and political problems it is rather difficult to convince the institutions to have their data in our digital library. It is more acceptable for them to build together a shared catalogue of historical collections than to let us have their digital images. In addition, the MASTER-based format seems very difficult to be understood and applied as well as librarians find it difficult to adapt their thinking for work in an XML-based metadata environment.
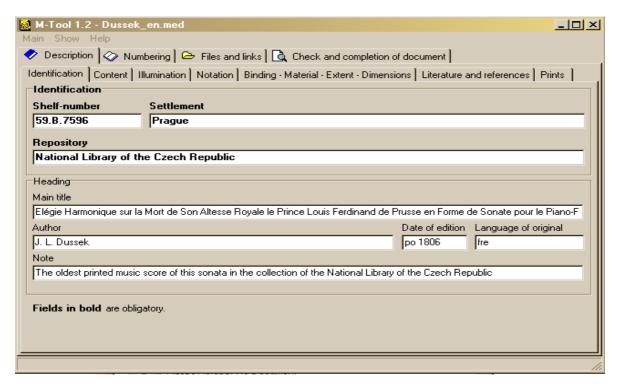
To make everything easier, our goal is to provide such tools that would enable an easy authoring on the full MASTER PLUS platform. The idea comes from the fact that we do not need too much complicated and complete identification records for having the digital documents in the library. In other words, this makes possible to reduce substantially all the complexity of a rich MASTER record, and also to omit the very complicated technical metadata area, while concentrating especially on the most practical metadata.

From such a point of view, the most important metadata group is the structural mapping of the whole compound digital document, i.e. the mark-up of the correct pagination or foliation that would correspond with the original and creation of a related linking to image representations

of individual pages incl. covers, book spine, and any other elements of the physical structure of the book that are directly represented by image files.

However, the situation is a bit more complicated in the Manuscriptorium Digital Library, as one page is usually represented by several images having different qualitative parameters: thumbnail, preview, low, black-and-white, and normal quality levels, while the rich archival image is not accessed on-line. The legal formats for the Manuscriptorium are considered those recommended for the World Wide Web, i.e. JPEG, GIF, and PNG. Due to technical reasons, this kind of thinking does not cover the digitized maps to which the efficient Internet access is done via a special image server processing the source image on-the-fly.

Having this in mind, a special editing software has been developed; it is called M-TOOL[6] and - on the basis of a simple interface - it provides the basic guidance while complying with the Manuscriptorium requirements in the areas of Identification (Cataloguing), Automated Numbering of Pages/Folios, Linking to Image Files, and Verification of the Input.

The Content group (**msContent** element) enables the analytical description of the manuscript contents, because a manuscript is often only a physical collection volume of various texts, and it is useful to have them on the formatted output, for example, like this:

Content

1r - 102v: [Hieronymi de Praga monachi: Sermones dominicales per circulum anni, qui vocantur "Linea salutis", cum suis percopis, quibus passim superscriptae sunt glosae bohemicae] Ve michi quia tacui hec verbalo cutus est ... x ... et sumkám desiderium bonum ad quod nos perducat ... vivit et regnat in seculorum secula amen.
103r: vacuum.
103v - 116v: [Lectionarium epistolarum per circulum anni] Fratres scientes quia hora est iam nos de sompno surgere ... x ... habemus redempcionis et remissionis omnis peccatorum per Jesum Christum dominum nostrum.
117r - 119r: [Expositio orationis dominicae] Pater Sanctus Thomas de Aquino non dominus omnia (?) amari appetit non timeri ... x ... ex intellectu et affectu dicenti est. Explicit Summma Sancti Thomae de Aquino super Pater Noster.
119v - 119 bis v: vacuum
120r - 258v: [Extractiones super IV libros sententiarum] Quoniam in paucioribus magis ideo scripti sententiarum communia cogitavi fore ... x ... ad gaudia nos secum trahit eterna ad que res per ducere dignetur Jesus Christus Amen. Expliciunt extractiones super quatuor libris sententiaeum continentes levitatem omnium conclusionum cum pricipalibus racionibus earundem.
259r - 261r: [Notae variae de mania canina se missis pro obsesso et pro furtu, preces exorcisticae] Hic scribitur in Wilhelmando capitulo 21o de mania canina ... x ... quod cum incipiunt finire orationem non que senciunt.
261v - 262r: [Sermones tres] Nemo prout venire ad me ... x ... prout diligere si hunc quem diligit non haberet.
262v - 263r: vacuum
263v - 264r: [Sermones tres continuant] Egressus Jesus per am (?) veritas ... x ... ab eo quam caritas (?) ipse dominus est in illa terra nullo modo. Salve mater gratiae.

Other groups enable to concentrate on the description of illuminations or music notations, physical properties of the document, additional data for printed books, bibliography and references. The references can enable navigation to other documents available on Internet; any links are becoming active in the outputted XML document so that the simple completed identification description looks as below:

Location
Settlement: Prague
Repository: National Library of the Czech Republic
Shelf-number: 59.B.7596

Heading
Main title: Elégie Harmonique sur la Mort de Son Altesse Royale le Prince Louis Ferdinand de Prusse en Forme de Sonate pour le Piano-Forte composée et dédiée à Son Altesse le Prince de Lobkowicz Duc de Raudnitz
Author: J. L. Dussek
Place of publication: Leipsic
Name of Publisher: Breitkopf und Haertel
Date of origin: po 1806
Language of original: fre
Note: The oldest printed music score of this sonata in the collection of the National Library of the Czech Republic

