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		VIAF (Virtual International Authority File): Linking Die Deutsche Bibliothek and Library of Congress Name Authority Files
		Rick Bennett OCLC Online Computer Library Center Dublin, Ohio USA
		Christina Hengel-Dittrich Die Deutsche Bibliothek Frankfurt am Main Germany
		Edward T. O'Neill OCLC Online Computer Library Center Dublin, Ohio USA
		Barbara B. Tillett Library of Congress Washington, D.C. USA
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Abstract

Die Deutsche Bibliothek, the Library of Congress, and OCLC Online Computer Library Center are jointly developing a virtual international authority file (VIAF) for personal names which links authority records from the world's national bibliographic agencies and will be made freely available on the Web. The goals of the project are to prove the viability of automatically linking authority records from different national authority files and to demonstrate its benefits. The authority and

August 12, 2006

bibliographic files from the Library of Congress and Die Deutsche Bibliothek were used to create the initial VIAF which contains over six million names with over a half million links. A key aspect of the project was the development of automated name matching algorithms which use information from both authority records and the corresponding bibliographic records. The practicality of algorithmically linking the personal names between national authority files was demonstrated; seventy percent of the authority records for personal names common to both files were automatically linked with an error rate of less than one percent. The long-term goal of the VIAF project is to combine the authoritative names from many national libraries and other significant sources into a shared global authority service.

Introduction

Several groups within the International Federation of Library Associations and Institutions (IFLA) Section on Cataloguing recognized the potential of a virtual international authority file (VIAF) [1] where authority records representing the same entity from the world's national bibliographic agencies would be linked and made available on the Internet. Such a VIAF would be a practical expansion of the concept of universal bibliographic control and would build on the work done by each national bibliographic agency. It would permit national or regional variations in authorized form to co-exist, thereby supporting worldwide users' needs for variations in preferred language, script, and spelling.

Current proposals for the future of the Web describe the use of ontologies for making the Web more intelligent for machine and automatic processing. The VIAF could be one of the basic building blocks for a "semantic Web" [2] when combined with other controlled vocabularies and authority files from such sources as abstracting and indexing services, archives, museums, publishers, etc. Libraries now have an opportunity to make a great contribution to this future and should help make this vision a reality. It is important to the development of this shared vision that the VIAF be made freely available to users worldwide.

Other projects have looked into linking personal names in authority files. The LEAF Project [3] (Linking and Exploring Authority Files) proposed to link authority records from many different sources, including libraries, archives, documentation and research centers. These records have various formats, and the details of the type and amount of content varies considerably. The LEAF project proposed automatic linking of the records as they are loaded into the system. Due to the diverse sources of name authority records, they found that the only common information that was available for establishing links was the name, including "see-references," and associated dates. Because the name authority records of the current participants frequently don't include dates, the mismatch error rate for their name authority records is expected to be unacceptably high.

The InterParty Project [4] is an EU-funded demonstration project to create linking authority files among diverse organizations for the primary purpose of supporting digital rights management. The proposed InterParty system would provide a single point of access to the multiple databases involved in the system, so it first provides a centralized search service. As links are manually identified between the names in any of the databases, the individual making the association can enter the link. These links can then be used automatically. Depending on the organizations making the links, the links may be considered sufficiently trustworthy. The assertion of a link by one party does not need to be accepted by other parties involved in the system. The project allows for the possibility of algorithmic matching, but does not specify the techniques or data requirements necessary to support the linking capability.

The VIAF Project

During the 2003 IFLA World Library and Information Congress in Berlin, Die Deutsche Bibliothek (DDB), the Library of Congress (LC), and OCLC Online

Computer Library Center (OCLC) agreed to develop a Virtual International Authority File (VIAF) for personal names [5]. The goals of the VIAF project are to prove the viability of automatically linking authority records from different national authority files and to demonstrate the benefits of a VIAF. The VIAF project will link the name authority files of the Library of Congress and Die Deutsche Nationalbibliothek through a single virtual name authority system. OCLC is developing the software to match personal name authority records between the two authority files. The long-term goal of the VIAF project is to link the authoritative names from many national libraries and other authoritative sources into a shared global authority service for persons, corporate bodies, conferences, places, etc.

