The word “identifier” can mean several different things, e.g.:

- **Labels**
  - Output of numbering schemes (ISO, others)
  - e.g. “3-540-40465-1” (an ISBN) [individual label]
  - “ISBN” (an ISO numbering identifier) [scheme]
  - Functional requirements [e.g. persistence] can be defined

- **“Actionable” labels**
  - Infrastructure specifications
  - e.g. URI, URN (URI = Uniform Resource Identifier)
  - “if you follow this spec then you can make the label actionable ...given the right tools...”

- **Implemented systems**
  - Labels, following a specification, in a system
  - e.g. Bar code system, DOI system
  - “if you use this system, then the label IS actionable”
  - Packaged system offering label + tools + business model
  - A packaged system is not essential, but is convenient
“Identifiers”

- DOI = Digital Object Identifier
- An example of an implemented identifier system
- Packaged system of components
- Principles of persistent identification including semantically consistent interoperation

- Implemented systems
  - actionable labels following a specification
  - e.g. Bar code system, DOI system
  - “if you use this system, then the label IS actionable”
  - Packaged system offering label + tools + business model
  - A packaged system is not essential, but is convenient
Tools for description by metadata

Numbering scheme

Policies

Internet Resolution
**DOI syntax** can include any existing identifier, formal or informal, of any entity

- An identifier “container” e.g.
  - 10.1234/5678
  - 10.5678/978-0-7645-4889-4
  - 10.2224/2004-01-Overview-DOI
- NISO standard Z39.84
- First class object: name
  - Not “intelligent” as a label
  - Cannot tell from looking at the DOI
- Redirection through *resolution*
• Resolve from DOI to multiple data:
  - Location (URL) - persistence
  - Multiple locations
  - Metadata
  - Services
  - Extensible

• Uses the Handle system
  - Implementing “URI”
  - Granularity
  - Scalability
  - Administrative delegation
  - Security
  - etc
Why do we need “metadata”?

• Having an identifier alone doesn’t help – we want to know “what is this thing that’s identified?”
  - we want to know precisely
  - precisely enough for automation

• Q: “We have a journal which wants to create a review article which will be extended over time. So today, the article may cover the period from 2000-2003, and next year, 2000-2004. From one perspective, it is the same article; it is just not, and may never be, in its "final" form. Do the article versions need to be maintained separately, and be assigned different identifiers...?”
  - “Is it the same thing”?

• A: could have one ID for all, or each version identified
  - functional granularity
  - BUT to be of any use you must SAY WHAT YOU ARE DOING “say” = through metadata (a declaration, an “Application Profile”)
Why do we need a “data dictionary”?

- There’s lots of metadata already
  - Which should be (re-) used
- People use different schemes
  - So we may need to map from one scheme to another
- Does “owner” in scheme A mean “owner” in scheme B?
  - We need to map meanings
  - Meanings need to be detailed relationships (e.g. consider “rights for this music”: songwriter, artist, label)
- Once done, others can use the mapping
  - Creating extensibility
Data Dictionary: DOI can describe any form of intellectual property, at any level of granularity

- Metadata tool: a data dictionary
- Necessary for interoperability
  - "Enabling information that originates in one context to be used in another in ways that are as highly automated as possible”.
- Able to use existing metadata
  - Mapped using standard dictionary
- <indecs> = interoperability of data in e-commerce systems
  - Adopted by ISO MPEG 21 etc
  - Indecs Data Dictionary
  - MPEG Rights Data Dictionary (RDD)
DOI policies allow any business model for practical implementations

- Implementation through IDF
  - Governance and agreed scope, policy, “rules of the road”, central dictionary, resolution mechanism
  - Cost-recovery (self-sustaining)
- Registration agencies (“franchise”)
  - Each can develop own applications
  - Use in “own brand” ways appropriate for their community
  - Example CrossRef
More than an identifier...