Content
P. 1: Title page
P. 2: Explanation of the composer saying why he wrote this work
P. 3: First Movement - Lento patetico
P. 12: Second Movement - Tempo Vivace e con fuoco quasi Presto
P. 20: Stamp of the library with the date indicating the purchase of the document in 1982

Physical description
Material: paper
Extent: 20 pp.
Dimensions: 23,7 x 31,9 cm

Notation:

Illumination:

Binding:
Missing covers
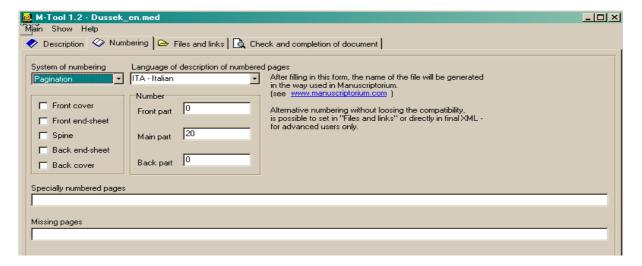
Additional information

Bibliography:

Sound Recording: http://digit.nkp.cz/audio/Hudba_1/Cs/Bibldesc/Bibldesc.htm
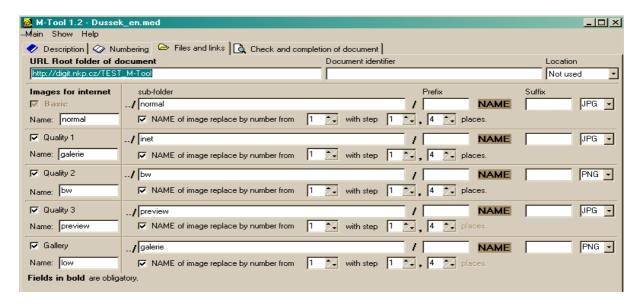Short Biography:
http://members.klosterneuburg.net/handerle/COMPOSER.HTM
http://www.classiccat.net/dussek_jl/biography.htm

As manuscripts or old printed books can consist of hundreds of pages, it is important to generate automatically anything that is possible to be done so. We can predefine the presence or absence of typical parts of the book and even note the exceptions (specially numbered pages, missing pages):

We can generate the user images and place them on any server on Internet and the Manuscriptorium Digital Library will call them from this remote site of they are requested by the user who will have seamless access to closer and remote data files under the same interface:

As we can see, we can set up the URL of the root folder, the formats as well as the naming or renaming of the image files in batch. These two above-shown work sheets help enormously, because due to the quantity of possible images files, it would be difficult to work directly in the XML code without errors.

In this concrete document, each *page* element will contain the following description:

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  <pgDescription lang="ITA">
  <pgText>
  <pgItem />
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    Tool/inet/0002.JPG" quality="galerie" />
  <pgImage id="ID0002" href="http://digit.nkp.cz/TEST_M-
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  <pgImage id="ID0002" href="http://digit.nkp.cz/TEST_M-
    Tool/preview/0002.JPG" quality="preview" />
  <pgImage id="ID0002" href="http://digit.nkp.cz/TEST_M-
    Tool/galerie/0002.PNG" quality="low" />
    </page>
```

Furthermore, the M-TOOL enables to check also the correct availability and linking of referenced images on Internet. Of course that the XML file can be exported and further processed and completed in any suitable XML editor as, for example, the case of the XMLSpy is.

In this way, we hope to enhance the Manuscriptorium capability to integrate other resources addressing similar target audiences. The digital library can behave as an integral entity or as various localized partial virtual libraries. Thus, it can serve also as a gateway for the resources of such institutions, which have not yet developed their own digital library interfaces. They can have their own personalized interface in the Manuscriptorium and simultaneously be present in the shared digital library and catalogue.

It is well-known that the original historical collections have been dispersed among many institutions in the world, while many of such institutions possess important documents of foreign provenance. The Manuscriptorium activities provide a chance to join them and create better services for the user.

The future development will stress on the authoring qualities of the Manuscriptorium tools with plans to enable such work on-line in case it is requested. On the other hand, the Manuscriptorium is going to concentrate also on application of ontologies to improve the quality in the area of search of information. In addition, other data types – especially structured full text and also audio data – are being included as well as it is foreseen to include also the reference literature. An international workshop will take place in Prague on 9 June 2006 and it will prove, whether there is enough interest to develop the activities and tools that internationalize the coverage of the Manuscriptorium Digital Library.

Supplement

The whole XML file of a simple piece of old printed music can then look like this:

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<!--generated by M-Tool ver. 1.2, for more info visit www.aipberoun.cz-->
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            <settlement>Prague</settlement>
            <repository>National Library of the Czech
Republic</repository>
            <idno>59.B.7596</idno>
        </msIdentifier>
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Royale le Prince Louis Ferdinand de Prusse en Forme de Sonate pour le
Piano-Forte composée et dédiée a Son Altesse le Prince de Lobkowicz Duc de
Raudnitz</title>
            <author>J. L. Dussek</author>
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                <name type="place" role="publisher">Leipsic</name>
                <name type="person" role="publisher">Breitkopf und
Haertel</name>
            </respStmt>
            <origDate>po 1806</origDate>
            <textLang>fre</textLang>
            <note>The oldest printed music score of this sonata in
the collection of the National Library of the Czech Republic</note>
        </msHeading>
        <msContents>
            <overview>
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                <p>P. 2: Explanation of the composer saying why he
wrote this work</p>
                <p>P. 3: First Movement - Lento patetico</p>
                <p>P. 12: Second Movement - Tempo Vivace e con
fuoco quasi Presto</p>
                <p>P. 20: Stamp of the library with the date
indicating the purchase of the document in 1982</p>
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