	A	B	C	D	E	F	G	H	I	J
1			Identification scheme	Identification scheme	Identification scheme	Identification scheme	Identification scheme	Identification scheme	Identification scheme	Identification scheme
2	Axes	Criterion	DOI	ARK	OID	PURL	Handles	UUID	XRI	LSID
3	**ID Assignment / Maintenance Issues**	**1. What is relationship with URI (Addresses unique identifier capability)? (Addresses unique identifier capability, and interoperability)**	Uniform Resource Identifier (RFC 3986) provides an extensible means for identifying a resource within the World Wide Web. The syntax for Uniform Resource Identifiers (URIs) is much more restrictive than the syntax for the DOI. DOIs can identify physical objects as well as digital objects and may be used in applications other than the WWW or Internet. DOI is registered with info URI scheme (RFC 4452: http://info-uri.info).	The syntactical requirements of an ARK meet the requirements for a URI, but extend the definition of a URI by assuming the existence of a "set of verifiable assertions, or metadata about the object" that make explicit the association between an identifier (as a string of data) and the object being identified. That is, an ARK is a special URI / URL that provides access to an information object, its metadata, and a policy statement from the provider regarding its maintenance promises.	Not a URI.	A PURL is a URL, and so can be considered a URI. PURLs are usually assigned only to digital objects that are locatable on the WWW. Considered a URL whose task is to locate a resource, a PURL is an HTTP URI in a domain backed by a strong persistence policy.	Handles can be used natively, or expressed as Uniform Resource Identifiers (URIs). Although the Handle System is not currently a registered stand-alone implementation of URI, it is a part of the info URI specification, RFC 4452 http://www.rfc-editor.org/rfc/rfc4452.txt).	By virtue of its being capable of serving as a URN, a UUID can be considered a URI.	An XRI is transformed into a URI by adding "http://xri.net/" at the beginning and then appending the XRI. This URI then resolves to an XRDS (Extensible Resource Descriptor Sequence) document which is a simple XML document. XRIs can resolve to an XRDS document also by use of the HTTP(S) protocol. The 2nd form is called HTTP XRI or HXRI. Other parameters can be added to the HXRI to further specify the resolution of the XRI. See: https://www.fullxri.com/documentation/DocumentationPage/category/1/entry/4/ for documentation from one of the registry services about the advantages of XRI.	By virtue of being included in the URN namespace (and URN being is a URI), LSID is a URI.
4		**2. What is relationship with URL (one of the main citable locator schemes)?**	As a Uniform Resource Identifiers (URIs), the Uniform Resource Locator (URL) syntax is much more restrictive than the syntax for the DOI. When DOIs are embedded in URLs, they must follow the URL syntax conventions. A DOI name may be represented as a URL (http string) by prefacing the string http://dx.doi.org/ to the DOI of the document (e.g., to resolve the DOI name 10.1000/182, enter into a browser the address: http://dx.doi.org/10.1000/182).	A properly formed ARK identifier conforms to a URL with the addition of a Name Mapping Authority Hostport (NMAH) of http://organization name/ that precedes the ark: label. An ARK is a URL, but has specific syntax requirements for the "label" part of the URL. [http://NMAH/ark:/NAAN/Name[Qualifier]. The NAAN is the Name Assigning Authority Number - a mandatory unique identifier of the organization that originally named the object; the NMAH is the Name Mapping Authority Host - optional and replaceable hostname of an organization that currently provides service for the object; the Qualifier is an optional string that extends the base ARK to support access to individual hierarchical subcomponents of an object, and to variants (versions, languages, formats) of components.	Not a URL. Does not support use as a locator.	A PURL is a URL, but has no specific or proprietary syntax for the naming part of the URL.	Handles can be used natively, or expressed as Uniform Resource Identifiers (URIs). Although the Handle System is not currently a registered stand-alone implementation of URI, it is a part of the info URI specification, RFC 4452 http://www.rfc-editor.org/rfc/rfc4452.txt). Handles may also be expressed as Uniform Resource Locators (URLS), by the use of an http proxy server (http://www.handle.net/proxy.html).	Not a URL by itself. No mechanism per se of resolving the location of a UUID.	By using the proxy resolvers described above, an XRI can resolve to the location of a digital resource.	There are mechanisms for building a resolution service using URLs with LSIDs with an LSID Server Framework, but an LSID per se is not a URL.
