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D04.02.3 Comparison of using PURI & DOI

Document Metadata

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Authors	Makx Dekkers – AMI Consult Ioana Novacean – PwC EU Services
Reviewed by	Nikolaos Loutas – PwC EU Services Carol Riccalton – Publications Office of the EU
Approved by	Susanne Wigard – European Commission, ISA² Programme

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1. INTRODUCTION

This document is part of TASK-04 "Support Activities" of ISA² Action 2016.07 "Promoting semantic interoperability among EU Member States", commonly known as SEMIC.

As part of deliverable "D04.02 – Report on URI local policies and Good Practices", this work provides support on URI policy. The report comes in the context of the Publications Office of the EU (OP) being asked to give advice on assigning identifiers to the documentary material in the European Commissions' Historical Archives[1]. They had to decide whether to use Persistent URIs under data.europa.eu (henceforth referred as PURI)[2] or the Digital Object Identifier (DOI) system[3].

This study aims to consider issues that should be taken into account when deciding on the best approach for a given project.

1.1. Objectives & scope

The objective of this document is to provide a set of issues for consideration which can be used to assess collections of resources (metadata, data, documents, datasets, etc.) and to decide whether to create URIs under data.europa.eu for these resources, or to assign DOI names as identifiers for them, or both. The issues will result from an analysis of the difference between the use of PURI and DOI.

The scope entails an analysis of the aspects of either of these modalities, in relation to the characteristics of the resources as well as the characteristics of the identifier system.

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[1] European Commission. Historical Archives. http://ec.europa.eu/historical_archives/
[2] European Commission. Joinup. EU Institutions define a common Persistent URI Service. https://joinup.ec.europa.eu/node/157234
[3] The DOI® System. https://www.doi.org/

2. DESCRIPTION OF THE TWO APPROACHES

2.1. Digital Object Identifier (DOI)[4]

DOI stands for Digital Object Identifier, i.e. the digital identifier of an object and not the identifier of a digital object. In this context, the following terms are in use:

- **"DOI name"** for the string that specifies a unique referent in the DOI system; and

- **"DOI system"** for using DOI names as identifiers in computer sensible form through assignment, resolution, referent description, administration, etc.

The DOI system is implemented through a federation of Registration Agencies which use policies and tools developed through a parent body, the International DOI Foundation (IDF)[5] which is the governance body of the DOI system. The DOI system has been standardised through the International Organization for Standardization (ISO) as ISO 26324[6].

Registration Agencies provide services to Registrants, i.e. any individual or organisation that wishes to uniquely identify entities using the DOI system. These services include allocating prefixes, registering DOI names and providing the necessary infrastructure. Registration Authorities are free to develop their own business model for running their businesses; they may offer services to Registrants for free, under a membership scheme, or based on a per-DOI name registration fee. The OP has been a Registration Agency for the DOI since 2004.

Any entity – physical, digital, abstract – can be assigned a DOI name. DOI names may be assigned to an entity if there is a need to share it with a user community or to manage it as intellectual property.

The syntax of a DOI name has three parts:

- A directory indicator (always 10);

- A registrant code assigned by a Registration Agency; and

- A suffix chosen freely by the registrant.

A typical DOI name may look like this:

10.1000/123456

An object receives a DOI name on a permanent basis to act as a resolvable persistent link to current information about that object. Current information in this context may refer to where the object, or information about it, can be found on the Internet. The persistent character of this system means that, while information about an object may change over time, its DOI name will not change.

Resolution in the DOI system is based on the Handle[7] system. A DOI name resolves in the DOI system to values of one or more types of data, relating to the object identified by that DOI name, such as a URL, an e-mail address, other identifiers and

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[4] From selected sections of the DOI Handbook. https://www.doi.org/hb.html
[5] IDF is a not-for-profit, non-stock membership corporation under the General Corporation Law of the State of Delaware, USA. https://www.doi.org/doi_handbook/7_IDF.html#7.1
[6] International Organization for Standardization. ISO 26324:2012. Information and documentation -- Digital object identifier system. https://www.iso.org/standard/43506.html
[7] Factsheet DOI® System and the Handle System®: https://www.doi.org/factsheets/DOIHandle.html

descriptive metadata. DOI names can be treated as URIs by prefixing them with a URL pointing to central resolver services, such as http://doi.org. DOI name resolution is freely available to any user encountering a DOI name. The OP has created its own branded resolution service: https://data.europa.eu/doi.