The VIAF project consists of five phases:

1. Build "Enhanced Authority" records from both Personennormdatei (PND) and LC Authority Records. This will include identification of the appropriate authority records to include in the enhanced authority records and determination of any special handling needs for the incoming files.
2. Develop matching algorithms, and match PND and LC enhanced authority records to create the initial version of the VIAF. This was an iterative process with Phase 1, as intermediate matching results highlighted additional information that could be extracted and included in the enhanced authority records to improve matching.
3. Build an Open Archive Initiative (OAI) [6] server to provide access to the VIAF.
4. To maintain the VIAF database, additions and changes to both the authority and bibliographic records of all participating agencies are required. This update and maintenance system will be designed around the protocols used by the OAI to request this information for the updates.
5. To access the VIAF records, a user interface will be made available on the open Web. Eventually, the database and interface will support Unicode and multi-language, multi-script capabilities. Direct requests to the database, providing for example an LC version name and requesting the matched PND name as a simple HTML link, can be used to support semantic Web capabilities.

The project initially is focused on demonstrating the feasibility of VIAF by linking the personal names authority records between the Personennormdatei (PND) and the Library of Congress Name Authority File (LCNAF). As of December 31, 2005, the LCNAF file contained 4.2 million authority records for personal names. As of the same date, LC had created and distributed a total of 9.3 million bibliographic records.

As of Fall 2005, the PND file contained 2.6 million authority records for personal names. The PND authority file is used in both DDB bibliographic records and the Bibliotheksverbund Bayern (BVB) bibliographic records. Between the two bibliographic files, there are a total of 15 million bibliographic records associated with PND authority records.

The Name Matching Problem

Initially, the VIAF will function as a German-English and English-German dictionary for personal names. For example, for an American user searching for **J. P. De Valk** (the form of the name established by LC), the name could be automatically 'translated' to **Johannes P. De Valk** (the form established by DDB). As in this case, it is common for different international cataloging agencies to establish the names differently or, conversely, to use the same form of the name to represent different authors. It is possible that **J. P. De Valk** could be established by DDB for a completely different author.

Personal names may take different forms for the same person or have the same form for different people, making it difficult to reliably match names from different authority files. The coverage of the two authority files is significantly different; only a small fraction of the personal names are present in both files. Therefore, information other than the name itself must be used to ensure a reliable match. In authority records for personal names, the person's birth and/or death dates are often present. The combination of birth and death dates is usually sufficient to distinguish people with similar names.

To confirm this difficulty in matching authority records without using supplemental information, a sample of common names from the LC and DDB authority files were extracted. These authority records pairs were then manually reviewed to determine whether they represented the same person. This review found that about 10% of the personal name pairings were for different people. Thus, the match error rate using just the established form of the name would be unacceptably high. Since the name forms are not always identical between the two national authority files, pairing similar, but not identical, names would lead to an even higher error rate. This simple approach also fails to match numerous names that had been established differently.

The Name Matching Solution

Additional matching information is clearly needed to confirm or reject potential personal name matches. For example, consider the following LC authority information for Diane Glynn:

```
100 10 $a Glynn, Diane, $d 1946-
400 10 $a O'Connor, Diane, $d 1946- $w nna
670   $a Country western dancing, 1994: $b CIP t.p. (Diane
      Glynn) pub. info. (an avid country w. dancer & co-
      author          of How to make your man more sensitive)
```

The only directly usable data are the names and the date of birth. Two titles are included in the 670 (Source Data Found) field that might be extracted by machine processing. In practice, only some of the titles can be reliably extracted from these fields.