5		**3. What is relationship with URN (as internet naming scheme)?**	DOI is not registered as a URN namespace, despite fulfilling all the functional requirements, since URN registration appears to offer no advantage to the DOI System. It requires an additional layer of administration for defining DOI as a URN namespace (the string urn:doi:10.1000/1 rather than the simpler doi:10.1000/1) and an additional step of unnecessary redirection to access the resolution service, already achieved through either http proxy or native resolution.	ARK is not an IANA registered URN namespace either formally or informally. URNs are designed to describe an identity rather than a location; thus, because an ARK specifies a location (along with an implied commitment to persistence by virtue of its specific syntax), it is not a URN. Also, URN namespace assignments are handled via the IANA, the Internet Assigned Numbers Authority. Namespaces for the ARK are maintained as part of the NAAN Registry which is maintained by the California Digital Library and replicated at the Bibliothèque Nationale de France and the National Library of Medicine.	Can be expressed as a URN by prepending "urn:oid:". Is an IANA registered URN namespace per RFC3061.	A PURL can become a URN by attaching the requisite URN: path prefix and adding a naming authority (/org/oclc) in front of the name (/purl/keith/home),as in URN:/org/oclc/purl/keith/home. By itself, however, it is not a registered IANA namespace.	Handles can be used natively, or expressed as Uniform Resource Names (URNs) . Although the Handle System is not currently a registered stand-alone implementation of URN, it is a part of the info URI specification, RFC 4452 http://www.rfc-editor.org/rfc/rfc4452.txt).	UUID is an IANA registered namespace per RFC4122.	While XRI is not registered as a URN per the URN Syntax (RFC2141), a properly designed XRI can meet the reqs for RFC 1737 (Functional Requirements for Uniform Resource Names). XRIs were designed to offer additional features that URNs don't, i.e., support for XRI defined synonyms for a resource, global context symbols for identifier authorities,and a syntax for cross referencing other URIs. See: http://equalsdrummond.name/2005/08/02/urns-and-open-tagging/ and http://en.wikipedia.org/wiki/Extensible_resource_identifier.	LSID is not a registered URN namespace per the IANA registry, but is considered a URN by using the form urn:lsid:authority:name:.
6		**4. What are roles & rights for roles to assign IDs, delete IDs, edit IDs or associated MD?**	With EZID service, one or more user names / passwords can be set up using groups for an account to assign IDs, add and edit required and optional descriptive metadata about the resource. IDs cannot be deleted or edited after creation. IDs can be added one by one batch loaded using an API. All rights are associated with the user name; any restrictions would have to be managed by the account holder.	Besides the inherent existence of a hostname or National Mapping Authority (NMA) in the syntax of an ARK, there is also the assumption of a Name Assigning Authority Number (NAAN) that is given to an organization whose responsibility it is to name an object and maintain the names of all objects it assigns. The roles & rights to manage the IDs would depend upon the organization that is managing the names. In the case of the EZID service, the same assumptions apply to ARKs as for DOIs. To mint ARKs, any softwaremay be used that can produce identifiers conforming to the ARK specification such as the open-source "noid" software. The EZID Service provided by the California Digital Library also mints ARKs under the same arrangements described as with DOI assignment.	User takes on all responsibility for managing a namespace. There is no batch mechanism for creating root namespaces.	PURLs can be created by registered user s who may belong to groups, and who are therefore included on access lists with the rights to read, write and/or maintain PURLs and PURL domains, on a given PURL Server. PURLs can also be modified (by submitting a PURL of type clone), searched, validated, or rendered null (causing a history page to be returned noting the deprecation of a PURL) by registered users.	Conducting handle administration (i.e., creating, modifying, and deleting individual handles) requires authentication by the Handle System. Authenticatication requires an ID that uniquely and globally identifies the administrator, and could be a handle as well. The information necessary to locate, access, contact, authenticate, or otherwise make use of the resources can be changed as needed to reflect the current state of the identified resource without changing its identifier, thus allowing the name of the item to persist over changes of location and other related state information. The roles & rights related to administering handles, and the editing or the contextual information will depend upon the implementation system used. See: http://www.handle.net/overviews/system_fundamentals.html#persistence	Anyone can create a UUID as there is no central registration for them. There are several variants and versions of UUID, characterized by the mechanism by which they are created, e.g., using MD5 hash or Unix. Since there is no central registration, the deletion or editing of a UUID is not relevant.	To implement the use of XRIs, either an i-name (a reassignable, human-friendly XRI) or an i-number (a persistent, machine-friendly XRI) needs to be created. A fully implemented XRI should also include the assigned of a small subset of metadata based on the XRI Metadata 2.0 specification to aid cross-context interoperability. The infrastructure to create the XRIs would need to be developed by the company or project intending to use them as has OpenID. A public registry has been available for both i-names and i-numbers called XDI.org. XRIs in the form of i-names can be reassigned or deleted; XRIs in the form of i-numbers are never reassigned.	IBM developed the software to create LSIDs and made it available as open source. A database for containing the LSIDs and the metadata associated with it must be part of any LSID implementation, so the roles & rights associated with the creation of the IDs will depend upon the system used. TDWG recommendations state that a client using an LSID should "dereference" an LSID rather than infer any relationships among objects or find the status of objects, and rely upon the metadata that must be returned with the LSID.