To promote interoperability within the network of DOI system users as well as to facilitate persistence, the DOI system mandates a minimum set of metadata (the "Kernel" metadata) to describe the referent of a DOI name, supported by an XML Schema. Kernel metadata includes the name (title), type (creation, party, event), character (music, language, image, other). A full list of metadata elements is provided in the DOI Handbook[8].
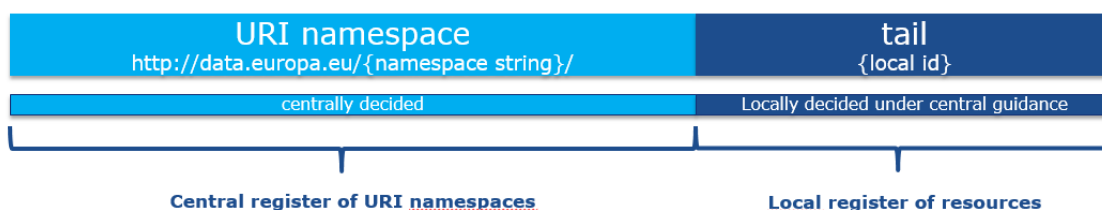
2.2. EU Persistent URI Service (data.europa.eu)

The EU Persistent URI Service[9] has the purpose to support persistent URIs identifying digital resources managed by the EU institutions. The policy underlying the service defines a common governance approach, a common URI design pattern, and a central URI redirection service.

The governance of the service has three levels:

- The EU Open Data Portal Steering Committee takes decisions on the URI policy, the URI management process, the scope criteria, and design rules for URI sets;

- The URI Committee acts as a Secretariat and takes decisions on requests for URI namespaces by applying the scope criteria and design rules, ensuring the permanency of the central URI management;

- The URI Technical Team provides technical support for the management and the monitoring of the URI namespaces

The persistent URIs under the persistent URI policy consist of two parts: one part that identifies a collection, and one part that identifies an individual resource in the collection.

The common URI pattern is:

The *namespace string* is assigned under responsibility of the URI Committee. It is usually an opaque string i.e. a string of characters that has no intended meaning, unless when a collection already has an externally well-known acronym or when existing identifiers for the resources are based on a formal identifier standard. The local institution is free to design and assign the *local id*.

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[8] DOI Handbook. Section 4 Data Model, 4.3.1 DOI metadata Kernel.
  https://www.doi.org/doi_handbook/4_Data_Model.html#4.3.1
[9] European Commission. Joinup. EU Institutions define a common Persistent URI Service.
  https://joinup.ec.europa.eu/node/157234

Namespace strings can be requested by any EU institution for a collection under its control if it meets certain scope criteria. For example, the institution must be the authoritative source for the collection, have a commitment of persistence for the collection and must already have an existing register in which the resources are formally maintained. In addition, the collection must have an inter-organisational character and be associated with machine-readable information.

The central URI redirection service allows for URI redirection on the level of namespace strings. For each namespace string, redirection is configured using one or more redirection rules.

The technical implementation of the Persistent URI Service is currently run for OP by DG DIGIT.

2.3. DOI and Persistent URIs at the OP

The OP plays a role in both the DOI system and the Persistent URI Service.

DOI:

In the context of DOI, OP is a DOI Registration Agency[10], the role of which is to provide services to Registrants of DOI names, including: allocating prefixes, registering DOI names, and providing the necessary infrastructure.

OP maintains a central register of DOI names and their redirection for the European institutions and assigns prefixes to institutions that want to assign DOI names to their resources. In most cases the OP also creates the suffix (an opaque number). However, in some well-defined cases, responsibility is devolved to the authoring institution who assigns DOI names under a pre-assigned prefix and is responsible for registering the DOI with associated metadata including URL for resolution. The central register redirects individual DOI names to the actual URLs where the resources are made available.