Bibliographic records are an obvious source for additional information about the person. These bibliographic records can be mined for additional attributes about the

person's work, which can distinguish the person from others with similar names. One bibliographic record has:

```
100 1 $a Glynn, Diane, $d 1946- -  
245 10 $a How to make your man more sensitive / $c by Diane and  
      Dick O'Connor.  
700 1 $a O'Connor, Dick, $d 1938- $e joint author -
```

Bibliographic records contain two types of additional information. The bibliographic records usually include work specific information such as the title and manifestation specific information such as ISBN number. A title match provides nearly definitive support for a name match.

The bibliographic record also has additional information that may apply to multiple works by the person. This information may help to match authors when specific title matches are not available. The joint author Dick O'Connor is an example of this type of information. Dick O'Connor may co-author more than one book with Diane Glynn, which is strong support for a name match across authority files. Even if the same work appears in both national databases, but the work is translated in one of them, a title match may be difficult to make automatically. In this case, the joint author's name is likely to be far more similar across the databases, confirming the match.

Information from all available bibliographic records where the name is included as a main entry, added entry, or subject is transformed to create an intermediate record called a "derived authority." These derived authority records are then combined with the original authority record to create the "enhanced authority" record. Because the enhanced authority records include additional information associated with the name from bibliographic records, they can support a more rigorous matching process than can the authority records themselves.

Name Match Confirmation

Simply comparing names across two national authority files is a reasonable way of finding the same individual. Variations in the form of the name can be expected, resulting in a reduced chance that the individuals will be the same person. To automatically confirm a match for these individuals, the approach taken here is that (1) the names must be compatible and (2) there must be sufficient supplemental confirming information to confirm the match.

Compatibility requires that there are no differences that would preclude the names representing the same person. The names may differ in completeness, as with John A. Smith and John Allen Smith. These names are compatible because the 'A' could be for Allen. However John A. Smith and John B. Smith are not compatible due to the conflicting middle initials. Both the authorized form of the name and variant forms are considered when testing for compatibility.

Once the names have been determined to be compatible, the supplemental information collected for these names is used to confirm the match. The bibliographic files may contain many different but similar titles and many different but similar names. If a name/title pair is similar in both files, however, it is quite likely that the name

represents the same person. This basic strategy is extended to other types of information collected from the bibliographic records.

The dates are considered separately as a positive correlation. When the dates differ by more than a year, the names are considered incompatible, and a match is rejected. Allowances are made for single year differences in the dates. In the development of the VIAF, it was relatively common to find small discrepancies in some of the dates, and the additional matching information was sufficient to confirm the match even with slight variations in the dates.

When comparing two enhanced authority records, each element that matches is considered a matching point. The matching points are separated into three categories; strong, moderate, and weak. For compatible names, a strong point of match is considered sufficient to confirm that the individuals are the same person. Strong matching points are titles, ISBNs, birth and death dates, or joint authors. The birth date alone was not sufficient to differentiate names, and is more properly considered a moderate matching point. Moderate matching points are indicators of the persons work environment, such as the publishers used, subject area, or the person's role (e.g., illustrator or composer). A large publisher will publish the works of many authors, and at least some of them may have similar names. Matching on multiple moderate points is sufficient to confirm a match. Weak matching points are considered sufficient only to differentiate otherwise ambiguous matches. Examples of these weak matching points include language, subject area, and country of publication.

To combine matching points, numeric scores are assigned to each matching point. For a number, such as an ISBN, the match is either exact or it is not a match, resulting in a score of one for a match and zero for a non-match. For text, such as a title, a score can be assigned based on how similar the text is, for a score of between zero and one. A trigram based scoring technique is used for the text similarity scoring. The individual scores are modified by a weight based on the strength (strong, moderate, or weak), and summed. When the total score exceeds a threshold determined through the testing process, the match is confirmed. In the actual matching algorithm, testing of many records allowed adjustment of the scoring within these categories, and it is expected that the adjustments will continue as more authority files are added to the system and as experience is gained.

Building the Enhanced Authority Records

The techniques described above were using to create enhanced authority records for both the PND and LC name authority records. The LC bibliographic files were processed for derived authority records to enhance the LC authority file, and both the DDB and BVB bibliographic files were processed to enhance the PND authority records. Figure 1 shows a brief diagram of the information flow contributing to the enhanced authority records.

