From: Norman Paskin, Managing Agent, International DOI Foundation
To: Todd Carpenter, Secretariat ISO TC46/SC9
Date: 3 May 2013
Re: Report of the Registration Authority for ISO 26324
for TC46/SC9 Paris meeting, June 2013

Publication of ISO 26324

ISO 26324 Information and documentation — Digital object identifier system was published by ISO, the International Organization for Standardization, on May 1, 2012. The DOI System was approved as an International Standard through ISO in November 2010, but publication was held back awaiting revision by ISO of its generic Registration Authority agreement. ISO 26324 is the instrument through which the DOI System, developed by the International DOI Foundation (IDF) from 1998, was adopted as an international standard, and IDF is the ISO 26324 Registration Authority.

ISO 26324 specifies the syntax, description and resolution functional components of the digital object identifier system, and the general principles for the creation, registration and administration of DOI names. The ISO standard complements, and is compatible with, the existing US National Standard ANSI/NISO Z39.84, Syntax for the Digital Object Identifier (2000, 2005, 2010), through expansion to cover a detailed extensible metadata schema and discussion of the guarantees provided re persistence and interoperability.

DOI System statistics

- 83.5 million DOI names have now been assigned. At the current rate of registration, it is forecast that the significant step of 100 million DOI names will be registered by later in 2013.
- The dx.doi.org proxy resolver (handling DOIs expressed as URLs) is currently receiving 123 million resolution requests per month (=approximately 1.5 billion per annum).
- There are currently almost 10,000 DOI name prefixes (naming authorities within the DOI system) managed under ten Registration Agencies.
- The number of ShortDOIs (which are not DOIs, but are shortcuts to DOIs) is growing at around 30,000 per month.
DOI documentation and brand

Coinciding with the publication of ISO 26324, the DOI Handbook (the main source of information about the DOI System) was fully revised to be compliant with the Standard. The DOI web site was substantially revised, as were the DOI factsheets and FAQs. The DOI website also includes other public information, news, events and Members-only information.

Following a member decision, a new DOI brand identity and logo were introduced in April 2013. Registration Agencies must display the core DOI logo somewhere on their primary corporate website, to indicate membership of the International DOI Foundation. Detailed guidance is available to members in "The DOI Identity", a document that contains full guidelines for members on the correct way to use DOI logos to uniformly present the DOI brand in print and on screen, with examples and illustrations. This document is available to SC9 members on request.

Main DOI System developments since last SC9 meeting

1. New RA: China National Knowledge Infrastructure (CNKI)
The International DOI Foundation announced in January 2013 the appointment of a further Registration Agency in China. China National Knowledge Infrastructure (CNKI), launched in 1988, is the largest authoritative, comprehensive source of China-based information resources in the world, reflecting the latest developments in Chinese politics, economics, humanity and social science, science and technology. The parent company of CNKI is Beijing-based Tsinghua Tongfang Knowledge Network Technology Company (TTKN), founded by Tsinghua University. CNKI publishes databases containing e-journals, newspapers, dissertations, proceedings, yearbooks, reference works, etc. CNKI is the second agency to be appointed in China, with ISTIC already a major agency in the DOI community. The appointment of a second DOI agency in China reflects the importance of the digital sector in one of the world's largest economies. To date, some 15 million DOI names have been registered.

2. Change to existing RA
The existing DOI Registration Agency R R Bowker will cease to offer independent DOI registration services from September 2013, but will now purchase DOI services from other DOI Registration Agencies as needed. R R Bowker will continue to support the DOI System and will continue as a General Member of the International DOI Foundation. Both the International DOI Foundation and R R Bowker will continue to promote interoperability where appropriate between various identifier systems, as highlighted by recent initiatives such as the Linked Content Coalition.

In line with DOI policies, existing DOI names registered via R R Bowker will continue to resolve: the management of these records will be transferred to the existing DOI agency CrossRef (www.crossref.org), ensuring persistence.

3. Improvement to DOI social infrastructure
DOI Registration Agencies are free to offer to their customers unique services built on DOI registration. The DOI system has now agreed an additional Registration Agency Collaboration Policy, which provides safeguards ensuring that customers can choose from multiple Registration Agencies for appropriate services whilst avoiding the allocation of multiple DOI names to the
same entity, or conflicting services for one DOI name. The policy also sets out appropriate measures for sharing information across DOI Registration Agencies within the DOI federation. The policy joins other existing policies which form a social infrastructure unique to the DOI system, which ensures persistence and interoperability. For further information see the DOI Handbook, Chapter 6, Policies.