In some cases, OP shares metadata of OP-registered DOIs with Crossref[11] and DataCite[12].

PURI:

In the context of the Persistent URI Service, OP chairs the URI Committee that assigns namespace strings to collections proposed by managing institutions for redirection under the Persistent URI Policy.

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[10] DOI Handbook. Registration Agencies.
 https://www.doi.org/doi_handbook/8_Registration_Agencies.html
[11] Crossref. https://www.crossref.org/
[12] DataCite. https://www.datacite.org/

3. ISSUES FOR CONSIDERATION

3.1. Characteristics of the collection of resources to be identified

3.1.1. Type of collection

Objective: Use an identifier system that is appropriate for the type of resources.

DOI:

As stated in the Factsheet on the DOI® System and Standard Identifier Schemes[13], *the scope of the DOI System is potentially any resource involved in an intellectual property transaction*. According to this statement, the scope of the DOI system is not restricted to any particular type of resources – e.g. DOI names could in principle be assigned to real-world objects or to abstract ideas. However, in practice, DOI names are most commonly assigned to resources that could be called 'document-like objects'. Such resources include text documents, datasets, images, sound and video or other types of digital files. Such 'document-like objects' have typically gone through a publication process and are managed as self-contained resources with clearly defined, and stable content. Consequently, a DOI-based approach is very much present in the areas of libraries, archives and digital publication.

PURI:

Some types of resources, which are managed as a collection of smaller items that might change, usually receive URIs in a namespace owned by the organisation that maintains the resources or through more general redirection services such as purl.org. These resources could be metadata schemas or terms in controlled vocabularies, while the changes could refer to addition, modification or deletion of items. Examples include the namespaces maintained by W3C for various ontologies and vocabularies – e.g. http://www.w3.org/2004/02/skos/core#, http://www.w3.org/ns/dcat, or the Dublin Core terms namespace http://purl.org/dc/terms/.

However, the Persistent URI Service is also used for identification of datasets in the JRC Data Catalogue (http://data.europa.eu/89h/) and for identification of legal resources (http://data.europa.eu/eli/).

Conclusion:

DOIs are most commonly used for document-like resources created and managed in publication processes. DOIs are not commonly used to identify terms in controlled vocabularies and similar resources.

Terms in controlled vocabularies and codelists may be better served by persistent identifier schemes such as operated under the Persistent URI Service, operated by the organisation itself or by more general redirection services.

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[13] Factsheet DOI® System and Standard Identifier Schemes. https://www.doi.org/factsheets/DOIIdentifiers.html

3.1.2. Size of collection, scalability

Objective: Use identifier system that is appropriate for the size of the collection and its expected future growth.

DOI:

DOI names can be assigned to any number of resources. However, the fact that redirection records need to be kept for each individual resource requires the availability of potentially large correspondence files between DOI names and URLs. According to the DOI Factsheet[14], in terms of scalability, the Handle system on which the resolution of DOI names is based was not designed to scale above a few million handles; the DOI system adds a more robust database implementation capable of scaling to any number of handles. Until August 2017, approximately 148 million DOI names have been assigned to resources, giving rise to over 5 billion resolutions per year[15].

PURI:

The Persistent URI service can support redirection for any number of collections, although scalability to large numbers has not been considered at this time. The service is designed to work on the level of collections, and is agnostic to the number of resources within those collections.

Conclusion:

Both the DOI system and the Persistent URI Service can support redirection for collections of arbitrary sizes. A difference is that the DOI system maintains correspondence tables between DOI names and URLs for all individual resources, while the Persistent URI service only maintains a correspondence table on the level of collections.

The DOI system includes explicit considerations related to scalability – as it states that it is capable of scaling to any number of handles. The aspect of scalability has not been considered explicitly for the Persistent URI Service, but, as it is designed to work on the level of collections, this is less critical.

3.1.3. Rate of change

Objective: Use identifier system that supports the expected rate of change.

DOI:

The DOI system is specifically designed to provide a solution for situations where the organisation responsible for a collection of resources changes, for example when an organisation ceases to exist or hands over responsibility for a collection to another organisation. For other types of changes, such as a relocation of a collection to a different Internet address, the DOI system requires an update to the correspondence tables so that the DOI names for the items in the collection are redirected to the new URLs.