For the enhanced LC authority file, 3.8 of 4.2 million (90%) authority records could be enhanced. Only 2.6 million (60%) were enhanced with information from bibliographic records, a total of 7.4 million titles. Other enhancements were made using 4.1 million titles extracted from the 670 (Source Data Found) fields in the

authority record. The titles are the most important enhancement element for producing matches, as will be seen in the results section.

For the enhanced PND authority file, 2.4 million of 2.6 million (90%) authority records receive some enhancement, although only 2.0 million (80%) were enhanced by bibliographic records. The remaining 400,000 records were enhanced with titles extracted from PND authority records themselves.

Testing Matching Techniques

The VIAF participants supported the development of the matching process through accuracy reviews and comments on the results. For example, series titles were initially used, but were found to frequently incorrectly match names. Each review resulted in some modifications that either increased the number of matches or reduced the false matches. During that time, a reasonable accurate threshold score and scoring algorithm was developed. Only the final confirming tests are described here.

To confirm the accuracy and effectiveness of the matching process, name matching samples were reviewed by the experienced authority catalogers at both DDB and LC. The first sample had two goals, to determine the overlap in names between the two authority files, and to find what fraction of those name pairs can be identified by the matching process. The second sample was used to look for any systematic errors or deficiencies that could be repaired and to estimate the overall error rate.

The first sample contained 391 randomly selected PND authority records. The LC authority file was searched, both automatically and manually, for matches to these records. For the automatic portion of the effort, the PND authority records in the sample were paired with all LC authority records that share a surname, resulting in 74,000 pairs for examination. The matching algorithm was applied to all 74,000 name pairs and automatically matched 79 PND/LC authority records pairs.

Manual reviews of all 391 PND authority records found an additional 35 names that had a corresponding LC authority record, but either the pairing was not made based on the surname, or the matching algorithm failed to confirm the match. The 79 automatic matches were confirmed to be accurate through this manual review. Using the PND sample, it is estimated that about 30% of the PND names also appear in the LC authority records, and that the algorithm can match about 70% these common names. This translates into an estimated 800,000 names in common between the two authority files of which the automatic matching process is expected to identify 550,000.

The results were also reviewed to improve the name pairing process. Using surnames only, almost 1000 name pairs would need to be subjected to the full matching process for each match made. The manual matching test result was used to determine that a strategy based on the surname, forename, plus limited date information could be used as a rough estimate of name compatibility. This simple index was found to locate 95% of these matches with only four pairs to examine for each match. The simple index is both efficient and effective, and small adjustments in it are likely to result in further improvements.

The goal of the second sample was to estimate the matching error rate. As a part of the process, the sample tested the adequacy of the preliminary threshold score, and adjusted it if necessary. When using a threshold score, the error rate for matches with scores near the threshold is expected to be larger than for matches with scores much larger than the threshold. Most matching name authority records had scores well above the threshold value. To provide the best error rate estimate with the least amount of manual review effort, the sample was divided into four sub-samples based on the score. Manual reviews identified any matching errors, and the error rate and confidence was established for each sub-sample. These partial results were weighted and summed to find the overall error rate for the matching technique. The number of false matches was less than one percent.

One of the sub-samples looked at a range just below the threshold. If the threshold were lowered, one incorrect match would be added for every three correct matches. Lowering the threshold is clearly not justified. In the score range just above the threshold, there was only one bad match in 25 matches. Since relatively few matches are made in this range, the overall impact on the error rate is low, and a large number of valid matches are kept. Therefore, the preliminary threshold level was accepted.

Building the Initial VIAF

The enhanced authority files from both sources were passed through the matching algorithm, and the resulting records, both matched and unmatched, were converted to VIAF records. The process is illustrated in Figure 2. There are 6.3 million enhanced authority records in the resulting VIAF file including, out of 500,000 linked records, 3.7 million unmatched records from the LC authority file and 2.1 million unmatched from the PND authority file. This is very close to the estimate based on the manual testing. It is estimated that there are an additional 250,000 pairs of authority records representing the same person that could not be automatically matched due to lack of usable information. The final system will allow manual linking for matches such as these and to allow for other intellectually identified matches. The authority records will include a sequentially assigned VIAF record number.

