

The National Libraries Resolver Discovery Service

- a CENL recommendation -

This document describes the initial steps to realise a basis for a resolution service of national libraries, according to the approach as endorsed by CENL¹.

The National Libraries Resolver Discovery Service will provide the following main functions:

- 1) making the NBNs (National Bibliography Numbers)², ISBNs and other identifiers that we assign for the digital objects actionable and persistent in the collections of national libraries and by doing so, guaranteeing a valid link to these objects;
- 2) forwarding requests to the resolution services of European national libraries as well as to resolvers for other identifier frameworks.

An international network of resolvers

According to this agreement of CENL, the resolution services of the national libraries jointly form the National Libraries Resolver Discovery Service (or Infrastructure) to resolve URNs expressed as hyperlinks (URLs). The effect is that by clicking on the URL of a digital object in the libraries' collections, users will automatically be directed to the resolver of the appropriate national library.

Examples:

NBN: [fe20071572](#)

URN: [URN:NBN:fi-fe20071572](#)

URL: <http://urn.fi/URN:NBN:fi-fe20071572>

ISBN: [978-952-11-2763-2](#)

URN: [URN:ISBN:978-952-11-2763-2](#)

URL: <http://urn.fi/URN:ISBN:978-952-11-2763-2>

For other Persistent Identifiers, e.g. DOI, PURL and ARK, the user will be directed to the appropriate resolving service; how to implement this aspect will be investigated further and we will seek to work with other organisations to persist the link between identifiers and the underlying objects.

The approach

The National Libraries Resolver Discovery Service will consist of:

- 1) a resolution service at each national library that is known by a persistent URL (the base-URL); for instance <http://urn.fi> in Finland
- 2) a registry of the fixed base-URLs of the participating national libraries' resolution services, providing interoperability and interconnectivity between the services.

The essence of the approach is to make the address (the base-URL) of a resolution service persistent. The services should take into account that besides NBN, other identifiers (e.g. ISBNs) should also be recognised in order that users can be redirected to the appropriate specific URN resolution service. Links to e.g. DOI-based resolution services hosted by publishers will be discussed separately.

¹ Persistent identifiers. Towards an Agreement on the Specifications for a European Resolution Infrastructure. Proposal to CENL. 7 September 2006.

² The NBN (National Bibliography Number) has been endorsed by CENL as the basis of the URN implementation in national libraries. (CENL meeting 1998. A discussion paper by Esko Häkli & Juha Hakala, Helsinki University Library).

Including the address of participating resolution services into the URL hyperlinks removes the need for browser plugins needed for processing URNs.
See the annexes for further details.

Vision for the future

The TEL office³ seems to be the most appropriate body for technical maintenance of the National Libraries Resolver Discovery Service. Its role will be to provide instructions, information and the available tools for implementing and operating the national resolution services and maintain a registry of resolution services participating in the discovery service.

³ The European Library (TEL) www.theeuropeanlibrary.org

Annex 1 Using URLs

Making URLs persistent

URLs are used to locate digital objects on the Internet. As such they are not identifiers. If the physical location of an object changes or if the syntax of an identifier (URL), that has already been published, is changed, a valid link to the object can no longer be generated. To be persistent, the identification of digital objects has to be independent of its physical location. For this purpose, persistent identifiers are used. Examples of persistent identifiers are URN, PURL and DOI. A digital object may have e.g. both URN and DOI, if it is available from both national library's and publisher's digital archives. .

Both URN and DOI system can encompass any existing identifier. NBNs can be expressed as URNs and made resolvable because a URN namespace has been registered for them (see <http://www.faqs.org/rfcs/rfc3188.html>).

To retrieve an object we must in the present Internet express the URN as a hyperlink (URL) in order to make it actionable. The actual linking is done by a resolution service. The reason is that URNs are not (yet) recognised by web-browsers and so are not clickable like regular URLs. Therefore, in the approach proposed, URLs are used. However, for persistency reasons, such URLs do not directly point to the physical location of an object, but to a resolver, identified by a base-URL. The base-URL needs to be fixed, so once defined, it is never changed .

Used in this way, the URL containing the URN is de facto persistent. URL is used to direct the user to an appropriate resolution service, identified by a base-URL that, in turn, will retrieve the object. Using this approach parts of a complex object can be also interlinked, so that the whole object can be retrieved.

The URL will be a valid URI (Uniform Resource Identifier) with a known encoding. How the URI needs to be interpreted, or used, can be deduced from this encoding scheme. The targeted resolver will perform the identification of the object and generate information about its physical location from a table containing URN and corresponding URL/URLs. The resolver then can, after eventual authorisation, either retrieve the object or redirect the user to another resolver.