The growth of a collection, in terms of adding items, may occur more frequently, for example if the collection includes documents or datasets that are being produced in an ongoing publication process. The DOI supports the addition of new items in a

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[14] Factsheet. DOI® System and the Handle System®. Section Technical Infrastructure.
https://www.doi.org/factsheets/DOIHandle.html
[15] DOI® Factsheet. Key Facts on Digital Object Identifier System.
http://www.doi.org/factsheets/DOIKeyFacts.html

collection through the addition of a new record in the per-item correspondence table between DOI name and URL.

PURI:

The Persistent URI Service is based on a policy that assigns a collection identifier (namespace string) that is independent of the organisation or agency responsible for the collection, thereby allowing transfer of responsibility for a collection without the need to reissue URIs. In case a collection moves to a different Internet address, a single record in the redirection table of the Persistent URI Service needs to be updated to point to the new location. The growth of the number of items in a collection is invisible to the Persistent URI Service.

Conclusion:

On the level of the collection, changes in responsibility for a collection will occur only very occasionally – maybe once every 5-10 years. Relocation may occur more often but also not very frequently – maybe once every 1-3 years. Both the DOI system and the Persistent URI Service support such collection-level changes, with the DOI system requiring updates to all records for the individual items and the Persistent URI Service only requiring an update to one collection-level redirection record. For adding an item to a collection, the DOI system requires the introduction and propagation of a new correspondence record, while no actions are required for the Persistent URI Service.

3.1.4. Structure of the collection

Objective: Use identifier system that supports the structural characteristics of the collection.

DOI:

The DOI system treats the resources to which DOI names are assigned as independent, i.e. apart from their grouping under a registrant's prefix, *'the DOI name is an "opaque string" or a "dumb number" — nothing at all can or should be inferred from the number in respect of its use in the DOI system'*[16]. This does not restrict the way a registrant can incorporate structural elements in the DOI name, such as http://doi.org/10.1000/12345 for a book and http://doi.org/10.1000/12345.ch1 for the first chapter of the book, or http://doi.org/10.1000/12345.01 and http://doi.org/10.1000/12345.02 for two items in the same collection. However, the DOI system does not assign any meaning to such local assignments.

PURI:

The Persistent URI Service allows local parts of the Persistent URI, i.e. the part of the URI that follows the collection identifier, to include elements that reflect the internal structure of the collection. For example, the local part of the URIs for the terms in the ADMS controlled vocabularies include an indicator for the specific vocabulary, e.g. a member of the ADMS Status vocabulary has URI http://data.europa.eu/3b1/**status**/Completed and a member of the ADMS Publisher Type vocabulary has URI http://data.europa.eu/3b1/**publishertype**/LocalAuthority.

Conclusion:

The DOI system does not allow assumptions to be made about the relationship between resources with different DOI names even if those names are similar.

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[16] DOI® Handbook, section 2 Numbering, 2.2 Syntax of a DOI name
https://www.doi.org/doi_handbook/2_Numbering.html#2.2

Relationships between resources can however be expressed in the metadata associated with the related DOIs. The Persistent URI Service on the other hand allows grouping of resources under sub-collections in the local part of the URI.

3.1.5. Audience and intended use

Objective: use an identifier system that corresponds to the expectations of the audience.

DOI:

The main users of the DOI system are in the broad area of publishing, and more specifically in publishing of scholarly and scientific research. Other areas include material published by the European Union and movie and television assets. These are the areas covered by the Registration Agencies[17].

In particular in the research domain, the fact that a resource (report, journal article, dataset) is identified with a DOI name lends credibility to the resource. This is due to the perception that the fact that a resource is identified with a DOI name implies persistence of the access to the resource. The DOI name may be required by aggregators as the identifier of the resource.

PURI:

The audience for the Persistent URI Service will include every person or application that needs to refer to material that is managed by one of the EU institutions. The fact that the PURIs are assigned under a subdomain of europa.eu lends credibility on the basis of the European Union's stability and trustworthiness.

