A guide explaining what the Digital Object Identifier system does, the advantages of using a DOI Name to cite and link research data and the ARDC DOI minting service.

Who is this for?

This guide is intended for researchers and eResearch infrastructure support providers.
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What is the DOI System?

The Digital Object Identifier system is used for identifying intellectual property in the digital environment. It is a more rigorous implementation of the Handle System for persistent identifiers. The International DOI Federation (IDF) appoints Registration Agencies who allocate DOI prefixes, register DOI Names, and provide the necessary infrastructure to allow registrants to declare and maintain metadata associated with a DOI.

Major applications of the DOI system currently include provision, linking and tracking of persistent citations in:

- scholarly materials (journal articles, books, etc.) through CrossRef, a consortium of around 3,000 publishers.
- scientific data sets and associated outputs (e.g. grey literature, workflows, algorithms, software etc.), through DataCite, a consortium of leading research libraries, technical information providers, and scientific data centres.

Anatomy of a DOI

A DOI Name (DOI) can be assigned to any object that is a form of intellectual property. DOI should be interpreted as 'digital identifier of an object' rather than 'identifier of a digital object'.

A DOI consists of a unique, case-insensitive, alphanumeric character sequence that is divided into four parts separated by a forward slash:

```
http://doi.org / 10.4225 / 01/4F3DB08617645
```

<table>
<thead>
<tr>
<th>Resolver service doi.org</th>
<th>This ensures the DOI resolves to an online metadata record about the dataset or collection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prefix e.g. /10.4225/</td>
<td>Assigned by a DOI Registration Agency (i.e. DataCite for research datasets and collections) and always starts with ‘10.’ This distinguishes it as a DOI as opposed to other types of Handle</td>
</tr>
<tr>
<td>Institution Suffix e.g. /01/</td>
<td>The ARDC assigns each Australian institution with a unique number which allows that institution to track their downloads and maintain their DOI records e.g. James Cook University is /28/</td>
</tr>
<tr>
<td>Unique Suffix e.g. /4F3DB08617645</td>
<td>Assigned by TheARDC for Australia and is always unique within a prefix</td>
</tr>
</tbody>
</table>
What are the advantages of DOIs for datasets?

A DOI is a Persistent Identifier (PID) with extra benefits described below:

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>High level of confidence in the quality and accuracy of DOIs</td>
<td>Supported by the International DOI Federation (IDF) and Registration Agencies infrastructure.</td>
</tr>
<tr>
<td>Data citation</td>
<td>DOIs require metadata elements which create an unambiguous data citation. For example: Hanigan, Ivan (2012): Monthly drought data for Australia 1890-2008 using the Hutchinson Drought Index. The Australian National University Australian Data Archive. DOI (doi.org/10.4225/13/50bbfd7e6727a)</td>
</tr>
<tr>
<td>Metrics</td>
<td>DOIs are used to track data citations in the same way as journal citation metrics.</td>
</tr>
<tr>
<td>Altmetrics</td>
<td>DOIs are frequently used to track references to datasets in social media.</td>
</tr>
<tr>
<td>Persistence</td>
<td>A DOI indicates that a dataset will be well managed and accessible for long-term use.</td>
</tr>
<tr>
<td>Accessibility</td>
<td>Resolvable DOIs provide easy online access to research data.</td>
</tr>
<tr>
<td>Published data as a first-class research output</td>
<td>DOIs for datasets are equivalent with DOIs for other scholarly publications.</td>
</tr>
</tbody>
</table>

The flow diagram in the next section provides guidance for deciding if you should use a DOI and how to mint a DOI for a dataset.
Digital Object Identifiers (DOIs)

A pathfinder for data managers

Australian publicly funded research organisations and government agencies may use the ARDC DOI service¹ to mint DOIs for data. Data includes data and associated workflows, software, models, and grey literature.

1. CITABLE: Is the data a citable part of the scholarly record?
   - Yes ▼

2. PRESERVE: Can we commit to the long term preservation of and access to the data?
   - Yes ▼
   - No ▲ Use a Handle² or other unique identifier

3. MAINTAIN: Can we commit to maintaining the currency of the URL?
   - Yes ▼

4. METADATA: Can we provide the six minimum metadata¹ elements?
   - Yes ▼

- DOI

- For data deposited or published elsewhere and assigned a DOI
  - Use the DOI assigned by that service

- For data deposited or published in your repository
  - Assign a DOI using the ARDC DOI minting service¹

¹ DOIs: ardc.edu.au/services/identifier/doi
² Handles: ardc.edu.au/services/identifier/handle
DOIs and other persistent identifiers

Using a range of persistent identifiers (PIDs) can contextualise the data by linking it to related outputs, people and projects. They also maximise their discoverability, reach and connectivity.

PID’s such as:

- DOIs for data and publications e.g. of DOIs applied to a:
  - dataset - (doi.org/10.4225/13/50bbfd7e6727a)
  - computational model - (doi.org/10.4225/13/50bbfd7e6727a)
  - dataset and related publication in the same record - (researchdata.ands.org.au/monthly-drought-australia-drought-index/61872)
- ORCID or ISNI ID for people and organisations - e.g. Toby Burrows ORCID record (orcid.org/0000-0002-0469-7584) pulls together over 130 research outputs, including datasets.
- RAiD (raid.org.au) for research projects and activities.
- PURL for for ARC and NHMRC grants e.g. ARC research grant (researchdata.ands.org.au/aaa-proteases-substrate-adaptor-proteins/72812)

ARDC DOI Minting service

ARDC is a member of the DataCite consortium, an international group of leading research libraries and technical information providers that aims to make it easier for research datasets to be handled as independent, citable, unique scientific objects. ARDC mints and manages DOIs for datasets and other associated research outputs on behalf of DataCite through the ARDC DOI minting service (ardc.edu.au/services/identifier):

1. A minting service for research data and related outputs from Australian publicly funded research institutions and government agencies.
2. Available as a machine to machine or manual minting service.
4. Mint DOIs for a wide range of relevant outputs such as:
   a. datasets and collections
   b. associated workflows
   c. software
   d. models
   e. grey literature.

DOIs for versioned data

Researchers need to be able to cite the exact version of a dataset that underpins their research findings.

However, there is no one model for assigning DOIs to versioned data. The Digital Curation Centre (dcc.ac.uk/resources/how-guides/cite-datasets/sec-versions) recommends that “data repositories should ensure that different versions are independently citable (with their own identifiers).” However, this recommendation may be not be applicable across data types and domains.

For example, the Federation of Earth Science Information Partners (ESIP) specifies that a new DOI should be minted for each ‘major’ but not ‘minor’ version. Some common practical approaches can be found on our website (ardc.edu.au/resources/working-with-data/datamanagement) under ‘Data versioning’.

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   d. models
   e. grey literature.
International DOI agencies

- Crossref is used for scholarly and professional publications - crossref.org
- DataCite is an international agency for DOIs for datasets - datacite.org
- The DOI handbook is the primary source of information about the DOI system - doi.org/hb.html

About the Australian Research Data Commons

The Australian Research Data Commons (ARDC) is a transformational, sector-wide initiative, working with sector, government, and industry partners to build a coherent national and collaborative research data commons. This will deliver a world-leading data advantage, facilitate innovation, foster collaboration and enhance research translation.

Visit ardc.edu.au for more information.

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