Figure 3 provides an example of a VIAF record in MARC 21 format. Because the primary purpose of the VIAF is to provide linkage between the files, the VIAF record contains an entry for each name in the 700 (Heading Linking Entry) field, along with an indication of its source. Because there is no single authorized name, the 100 (Personal Name Heading) field is not used. When a match is determined by the algorithm, two linking entries are placed into the record. When a name is unmatched, only a single 700 field appears.

The supplemental information is also included in enhanced authority records as local (9xx) fields. The local fields used in the enhanced authority records are briefly described in Figure 4. To simplify matching, all of the text is normalized using a modified version of the NACO (Name Authority Cooperative Program of the Program for Cooperative Cataloging) normalization rules. [7] The number of occurrences of a particular term is stored in \$9 subfield. Since this information is intended primarily for machine processing, it will not necessarily be present in end-user views of the records. As subsequent national authority files are added, these will first be compared with the existing, enhanced VIAF records, incorporating additional

matches as they are made into the VIAF records. When matches are made, the enhancing information from the matched records is merged as well.

In a significant number of cases, an authorized name in one file matches multiple authorized names in the other file. Since a goal of the VIAF is a one-to-one linking service, the match was not confirmed when these multiple matches occur, and 70,000 algorithmic matches were eliminated due to multiple matches. At least two reasons for the multiple matches were identified.

First, there are a number of undifferentiated names in the PND, each matching with two or more differentiated names in the LCNAF. Based on the German cataloging rules RAK-WB, it was German cataloging practice not to differentiate personal names. When DDB started to catalog with the authority file, this practice was abandoned and the DDB no longer creates undifferentiated personal name authority records. Nevertheless the PND still contains many undifferentiated names. DDB will differentiate the names with multiple matches, as far as possible automatically, on the basis of matches between LC and DDB titles recorded in the enhanced authority records, the rest intellectually. The corrections will reach the VIAF as part of the frequent updates and initiate unambiguous links between the matching records.

Second, a number of LC authority records reflect the AACR2 practice of having separate authority records for each bibliographic identity used by a person, such as with pseudonyms. This is the opposite case from the PND undifferentiated records. In this case, multiple authority records are created for a single individual. The PND, following RAK-WB rules, has only one authority record the names of all of the identities. As with undifferentiated names, these authority records for bibliographic identities pose problems for which no completely satisfactory solution for matching has been found.

One application of the matched records is that the linking names can be used directly as an automatic translation from the LC to the PND name authority or visa versa. This can support the needs of the semantic Web or federated search systems that desire this feature. Maintaining the “see from” tracings can provide human viewers with additional information.

The authority numbers from the participating files or the VIAF numbers themselves can also be the basis of URIs. This would provide the potential for a resolving service for authority URIs. Starting from whatever URI citation appears in a document, a record or a Web site, the user would be led to all materials, records, resources, etc., with which the authorities, represented in the URI, are related, and to the authority records themselves.

Ongoing System

The national name authority files and bibliographic databases change constantly. For a linking database built on two or more of the changing files, the links must be reevaluated and updated frequently. The logic and software of the initial VIAF system is being modified to allow for continuous update of the records. As new bibliographic or authority records are received, the existing enhanced authority records are modified, and the cross database matching is re-evaluated. New matches

will be made continuously, and matches that may no longer be supported due to changes in the underlying source records will be broken. When matches are broken, a history of the previous match will be maintained in each matched record for reference.

In the future, the VIAF system will take advantage of OAI feeds from the source database holders when these become available. In the meantime, more traditional file access means such as FTP will be used for the project tests.