Conclusion:

Depending on the audience for which the resources are intended, assigning DOI names or PURIs may increase the credibility concerning the persistence of the access to the resources. In cases where there are multiple audiences with different expectations, it may be worth the additional resources to operate more than one identifier system in parallel, e.g. DOI to connect with the general publishing worlds and the European Legislation Identifiers (ELI)[18] to connect with the legal profession.

Use of the namespace string **/doi/** under data.europa.eu as a parallel resolution approach builds on the strength of both approaches. For example, both http://doi.org/10.2833/80717 and http://data.europa.eu/doi/10.2833/80717 lead to the same publication at URL https://publications.europa.eu/en/publication-detail/-/publication/2e046bd0-b542-11e7-837e-01aa75ed71a1/language-en.

3.2. Characteristics of the identifier system

3.2.1. Governance

Objectives: Ensure influence on the governance of the identifier system, including specifications and infrastructure, so that organisational

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[17] DOI. Registration Agencies - Areas of Coverage. http://www.doi.org/RA_Coverage.html
[18]

requirements are taken into account; ensure openness and transparency of governance structures and processes.

DOI:

The governance of DOI[19] comes under the remit of the International DOI Foundation (IDF), which provides the social infrastructure, e.g. obligations for persistence and back-up in the event of failure, incidents, etc. IDF is a not-for-profit organisation with open membership (with a membership fee). It is governed by its members[20], through an elected board. The Board is responsible for all aspects of management of the DOI system, including policy formulation and standards maintenance[21]. Members can influence the strategic direction through their representation on the IDF Board. The OP as a DOI Registration Agency has a place on the IDF Board. It actively participates in the annual strategy meeting which dictates the policy of the IDF.

PURI:

The governance of the Persistent URI service is organised on three levels: the EU Open Data Portal Steering Committee issues the Persistent URI Policy under which the Persistent URI service is provided and may from time to time revise this policy. The URI Committee plays the role of secretariat. Membership of the URI Committee consists of staff of one or more EU institutions dedicated to taking decisions on URIs under this policy. A Technical Team performs the day-to-day operational tasks related to the provision of the Persistent URI Service and implementing the decisions of the URI Committee.

Conclusion:

Influence by authoring/managing institutions in DOI governance is indirect through the representation of the OP in the IDF Board, while all authoring/managing institutions can have direct influence in the governance of the Persistent URI service through representation in the EU Open Data Portal Steering Committee.

3.2.2. Persistence

Objective: Ensure long-term persistence of the resolution of identifiers and of the resources identified.

DOI:

Persistence of DOI information is a key aim of the DOI system, and is guaranteed by the DOI social infrastructure, policies and agreements[22]. Several technical and organisational aspects of the DOI system are addressed in the policies, and the institutional players in the DOI system (the International DOI Foundation and the Registration Agencies) commit to those policies. The persistence of the object that is identified by a DOI name is the responsibility of the organisation that has registered the DOI name. Registration Agencies may provide quality control and data checking.

PURI:

Persistence of the URIs managed by the Persistent URI Service is part of the Persistent URI policy. Agreements may be concluded between service provider and collection owners to ensure persistent resolution of URIs under the policy. The

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[19] DOI Governance. https://www.doi.org/factsheets/DOIKeyFacts.html
[20] IDF members. https://www.doi.org/idf-member-list.html
[21] DOI handbook. https://www.doi.org/doi_handbook/7_IDF.html#7.5
[22] DOI policies. https://www.doi.org/doi_handbook/6_Policies.html#6.5

Persistent URI Service may use redirection logs to check whether redirected URIs indeed lead to existing resources.

Conclusion:

Persistence is explicitly addressed in policies around the DOI system. DOI persistence is ensured through the design of the system and through formal agreements between the IDF and the Registration Agencies and quality control services provided by Registration Agencies to DOI registrants. This chain of commitments and services ensure the persistent resolution of DOI names.

For a local Persistent URI policy, the service provider and the collection owners may conclude bilateral agreements, while the Persistent URI Service may execute quality checks on resolved URIs.