7		**5. Is it possible to batch create identifiers? If so, how done? (Addresses scalability)**	An Application Programming Interface is available for batching creation of DOIs from the EZID service.	An Application Programming Interface is available for batching creation of ARKs from the EZID service.	User takes on all responsibility for managing a namespace. There is no batch mechanism for creating root namespaces.	PURLs can be batch created and modified by registered users by submitting an XML document from an input schema using the RELAX NG syntax. Batch operations are not available for searching or rendering PURLs null.	The capability of batch creating identifiers will depend upon the underlying infrastructure used to implement the Handle System.	Yes, depending upon the mechanism used.	Seemingly not available	Unable to determine.
8		**6. Is a registry or registration service required or provided? (Addresses third party maintenance)**	There are several services available that provide registration of DOIs with the DOI Registry: CrossRef used quite extensively for traditional published resources, such as journal articles, books, etc. CrossRef has less experience with datasets and other non-traditional resources. EZID is a service offered by the CDL in conjunction with the DataCite Consortium. EZID was chosen for the testbed because of its focus upon assigning IDs to data sets.	The EZID service provides registration services for ARKs in addition to DOIs. The registry of all currently assigned NAAN's that assign ARK name is maintained by the California Digital Library (host for EZID) which is mirrored at the (U.S.) National Library of Medicine and the Bibliothèque nationale de France. EZID is a service offered by the CDL that registers Name Authority Agencies and Name Mapping Hostports for ARKs. EZID was chosen for the testbed because of its focus upon assigning IDs to data sets, and because it could assign both DOIs and ARKs.	There are several informal, best-effort registries.	The registration of a PURL is done by a given PURL Resolver.	The interoperable network of distributed handle resolver servers (also known as the Proxy Server System) are linked through a Global Resolver (which is one logical entity though physically decentralised and mirrored). Users of Handle System technology obtain a handle prefix created in the Global Handle Registry`. The Global Handle Registry maintains and resolves the prefixes of locally-maintained handle services. Any local handle service can, therefore, resolve any handle through the Global Resolver.	No.	XDI.org is ostensibly the public registry organization for i-names and i-numbers, but now seems to be mostly related to OpenID Connect, one of the main projects that used XRIs initially. I-names can be registered at the "@fullXRI" registry provided by inames.net at https://www.fullxri.com. Other registries include 1id.com, and @freeXRI which is offered by the same organization as the @fullXRI service.	No central registration service is available for LSIDs. Similarly to the UUID, this fact is considered by proponents to be a benefit because of the distributed nature and diversity of the biological resources that the LSIDs are intended to identify.