With the large amount of data in a single location, many different methods of accessing and using the data can be envisioned. The links can be used to translate a personal name to an end-user's desired format as part of the semantic Web. Tools could be built to support automatic searching into alternate bibliographic databases by providing the appropriate name form for that database. Cataloging and authority control tools could be built in a similar fashion, identifying the appropriate form for a name included in the record. Of course, the VIAF database will also be directly searchable.

Conclusions

The PND file already gained substantial benefits from the project. The self-matching tests in both files initiated significant upgrades in the PND, and DDB is expecting substantial support in differentiating personal names through matching titles in enhanced record pairs. The matching processes and algorithms developed for the project are adaptable for many other applications. Services are being investigated which will make use of the personal name matching data to improve access to bibliographic information and to support the cataloging activities of the participants.

The project has demonstrated that it is practical to automatically link the personal names between two national authority files. Seventy percent of the authority records for people common to both files were linked with an error rate of less than one percent. The strategy of supplementing the original authority records with information from bibliographic records greatly improved the match rate while decreasing the number of false matches. Minor changes to authority records would significantly improve the matching. Many failed matches resulted from the failure to parse the 670 (Source Data Found) field. Additional structure, avoiding the use of brief names and titles, or explicit links to the source bibliographic record would be very helpful. Explicitly identifying the common role or specialty (composer, illustrator, mathematician, etc.) would further enhance matching, both automated and manual as would the inclusion of fuller forms of the name, at least as cross-references.

The research presents a convincing case for authority control, for the use of authority records, for networking and cross-linking, and for building a semantic Web for libraries. For those libraries and library networks that obtain or hold bibliographic records with LCNAF access points, the VIAF could serve as a platform to cross from one authority file to the other. In Germany, this offers the mapping of LCNAF and PND forms, either to transcribe the LCNAF access points in the bibliographic records with PND access points or to enable search and retrieve with PND headings through the VIAF. Implemented in multinational or multilingual portals such as The European Library portal, the VIAF could automatically combine search queries in both the

LCNAF and the PND, leading the user to the related bibliographic records from both sources.

With the matching techniques in place, an updatable system is planned that will collect current personal name authority and bibliographic data from the participants using OAI feeds. The system is designed to be scalable and new participants willing to share their authority and bibliographic records would be welcome. The limits of VIAF's scalability will not be clear until more institutions have joined the project.

The VIAF project has focused on the problem of matching authority records for personal names. To maintain, expand and implement the VIAF, a long-term service and governance strategy will be needed. Decisions are needed regarding the expansion of the project to include corporate names, uniform titles, etc., and the addition of participating institutions. There are plans to expand the capabilities of the system by incorporating the Unicode character set. Unicode will allow for the inclusion of non-roman scripts but extending the matching algorithm will be a challenge, particularly for ideographic based scripts such as Korean, Chinese, or Japanese.

References

1. IFLA Core Activity: IFLA-CDNL Alliance for Bibliographic Standards (ICABS) <http://www.ifla.org.sg/VI/7/icabs.htm> [May 2006]
2. Berners-Lee, Tim, James Hendler, and Ora Lassila. "The semantic Web: a new form of Web content that is meaningful to computers will unleash a revolution of new possibilities." *Scientific American*, May 17, 2001. <http://www.sciam.com/article.cfm?articleID=00048144-10D2-1C70-84A9809EC588EF21> [May 2006]
3. LEAF Project, <http://www.leaf-eu.org> [May 2006]
4. Project InterParty: From Library Authority Files to E-Commerce, Andrew MacEwan, http://www.haworthpress.com/store/E-Text/View_EText.asp?a=3&fn=J104v39n01_11&i=1%2F2&s=J104&v=39 [May 2006]
5. VIAF: The Virtual International Authority File, <http://www.oclc.org/research/projects/viaf> [May 2006]
6. Open Archives Initiative - Protocol for Metadata Harvesting, <http://www.openarchives.org/OAI/openarchivesprotocol.html> [May 2006]
7. Hickey, Thomas B., Jenny Toves, and Edward T. O'Neill. "NACO Normalization: A detailed Examination of the Authority File Comparison Rules", *Library Resources & Technical Services*, Vol. 50, No. 3, p. 18-24. [forthcoming]