**DOI syntax** can include **any existing identifier**, formal or informal, of any entity

e.g.
10.2341/0-7645-4889-1
10.5678/978-0-7645-4889-4
10.1000/ISBN 0764548891
10.1234/Godfrey_presentation
10.2224/2003-1-29-CENDI-DOI

DOI metadata can be of any type, standard or proprietary

e.g.
OnixForBooks
OnixForSerials
IEEE/LOM
MARC
Dublin Core
Proprietary scheme

(and if you want to interoperate with anyone else in the DOI network, you map to the `<indecs>` Data Dictionary (iDD).

The Handle resolution technology allows you to access **any kind of Service** associated with your DOI.

e.g.

<table>
<thead>
<tr>
<th>Retrieve ebook</th>
</tr>
</thead>
<tbody>
<tr>
<td>Articles and reviews</td>
</tr>
<tr>
<td>Books from same author</td>
</tr>
<tr>
<td>Accompanying music</td>
</tr>
<tr>
<td>Accompanying images</td>
</tr>
<tr>
<td>Accompanying moving images</td>
</tr>
<tr>
<td>Metadata</td>
</tr>
<tr>
<td>Rights information</td>
</tr>
<tr>
<td>Email query to publisher</td>
</tr>
</tbody>
</table>

A package of services is an Application Profile

**NB:** these Services themselves include metadata services
How are costs met?

• **Costs**: need for human intervention and support of an infrastructure. The DOI system operates on the basis that such costs are borne by the assigner of the DOI.

  - **Number and metadata registration** (maintenance of resolution destinations; declaration of metadata; validation of number syntax and of metadata; liaison with the IDF registry)
  
  - **Infrastructure** (resolution service maintenance, scaling and further development; customer guidance and outreach; marketing; administration)
  
  - **Governance** (common "rules of the road"; further development and support of the system)

• The way in which these costs are recouped depends on the application.
How are costs met?

• DOIs are assigned on behalf of registrants (content owners and other bodies) by approved DOI Registration Agencies (RAs).
  - These RAs contribute to the IDF to support the infrastructure (technical and social) which underpins the DOI system.
  - The IDF charges RAs a fee which is part fixed (currently $35K) and part varied (currently $0.04 /DOI) — aiming to reduce this as volume increases

• RAs are free to establish their own business model for the allocation of DOIs.
  - Value-added services offered by a DOI RA will include more than simple provision of a DOI: data, content or rights management.
  - DOI RAs may also choose to collaborate with others in business agreements and services, as well as use the generic facilities offered by interoperability features of DOIs.
  - Business models could include free DOI allocation

• So there is no single business model applicable to all DOI RAs,
  - consequently no single answer to the question of how a DOI is paid for and what it costs.
• Commitment that community of DOI Registration Agencies all follow basic rules:
  - any DOI will do this…
  - some DOIs will also do that…
• Fall back if an RA ceases to operate:
  - The DOIs it has assigned revert to control by the DOI community
  - Basic information message, or full take over of services
  - (or if IDF ceases to operate..)
• Collaboration in maintaining technical infrastructure
  - proxy servers, local Handle servers, mirrors, etc
  - Data Dictionary
• Participation in wider infrastructure
  - Handle, indecsDD
• Standardisation:
  - Currently NISO syntax; IETF Handle; ISO MPEG metadata; governance best practice (ISBN, EAN).
  - Now to move to ISO standard
  - DOI as URI
The DOI System has the flexibility to deliver identification and resolution services that fulfil the requirements of any application domain.

However, these don’t come “in a box”.

- Someone needs to build the specific social and technical structures to support the particular requirements of a community.

The rules about what is identified, and whether two things being identified are (or are not) "the same thing", are made at a lower level: in a specific application of the DOI.

This is a role of DOI Registration Agencies.
Governance

- International DOI Foundation; US-based not-for-profit membership organisation
  - 34 members
  - Total “organisations” users and members c.800
- Current users:
  - 624 naming authorities; 12 m+ DOIs,
  - 5m resolutions/month (*all business uses*)
- 9 Registration Agencies so far (others in process)
  - Mainly text focus so far, others coming
  - CrossRef, CAL, ...
  - Nielsen BookData, RR Bowker (*large ISBN agencies*)
- Initial uses: simple redirection (persistent naming)
  - adding data dictionary uses now
- Recent and forthcoming applications:
  - Photographs; Government documents; Scientific data
  - see www.doi.org
  - Future: Licences, Rights management
  - DOI News (sign up at www.doi.org)
Welcome

CrossRef is the citation linking backbone -- a collaborative reference linking service that allows the user to click on a citation and be taken directly to the target content. Online publishing is raising the bar for resource discovery. The scientific and scholarly community now demands navigational ease at the desktop. More than ever, publishers, librarians, and information aggregators are expected to provide seamless integration of current and archived content across publishers.