4. Improvement to DOI technical infrastructure
The DOI system provides a dedicated infrastructure system for DOI users, comprising 33 DOI handle servers in 10 international locations, in addition to the underlying Global Handle Registry™ (GHR) and DOI HTTP proxy servers, all of which are also distributed across multiple international locations. In 2013, the International DOI Foundation is extending this dedicated DOI network further by initiating cloud-based server resources to provide additional flexibility and resilience, and improved management of existing resources. Two different cloud services have been used, resulting in four essentially independent technical hosting services for the DOI System; an analysis and review of next steps will be made in June. Our experience to date indicates that cloud services are remarkably cost effective for lightweight resolution services.

5. Expressing relationships between identifiers: relators
The DOI system can provide support in the development of Linked Data or other mechanisms for relating entities identified with DOI names by offering the resolution capability combined with simple, useful and interoperable semantics to define (or map from existing schemes) specific relationships. An initial, and extensible, set of Relators has been recommended for use by Registration Agencies in devising typed relationships ("this DOI name is related to this other DOI name by a relationship of the defined type...").

The relevant semantics here are the "relators" or (in OWL/RDF terms) "properties" which join two DOI names representing resources or parties. IDF has added a small number of "key" relators to its data dictionary, in its own namespace, representing the most common and important relationships between Resources and Parties in existing content standards and databases. These are then recommended and available to RAs to use within their schemas. See http://www.doi.org/doi_handbook/5_Applications.html#5.6

6. Type registries
Of particular note in the context of resolution of identifiers (specifically multiple resolution), work is underway in several areas to develop a standard set of types for data. The type registry would contain metadata about a certain data type as well as metadata about available services that could be used to process data of a certain type. The combination would allow either humans or machines to encounter data of a certain type, consult a type registry to understand the structure of the data so as to be able to parse it and to find relevant processing services, e.g., visualization. This approach is common and usually implicit within proprietary closed systems but is not yet generally recognised as an inevitable requirement of open linked data. This type registry would provide one means of supporting multiple resolution by adding basic and extensible standard typing of resolution, so that different services (e.g. different metadata types) can be automatically located. We are aware of the following activities, which are being co-ordinated:

- We are participating in the Research Data Alliance (http://rd-alliance.org) Data Type Registries Working Group
• We are also developing our own straw man data model for types which could be tested with the RDA work, offering a means for DOI resolution to be typed. This work is expected to produce some suggestions within the next 12 months.

• The Corporation for National Research Initiatives (CNRI), developer of the Handle System which is used by DOI, is developing an open source Digital Object Based Interoperability Platform (in collaboration with the Alfred P. Sloan Foundation). This is focusing initially on two different use cases, science data and financial entity data, but the underlying principles may be useful for future “content” applications, as this will offer an open source suite for a distributed registration system linking to data and services across multiple existing information management systems, and thus enabling software clients to navigate and query multiple systems without detailed knowledge of those systems.

• The DOI type registry work would lend itself to expression of relators (see point 5 above) as data types.

**Identifier Interoperability**

1. **Linked Content Coalition** The International DOI Foundation continue to participate in the Linked Content Coalition, the framework for a fully interoperable and fully connected standards-based communications infrastructure to help businesses and individuals manage and communicate their rights more effectively online (http://www.linkedcontentcoalition.org/). The LCC published technical material including a detailed data model and identification specification at the end of the project in March 2013. The International DOI Foundation is using LCC specifications in developing further DOI applications complementing techniques already available for using DOI names with Linked Data applications. For further discussion see the report and meeting session of the SC9 Ad Hoc ID interoperability group.

2. **EIDR/ISAN/DOI** EIDR and ISAN have been working together since autumn of 2012, with the aim of allowing users to take full advantage of both systems. (See the press release at http://eidr.org/eidr-and-isan-to-provide-seamless-registration-of-content-ids/) A working group has been conducting technical investigations, and board members from each organization are discussing the commercial and organizational aspects of such cooperation. Major stakeholders have also contributed their views on interoperability between the two systems. EIDR and ISAN presented separately at a meeting of Licenses for Europe (Working Group Three) in March 2012, and made a joint presentation at the April 2013 meeting. (See http://ec.europa.eu/ licences-for-europe-dialogue/ )