Some digital objects, like journal articles, can be stored at more than one location. Dependent on several criteria, for instance access permissions, local availability and the user's location, a user might have to be redirected to another resolver, which will provide an "appropriate copy" for that user. Institution's resolver might use different criteria for redirection.

The URL syntax

The syntax of the URL used may contain some optional parameters depending on the software used locally for resolution. In general, it should be:

```
URL := <base-URL> {?} urn=<PersistentIdentifier>{&KEV}
KEV := <key>=<value>
<PersistentIdentifier> := urn:isbn | urn:issn | urn:nbn | etc.
```

So the URL consists of a base-URL (the address of the resolver), followed (optionally) by a question mark and next the identification of the object (PersistentIdentifier). Although the parameter name "urn" the persistent identifiers do not have to be restricted to formal URNs. Other optional URL parameters (KEV is Key Encoded Value) might be added.

An example of the base-URL, for the KB resolver is: <http://resolver.kb.nl/resolve>. In Germany it is <http://nbn-resolving.de/> and in Finland <http://urn.fi/>. There are no rules for choosing the base-URL of the service, and the differences do not have an impact on interoperability. The only thing that matters is persistence.

Objects in the KB e-Depot are each identified by a NBN. For example:

<http://resolver.kb.nl/resolve?urn=URN:NBN:nl-kb-edepot:0123456789>

Objects in other KB digital collections are in a similar way identified by the name of the collection, a colon followed by an identifier. For the URNs the syntax defined in the standard RFC 2141 has to be followed.

In Germany, NBN is also used for identification. Example:

<http://nbn-resolving.de/urn:nbn:de:hbz:466-2007050924>

which resolves into:

<http://ubdata.uni-paderborn.de/ediss/02/2007/ziegler/disserta.pdf>

In Finland, both NBN and ISBN have been used for identification. Examples of URL syntaxes have been given above.

Additional parameters

The additional “key encoded value pairs” are tools that can be used locally to enhance the functionality provided by the (basic) URN resolution. They are parameters that are not used by the resolver to locate the object but may be added to the URL to which redirection takes place. This is because there may be different services related to a single object. The identifier does not change when a different service is requested. For example:

<http://resolver.kb.nl/resolve?urn=urn:nbn:nl-kb;atvs:001&role=metadata>

In this case “role=metadata” is used by the KB’s resolution service to request only the metadata describing the object and not the object itself. Since the additional parameters are voluntary, resolution services in e.g. Finland and Germany would not be able handle the request.

In the Dutch implementation, parameters may also be used also used for requesting parts of complex objects. The additional parameters are not an extension to the identifier syntax. Passing additional parameters is a service provided by the resolver for linking to objects that use the additional parameters.

Parameters that can not be interpreted by the resolver are always added to the new target URL (the result of the resolving action) to be prepared for unknown functionality of the final application that provides the object. They are not intended for the resolution process.

In case items are moved

In the rare and unlikely case the base-URL is changed, persistence of the base-URL is obtained on the European level by replacing the former base-URL by the new one in the resolution discovery service. On the national level, HTTP redirection is needed.

If the location of a digital object is changed, it is necessary to change the URN – URL linking table within the national resolution service. Please note that there is only a single location where the change needs to be done. This contrasts with the presently common practice of using URLs as links in e.g. MARC records. In such a case, update of link information requires modification of every MARC record that contains the old URL.

When an organisation stops to exist the responsibility of maintaining a resolution service can in principle be taken over by the other partners in the national or international resolution service infrastructure. Such a transfer of responsibilities would guarantee that identifiers will remain “actionable”.

Relationship with OpenURL

The proposed URL syntax is somewhat similar to the syntax of OpenURL version 0.1. (For specifications of the OpenURL standard see http://www.niso.org/standards/resources/Z39_88_2004.pdf.) However, the proposed resolvers of the national libraries will not be OpenURL link resolvers. The purpose of the OpenURL system is to provide dynamic linking which takes into account the users' rights, whereas URN system aims at persistent linkage.

The national libraries' resolution services will provide direct access, for an authorised user, to the requested object. An OpenURL resolver delivers a HTML page with context dependent links from which a user might choose (e.g. search using the same search terms: in Google, in a local bookshop, in a document delivery service). There may be an overlap between OpenURL resolvers and the proposed national libraries' resolvers, but, for the time being, a separate implementation is envisaged and CENL will remain responsible for the persistent identification within the national libraries' European resolution infrastructure.

Annex 2 The Resolver

Implementing a resolver

Implementing a resolver is quite straightforward. One of the design aims of the URN system was simple implementation. One might choose to develop a local system or make use of existing open source tools or tools that are developed in collaboration with commercial vendors to support the URN resolver infrastructure as being described here. There are no requirements with respect to hardware platform or programming language and therefore a resolution service can easily be integrated into any national library's existing hardware and application infrastructure. Since URNs are stored as URLs all library systems support using them as hyperlinks already, which eliminates the need for modification of ILMS.