DOI Resolver

If you encounter a DOI (e.g., 10.1037/0003-066X.59.1.29) that is not hyperlinked, you can enter it in the box below:

[Input field for DOI]

TIP: You can turn a DOI into a URL by appending http://dx.doi.org/ to the front of it.

[Submit button]
CrossRef, the official DOI registration agency community with easier access to online research documentation to make cross-referee linking thorough.

"DOI" stands for Digital Object Identifier and The DOI is paired with the object’s electronic links while allowing the content to move as needed.

What do DOIs link to? CrossRef DOIs link to published or authenticated users or at no charge, as determined access, journal table of contents and homepages and resources.

The key benefits of the CrossRef DOI for libraries:

- Truly persistent links
  
- Increases usage of acquired resources

info for libraries

Not a primary publisher but interested in using CrossRef to lookup CrossRef member publishers without signing bi-lateral linking agreements.

If you are a database publisher, subscription agent, software vendor CrossRef Affiliate:

- Upon request, CrossRef will send you an Affiliate Agreement. CrossRef will issue you a query account.
- Familiarize yourself with the Affiliate Rules and Fee Schedule.
- Review the CrossRef specifications on How to Query and the
- Affiliates interested in real-time, or dynamic, linking should

CrossRef offers secondary publishers and other affiliates the opportunity to implement.

info for affiliates
Harvard Business Online

- Cases: *Steinway & Sons* by David A. Garvin
- Harvard Business Review: *IT Doesn't Matter* by Nicholas G. Carr
- Books: *The Innovator's Solution: Creating and Sustaining Successful Growth* by Clayton M. Christensen and Michael E. Raynor
- See examples of how DOIs can be embedded into downloadable documents such as PDFs. Each PDF is a "textbook map" showing which Harvard Case Studies HBSP recommends teaching in conjunction with each chapter of the book: *Global Business Today* by Hill (McGraw-Hill), *Finance* by Bodie & Merton (Prentice Hall)

Professional

- *The Rumsfeld Way*, by Jeffrey A. Krames

RAND

- *Networks and Netwars: The Future of Terror, Crime, and Militancy*, edited by John Arquilla and David Ronfeldt
- View additional DOIs for RAND titles by subject area: *National Security, Military Planning, United States*, view all RAND subject areas

Books: *New Catholic Encyclopedia*

View additional DOIs for Gale books by subject area: *Medicine, Music, Encyclopedias*, view all Gale book subject areas

e-Docs: *Sophocles' "Antigone": A Study Guide from Gale's "Drama for Students"*

View additional DOIs for Gale e-Docs by subject area: *European Drama, French Literary Criticism, Classic Fiction*, view all Gale e-Doc subject areas

Mona Lisa by Leonardo Da Vinci

View additional DOIs for Corbis photos by subject area: *Buddhism, Helmets, Sports*, view all Corbis subject areas

The Darwin Awards: *Evolution in Action* by Wendy Northcutt

View additional DOIs for Penguin Putnam eBooks by subject area: *Love Stories, Science Fiction, Westerns*, view all Penguin subject areas

penguin putnam inc

1 | 2 Next>
Cases: Steinway & Sons by David A. Garvin
- Books: The Innovator's Solution: Creating and Sustaining Successful Growth by Clayton M. Christensen and Michael E. Raynor
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- See examples of how DOIs can be embedded into downloadable documents such as PDFs. Each PDF is a "textbook map" showing which Harvard Case Studies HBSP recommends teaching in conjunction with each chapter of the book: Global Business Today by Hill (McGraw-Hill), Finance by Bodie & Merton (Prentice Hall)