3.2.3. Cost

Objective: Minimise costs related to the assignment of identifiers and operation of resolution services

DOI:

The operation of the central register for DOI names involves costs related to availability and maintenance of hardware and software, plus cost of staff time for maintenance. A DOI Registration Agency incurs costs in membership of the International DOI Foundation. Further costs may occur if a Registration Agency becomes a member of other Registration Agencies (such as Crossref or DataCite).

A Registration Agency may cover these costs by charging DOI registrants, but it has no obligation to do so. The OP takes up these costs and does not re-charge them to the authoring institution. Apart from the fees levied by Crossref per DOI name, these are fixed costs already taken into account with the regular budget at OP.

PURI:

The operation of the central registers for PURI also involves costs related to availability and maintenance of hardware and software, plus the cost of staff time for governance and maintenance. In addition, the Persistent URI Service is provided by DG DIGIT at a cost per redirection record.

Conclusion:

Both DOI and a Persistent URI service require investment in hardware and software and resources for maintenance. The cost associated with the DOI system pays for the technical and organisational infrastructure, while in the case of the Persistent URI Service the cost pays for the redirection service.

3.2.4. Services

Objectives: Provide or gain access to additional services related to the identifier system.

DOI:

The DOI system establishes a collaborative network of Registration Agencies that provide services to their members. For example, membership of Crossref gives

access to a 'Cited-by' service[23] that shows authors and readers what other Crossref content is citing their content.

PURI:

The Persistent URI Service does not currently provide additional services to the redirection.

Conclusion:

The DOI system gives access to additional services, while the Persistent URI Service does not.

3.2.5. Maintenance effort

Objective: Minimise maintenance effort for the creation, maintenance and resolution of the identifiers; maximise operational quality of the resolution service

DOI:

The DOI register maintains redirection to individual resources with DOIs assigned by authoring institutions. A DOI resolution service provided by a DOI Registration Agency requires the provision and maintenance of a redirection file with DOI name-to-URL mapping for all DOI names issued under the authority of that registration agency.

Example:

- http://doi.org/10.1000/001 → http://example.org/siteA/folderB/item001
- http://doi.org/10.1000/002 → http://example.org/siteA/folderB/item002

The Registration Agency may put tools at the disposal of the registrant of DOI names to update the correspondence tables in case the URLs of the resources identified with DOI names change.

PURI:

The PURI register only maintains redirection for the collection identifiers. A collection-level Persistent URI Service requires the provision and maintenance of a redirection file with mapping from the domain and collection identifier to the actual location of the collection, for all collections for which the Persistent URI Service provider has issued collection identifiers.

Example:

- http://persistenturiservice.org/coll001/* → http://example.org/siteA/folderB/* with '*' indicating that all URIs under /coll001/ will be directed to http://example.org/siteA/folderB/

The Persistent URI Service provider may put tools at the disposal of the collection manager to update the redirection in the cases that the URLs of the resources identified with PURIs change.

Conclusion:

In both cases, the OP provides tools for authoring institutions to convey redirection information for the central register. In cases where a collection is relocated, the PURI

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[23] Crossref. Services. Cited-by. https://www.crossref.org/services/cited-by/

register requires the update of one redirection record; the DOI register requires the update of the redirection records for all the DOI names under the prefix.

The operational guarantees are similar on the part of the OP. On the part of the authoring/managing institution, both approaches should be based on mutual trust between the OP and the authoring/managing institution, possibly supported by an explicit Service Level Agreement.

3.2.6. Monitoring and quality assurance

Objectives: Ensure that authoring/managing institutions correctly apply policies and honour persistent commitments.

DOI:

The DOI system requires authoring/managing institutions to register the DOI names for each individual resource. This enables the Registration Agency to have a complete view of all resources that are part of the system, and allows monitoring of the accesses to the resources.

PURI:

The Persistent URI Service requires collection managers to register the redirection on the collection level. The Persistent URI service does not have a complete view of all resources that are part of the collection and therefore cannot directly monitor the accesses to the resources.

Conclusion:

The DOI system allows control over the policies and quality concerning accesses to the individual resources, while the Persistent URI Service only has control over the accesses to the collections.