9		**7. If a registry service is available, what are the services provided?**	The EZID service provides identifier creation and resolution, as well as metadata entry and maintenance services. EZID's DOI services are dependent upon services provided by two external entities: DOI Registry services--German National Library of Science and Technology (TIB); DOI Resolution services--International DOI Foundation (IDF) and the Handle System.	Included in the ARK specification are generic service definitions for description, access & location, and generic policy services for declarations of object permanence, object naming, object fragment addressing, and operational service support, etc. The EZID Service can provide all these services, if full use is made of these ARK capabilities. At this time, the EZID service provides identifier creation and resolution, as well as metadata entry and maintenance services for ARKs as well as DOIs. EZID uses the N2T's (Name to Thing) database for resolving the ARKs created in association with its services. The EZID service can create ARKs using the open source NOID (Nice Opaque Identifers) software.	Lookup.	A PURL Resolver should be able to allow the creation, validation, modification, searching and rendering a PURL "null" (but not deleting) within its database.	There are two levels of service: a top level known as the Global Handle Registry, and a lower level that consists of local handle services. The Global Handle Registry provides the service used to manage the namespace of all handle prefixes, or naming authorities. The global service contains information about the local handle service responsible for resolving identifiers created with a given prefix. Local handle services can be used for many different kinds of Internet applications, but the most popular (and the simplest) use to date has been to give persistent identifiers to web content, so that the content can be referenced and located using those permanent identifiers (with location data stored in the associated handle records) rather than using locations as identifiers (such as URLs which frequently change).	N.A.	The @fullXRI registry service provides the capability to register an i-name, transfer an i-name from another broker to @fullXRI and the reverse, and query the status of an i-name. Any transfer includes the i-name itself, any synonym i-names (those XRIs that point at the same resource and share all settings), and the associated i-number. Other services for registering, configuring and managing XRIs are available as well as tools to help resolve XRIs. See: http://www.freexri.com/documentation/DocumentationIndex/. The @freeXRI service offers i-name creation and registration, service configuration, XRI management services, and various tools designed to help you resolve XRIs. See: http://www.freexri.com/documentation/DocumentationIndex/ . The 1id.com registry allows the creation / registration of an i-name as a reseller service for organizations, and other services including a single sign-on, contact management, forwarding, and community registry creation.	N.A.
10		**8. Is a specific naming scheme and/or naming authority required?**	The system behind the DOI ID Scheme is the Handle System, and as such must meet any Handle restrictions for naming. Neither the Handle System nor DOI system policies impose any constraints on the suffix, outside of encoding. Handle syntax imposes two constraints on the prefix — both slash and dot are "reserved characters", with the slash separating the prefix from the suffix and the dot used to extend sub prefixes. The root administrator for the Handle System has reserved all prefixes starting with "10." (for example 10.1000, 10.1000.1, 10.23) for the IDF to use for DOI names.	The part of the ARK directly following the "ark:" is the Name Assigning Authority Number (NAAN) enclosed in '/' (slash) characters. This part is always required, as it identifies the organization that originally assigned the Name of the object. It is used to discover a currently valid NMAH and to provide top-level partitioning of the space of all ARKs. NAANs are registered in a manner similar to URN Namespaces. Namespaces for the ARK Name Authority are maintained as part of the NAAN Registry that is managed by the California Digital Library and replicated at the Bibliothèque Nationale de France and the National Library of Medicine. See https://confluence.ucop.edu/display/Curation/ARK for more information.	Standards for basic encoding rules (BER), canonical encoding rules (CER), and distinguished encoding rules(DER) can be found at the International Telecommunications Union (ITU) X.690 website: http://www.itu.int/rec/T-REC-X.690/en . Example: {joint-iso-itu-t(2) ds(5) attributeType(4) distinguishedName(49)} .	PURLs use the URL syntax for the name portion of the ID, with some exceptions. Allowed and not allowed characters are described on the PURL FAQ: http://purl.oclc.org/docs/faq.html.	Handles (identifiers) are passed by a client, as a query of the naming authority/prefix, to the Handle System's Global Handle Registry (GHR). The GHR responds by sending the client the location information for the relevant Local Handle Service which may consist of multiple servers in multiple sites. A query is then sent to the relevant server within the Local Handle Service. The Local Handle Service returns the information needed to acquire the resource, e.g., a URL which can then be turned into an HTTP re-direct.	No, although a UUID can be construed as a URN by including the urn:uuid: prefix to the ID that is generated.	Yes, follows the proposed XRI Specification for Resolution, that was last considered by OASIS as version 2.0 when it was rejected. In 2008, activity on the XRI specification tapered off and split into efforts to deal with the need for a uniform approach to metadata discovery on the Web, and thus into a different specification for that, XRD, Extensible Resource Descriptor. In November 2010, OASIS approved XRD as a standard (version 1.0) which superseded XRI. See http://equalsdrummond.name/page/17/ for history and http://docs.oasis-open.org/xri/xrd/v1.0/os/xrd-1.0.os.pdf for specification.	Follows the URN naming syntax: urn:lsid:authority:namespace:object:revision-ID. The urn:lsid is a mandatory prefix while the Revision-ID is optional.