Books: New Catholic Encyclopedia
- View additional DOIs for Gale books by subject area: Medicine, Music, Encyclopedias, view all Gale book subject areas
- e-Docs: Sophocles's "Antigone": A Study Guide from Gale's Drama for Students
- View additional DOIs for Gale e-Docs by subject area: European Drama, French Literary Criticism, Classic Fiction, view all Gale e-Doc subject areas

The Rumsfeld Way by Jeffrey A. Krames
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- Publisher Home Page

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Networks and Networks: The Future of Terror, Crime, and Militancy, edited by John Arquilla and David Ronfeldt
- View additional DOIs for RAND titles by subject area: National Security, Military Planning, United States, view all RAND subject areas

The Darwin Awards: Evolution in Action by Wendy Northcutt
- View additional DOIs for Penguin Putnam eBooks by subject area: Love Stories, Science Fiction, Westerns, view all Penguin subject areas
Government documents

- TSO: UK Official Publications now have DOIs
  - Other services planned
- EC Office of Publications
- OECD: all publications, tables, etc
- DoD (with LON): Knowledge Resource System
- Collaborating with CENDI
  - Depts of Commerce, Energy, Defense, etc
Data

- **DOIs for Data:**
  - *German National Library of Science and Technology (TIB), the world's largest library of science and technology.*
  - *Major project funded by DFG: use of DOIs to persistently identify scientific data sets.*
DOIs and EPC (Electronic Product Codes)

- The EAN.UCC system
  - analogy and a model for DOI
  - identifies traded tangible entities
  - EAN bar codes are the main current product
  - AutoID and RFID will be future products: linked to internet
  - Joint study under way re collaboration and possible convergence
Welcome to the Digital Object Identifier System

The Digital Object Identifier (DOI) is a system for identifying and exchanging intellectual property in the digital environment.

A system provides a framework for managing intellectual content, for linking customers with content for facilitating electronic commerce, and enabling automated copyright management for all types of media. The system is managed and directed by the International DOI Foundation. Several million DOIs have been assigned by DOI Registration Agencies in the US, Australasia, and Europe.

DOIs are names (characters and/or digits) assigned to objects of intellectual property (physical, digital or abstract) such as electronic journal articles, images, learning objects, ebooks, images, any kind of content. They are used to provide current information, including where they (or information about them) can be found on the Internet. Information about a digital object may change over time, including where to find it, but its DOI will not change.

Using DOIs as identifiers makes managing intellectual property in a networked environment much easier and more convenient, and allows the construction of automated services and transactions for e-commerce.

To learn more about DOIs, see the Overviews, and begin with the Introductory Overview and Introductory Slide Presentation. The Frequently Asked Questions (FAQs) cover a wide range of topics, both general and technical. For the most complete description of all aspects of the DOI System technology and policy, consult the DOI Handbook.

In the News

R. R. Bowker appointed as RA
EPS Focus Report Published: “DOI in 2004”
Nielsen BookData appointed as RA
Analysis of Economic Benefits of DOI Published
43 National Libraries Participate in the IDF

Resolve a DOI!

Type or paste a DOI (i.e., 10.1000/182) into the text box below.
Identifiers at work

Entities such as:

- **Parties**: Companies, libraries, authors, publishers, etc.
- **Abstractions**: Books, CDs, DVDs, PDF files, MP3 files, etc.
- **Manifestations**: Vanity Fair, Beethoven's Fifth, etc.
- **Licences**: Licence from OUP to MIT #3456, etc.
Mapping to other Schemes

**Entities such as:**
- **Have identifiers**
  - *e.g. ISO:*
  - *e.g. non-ISO:*

**Data model/ontology**

*Define and relate entities to be identified*

**parties**
- ISIL
- IPI

**abstractions**
- ISTC, ISWC, ISAN
- PII

**manifestations** (**“products”**)
- ISBN, ISSN
- SICI

**licences**
- etc...

**structured metadata**

- associated by internal databases or global resolution to

**products**

*in common dictionary allows resolution to*

**Interoperable Public services**

*about identified entities:*

*global, interoperable*

**Mapping to other Schemes**

**Matching**
- *e.g. InterParty*

**Product information exchange formats**
- *e.g. ONIX, PRISM*

**via DOI**