3.2.7. Branding/corporate visibility

Objectives: Ensure the right level of branding in the usage context of the resources, for instance by building on trust within specific communities, or building on the trustworthiness of the organisation itself.

DOI:

The DOI system and DOI names are well-known and respected in many areas, for example in publishing of books, reports, journals and journal articles, conference proceedings and datasets. In those environments, the fact that resources are identified with a DOI lends credibility to the resources and their persistence.

PURI:

The Persistent URI Service at the OP, which issues URIs such as http://data.europa.eu/mg8/itemX, links the URI visibly to the European Union. As the EU is a stable and trustworthy structure, this lends credibility to the resources and their persistence, including in areas where the DOI system is not widely applied. At the same time, it gives an opportunity to the OP to underline its role as the leading EU institution in the areas of information management and governance.

Conclusion:

Branding under DOI and under a local Persistent URI Service lends credibility of resources for different audiences and environments. Dual branding, by assigning a

collection identifier to DOI under a local Persistent URI Service, combines the strength of the two approaches.

4. CONCLUSIONS AND CONSIDERATIONS

Aspect	DOI	PURI
Characteristics of the collection of resources to be identified		
Type of collection	No limitation, mostly used for 'document-like objects'.	No limitation.
Size of collection, scalability	No limitation, redirection records on the level of individual resources (DOI-to-URL).	No limitation, redirection records on the level of collection (PURI namespace to collection location).
Rate of change	Allows for change in ownership and location, requires individual redirection records to be updated.	Allows for change in ownership and location, requires collection-level redirection records to be updated.
Structure of the collection	Allows creation of DOI names reflecting collection structure, but no meaning in syntax.	Allows use of significant sub-collection strings in local part of URI.
Audience and intended use	Credibility in areas of publishing and research.	Credibility in areas of EU and member state public sector.
Characteristics of the identifier system		
Governance	Direct influence for Registration Agencies through IDF Board.	Direct influence for EU institutions through Open Data Portal Steering Committee and URI Committee.
Persistence	Commitment to explicit policies.	Commitment to European Commission's Persistent URI Policy.
Cost	Operational cost (hardware, software, human resources). Membership fee for Registration Agency. Additional cost for cross-agency membership (e.g. Crossref, DataCite).	Operational cost (hardware, software, human resources). Additional fees for running of redirection service.
Services	Access to services provided by members of the DOI network.	No additional services at this time.
Maintenance effort	Potentially large amount of redirection records for individual resources, tools are available to reduce maintenance effort in case of changes.	Limited amount of collection-level redirection records, tools are available to reduce maintenance effort in case of changes.
Monitoring and quality assurance	Resolution service can monitor redirection to individual resources.	Resolution service cannot monitor redirection to individual resources.
Branding/corporate visibility	Building on awareness and respect in certain domains.	Building on trustworthiness of European Commission. Dual branding through parallel resolution service for DOI as part of PURI redirection.

Concerning characteristics of collections or resources to be identified:

- Both DOI names and data.europa.eu URIs can in principle be used for any type of collection, irrespective of type, size, structure and rate of change.

- DOI names are good for 'document-like objects' (books, reports, journal articles, datasets) that go through some sort of publishing process, in particular for material where the main audiences are part of communities where DOI names are seen as good practice and contribute to trustworthiness of the resources.

- PURIs under data.europa.eu are good for 'metadata' resources, i.e. schemas, controlled vocabularies, although also in use for datasets (JRC Data Catalogue, http://data.europa.eu/89h/) and legal resources (ELI, http://data.europa.eu/eli/).

Concerning characteristics of the identifier systems:

- Using the DOI system implies building on an existing, external technical and organisational infrastructure with additional services which involves paying fees and sharing governance with other organisations, and benefiting from the DOI brand which is well-regarded in some communities (e.g. publishing, research).

- Using the EU Persistent URI Service implies full control over the governance and technical implementation, benefiting from the brand of the EU which is well-regarded in many communities (e.g. public sector in Europe).

- Dual branding, resolving DOI names through the redirection through data.europa.eu/doi/, combines the strength of both approaches.