The logic of the resolver is based on inspecting the identifier. The first prefix of the identifier is for lookup in a table to decide the next action. One possible action is redirecting the request to another resolver (of another national library or organisation). For example when the prefix is "NBN" the resolver will look at the next part (the country) and lookup the base-URL for that specific country and redirect the request. The other action can be retrieving the object and forwarding the object to the user. This last action is based on knowledge of the local infrastructure e.g. a local database. If authorisation is required; it is handled at this stage.

The resolver implementation is not fixed but has to be adaptable to new situations. Therefore it is desirable that if open source applications are built, they must be configurable so as to make it easy to adapt the software to the requirements of different countries and application environments. As it is not realistic that all possible use cases can be foreseen, software updates will be needed from time to time.

The resolver tables

The European Resolution Discovery Service uses a centralized table containing information on how, for each namespace prefix (base-URLs), the URL should be processed. This table contains at least:

- 1) the target location with an indication on how to fill in the parameters;
- 2) whether it is a redirect or a forward;
- 3) the rules for authorisation.

The local resolver table will need to be adjusted if the rules for resolving a collection changes.

The resolver will also contain a European base-URL table, containing the base-URL's of the resolution services of the participating national libraries. Information for this base-URL table should be provided by the experts in the national libraries via a web form to The European Library office. This information could then be published, in human and machine-readable form, in The European Library metadata registry.

Use cases

- a) Resolution of URNs that are embedded in an URL. These URL's can be stored in a document as is or constructed by a library application when presenting a persistent identifier in the user (or machine to machine) interface.
- b) When presenting metadata from different sources in a national libraries' portal, the national library may choose to link the persistent identifiers first to its own resolver before redirecting to other resolvers.
- c) If an organisation taking part in the European Resolver Discovery Service infrastructure disappears, another organisation may take over the responsibility for the base-URL and provide appropriate redirection based on the new situation.

Annex 3 Authorisation

As the resolver is the gateway through which digital objects can be retrieved, it may also support the enforcement of authorisation, based on rules that take into account the characteristics of the objects and the user's permissions. For this purpose, in addition to the resolver, functionality for Identity Management will be needed. Authorization will have to be organized locally by each library and is a local responsibility.

Digital objects, like journal articles, can be stored at more than one location. When resolution works but authorisation fails the resolver may decide to choose to redirect to another resolver. Dependent on access permissions, local availability and the user's location, a user might have to be redirected to another resolver, which will provide an "appropriate copy" for that user. This might have potentials for a federated authorisation infrastructure.

For the purpose of authorisation rules are needed, based on information about the users and the digital objects. The user information is requested using an API that is delivered by an IDM (Identity Management) application. The information about the object is, as a rule, retrieved from the metadata of the object. An authorisation rule is a Boolean combination of a number of elements, for example:
Rule 1: (ipnumber =internal) or (publicationdate < 1970) or (accessRights=free) or (user=cardholder)

If the requirements are met, access will be provided. A specific rule might be used for every collection. In addition to information on users and objects, other kinds of information can be applied, e.g. IP address authorisation or resolution will need to be supported by an IDM application, however, this is a matter of local implementation. As all requests for digital objects will be routed via the resolver, the resolver can support the enforcement of authorisation by other resolvers by providing encrypted authentication data.

Annex 4 Potential Questions

A. Can we provide persistency for other identifier schemes?

Answer: No, the National Libraries are responsible for keeping the NBNs persistent. Resolving other identifiers is just an additional service

B. Can different identifiers point to the same publication at different locations?

Answer: Yes, but we need to distinguish between identification of the intellectual work and identification of the item. NBNs identify the item.

C. Can persistent identifiers change?

Answer: No. Only the base-URL can change (but even that should not happen often).

D. Will urn's be recognized by browsers and use DNS for resolving?

Answer: No, for the time being. This is an old issue. It is possible that national libraries provide browser plug-ins to point to the local resolver. In the long run the aim is to support URNs as a part of the Internet infrastructure. Then URNs would be resolvable as such and no base-URL would be needed.

E. Can we request metadata instead of the object.

Answer: This will depend on the resolution service. Those which allow additional parameters will be able to provide additional services; the content and availability (for the external users) of these services will be made clear. .

F. Will the National Libraries Resolver Discovery Service solve the appropriate copy problem.

Answer: No, since URNs do not solve the appropriate copy problem. For that OpenURL-based additional services will be needed.

G. Can we authorise users from other institutions.

Answer: In principle Yes, but that requires further developments in the international implementation of services based on e.g. Shibboleth.