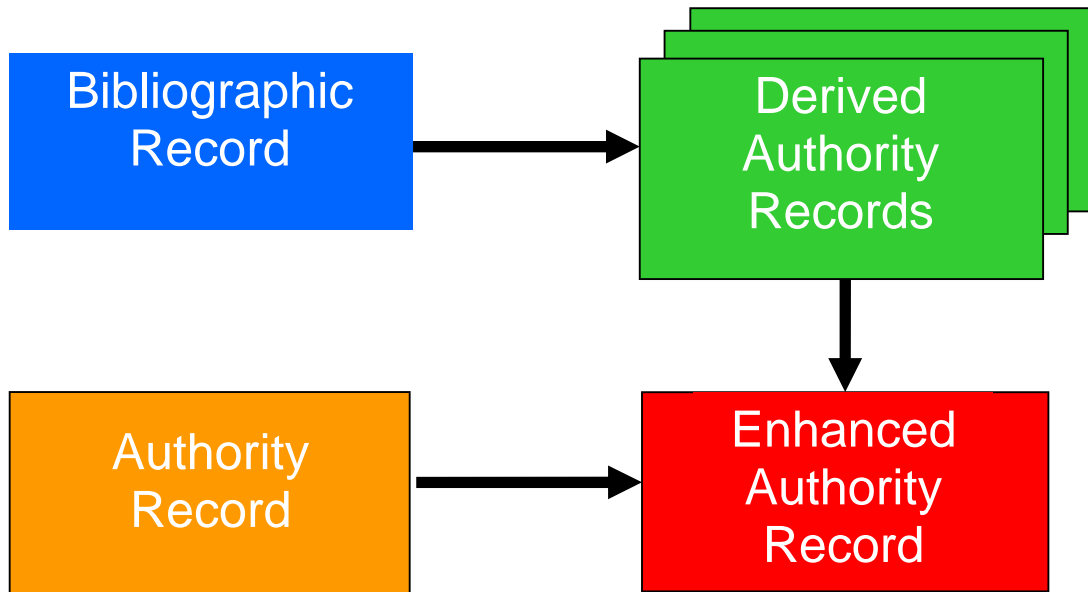


Figure 1. Creating the Enhanced Authority Record

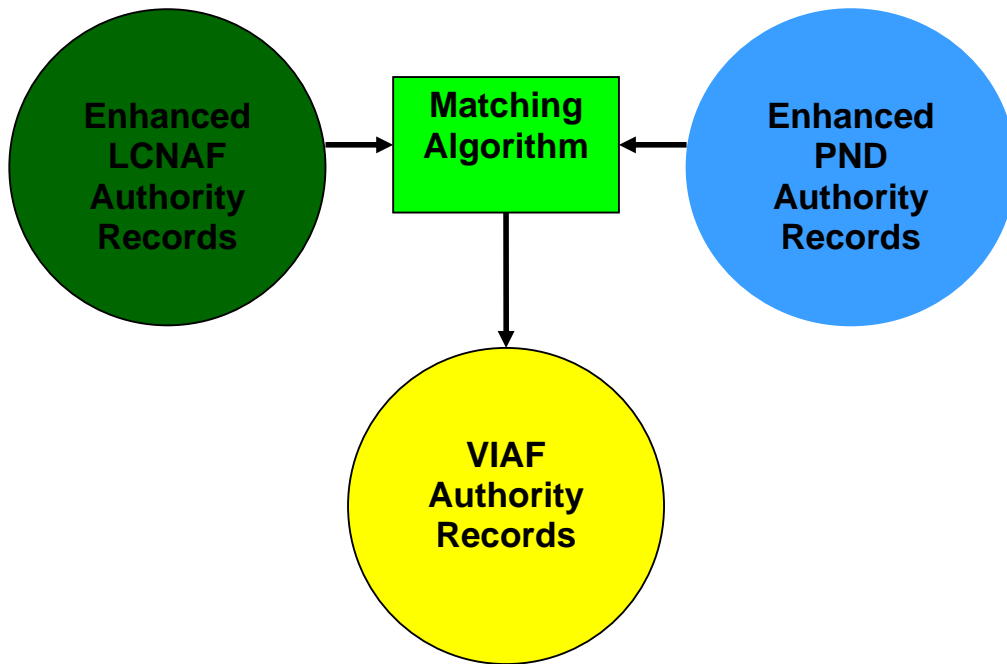


Figure 2. Creating the VIAF Authority Records.

August 12, 2006

```
000    nz n
001    viaf 30543
005    20050826163535.0
008    050826n|anannabn |a aaa
040    VIAF $c VIAF
400 10 $w nnaO'Connor, Diane, $d 1946-
700 17 Glynn, Diane, $d 1946- $2 DLC $0 n 94057411
700 17 O'Connor, Diane $2 DDB $0 108982424
901    052512920 $9 1
901    349917275 $9 1
901    350215532 $9 1
903    75014386 $9 1
910 11 how to make your man more sensitive $9 3
910 11 macht eure manner zartlicher $b liebevolle ratschlage
fur e neues rollenverhalten $9 1
910 11 macht eure manner zartlicher $b wie e frau ihrem mann
helfen kann e verstandnisvoll $9 1
919    country western dancing, $9 1
920    0-525 $9 1
920    3-499 $9 1
920    3-502 $9 1
921    dutton $9 1
921    rowohlt $9 1
921    scherz $9 1
922    gw $9 2
922    nyu $9 1
940    eng $9 1
940    ger $9 2
942    18 $9 1
943    197x $9 3
944    am $9 3
950 11 oconnor, dick $9 2
950 11 oconnor, dick $d 1938 $9 1
999    1 $b 75014386 //r94 $2 DLC
999    1 $b n 94057411 $2 LoCNA
999    2 $b 780147766 $b 790425319 $2 DDB
```

Figure 3. VIAF Record

Figure 4
Enhanced Record Formats

90x Control numbers		
901	ISBN	\$a Numeric portion of ISBN (no check digit or dashes)
902	ISSN	\$a Numeric portion of ISSN (no check digit or dashes)
903	LCCN	\$a Numeric portion of LCCN (no check digit or dashes)
91x Title fields		
910	Title from 245 Abbreviated title	Subfields a & b
911	from 210 Uniform title from	Subfields a & b
913	130 or 240 Translated title	Subfields a & b
914	from 242 Collective uniform	Subfields a & b
915	title from 243 Variant title from	All subfields
916	246 Authority Record	Subfields a & b Extracted from Name/Title authority records, field 100
917	Uniform Title Title extracted	\$t Various note or similar
919	from other text	fields
92x Publisher fields		
920	Publisher number	\$a Publisher number from ISBN
921	Publisher name Place of	\$a Publisher name from the 260 b or 533 c.
922	publication	\$a Country of publication code from 008
93x Usage		
930	Name Usage	\$a Form of name found in the statement of responsibility, 245 subfield c
94x Attributes		
940	Language	\$a Language code from the 008 or 041 subfield a
941	Author's role	\$a Relator code from 700, subfields e and/or 4
942	NATC Subject Decade of	\$a NATC survey line number.
943	publication	\$a Decade of publication
944	Format	\$a Type and bib level (008/06-07)
945	Conspectus Subject	Custom usage, see PND discussion
95x Joint Authors		
950	Personal Authors	Subfields \$a, \$b, \$c, \$d, and \$q from either the 100 or 700 fields
951	Corporate Authors	Subfield \$a from either the 110 or 710 fields
96x Name Subjects		
960	Name as Subject	Sub-fields \$a, \$b, \$c, \$d, and \$q from the 600 field Text "Subject" indicating the authority heading was used as a subject, and was extracted from a 600 field
969	Subject usage	
99x Special Fields		
999	Associated bibliographic records	\$a Total number of records \$b Record Control Number \$2 Source of Record