11		**9. What is the ID for the data set level digital object? For the component level digital object?**	MODIS data set: doi:10.5060/D4CC0XMZ; Granule within MODIS data set: NSIDC glacier photo collection, doi:10.5060/D4RN3SSD; Glacier photo within collection: doi:10.5060/D4RN3SSD/baird1929090101 for the photo with local ID baird1929090101.		No difference.	Glacier Photo collection: http://purl.org/5060D4/glacier_photos/, (a partial redirect that allows the PURL http://purl.org/5060D4/glacier_photos/{photo_id} to resolve to any glacier photo so long NSIDC maintains the practice of embedding the {photo_id} in the photo URL following the current pattern). This mechanism made it unnecessary to create PURLs for each photo in the Glacier Photo collection.		Did not assign.		Not assigned.
12		**10. What is the technical infrastructure upon which the implementation of the ID scheme is based (e.g., XML, Java, Python, other)?**	The EZID service and API is based on Java.	The EZID service and API is based on Java.	No infrastructure.	This appears to be XML because of the dependency of the batch processes upon submission of an XML (RELAXNG) document.	Handle client SW libraries available in both C and Java.	Generated by a UUID algorithm; the UUID must be of a fixed size (128 bits) and contains a time field	XML	PERL with a browser available for Firefox. There is also an LSID tester available as open source software that is based on PHP.

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	11. What is the mechanism for ensuring uniqueness of the ID within the ID provider system and/or globally?	The DOIs that are created by the EZID service are registered with the DOI Registry services provided by the German National Library of Science and Technology (TIB). The EZID service for managing identifiers populates and updates the databases of the DOI/Handle resolver services by the International DOI Foundation (IDF) and the Handle System.	This is up to the Name Mapping Authority that assigns the names (IDs). The CDL that operates the EZID service assigns identifiers within the ARK domain under the NAAN 13030 and according to the following principles: No ARK shall be re-assigned; that is, once an ARK-to-object association has been made public, that association shall be considered unique into the indefinite future. CDL-assigned ARKs shall be generated with a terminal check character that guarantees them against single character errors and transposition errors. CDL recommends that institutions generating ARKs may want to follow similar principles or develop their own assignment policies.	The ASN.1 standard defines an object as being "a well-defined piece of information, definition or specification which requires a name in order to identify its use in an instance of communication". In general, an object is a class of information (for example, a file format), rather than an instance of such a class (for example, an individual file). It is thus the class of information (defined by some referenceable specification), rather than the piece of information itself, that is assigned a place in the tree. See http://www.oid-info.com/faq.htm#31, #s 16 and18.	The registration of a PURL is done by a given PURL Resolver.	Handles are promised to be unique only within a local Handle system although they do resolve to a Global Registry system. Within the Handle namespace, every identifier consists of two parts: its handle prefix, and a suffix or unique "local name" under the prefix. The prefix and suffix are separated by the octet used for ASCII character "/" (0x2F). An identifier may thus be defined as <handle> ::= <handle prefix> "/"<handle suffix>. The collection of local names under a prefix is the local namespace for that prefix. Any local name must be unique under its local namespace. The uniqueness of a prefix and a local name under that prefix ensures that any identifier is globally unique within the context of the Handle System. Identifiers may consist of any printable characters from the Universal Character Set, two-octet form (UCS-2) of ISO/IEC 10646, which is the exact character set defined by Unicode v2.0. The UCS-2 character set encompasses most characters used in every major language written today. To allow compatibility with most of the existing systems and prevent ambiguity among different encoding, handle protocol mandates UTF-8 to be the only encoding used for handles. The UTF-8 encoding preserves any ASCII encoded names, which allows maximum compatibility to existing systems without causing naming conflict.	RFC 4122 specifies three algorithms to generate UUIDs: the first leverages the unique values of 802 MAC addresses to guarantee uniqueness, the second uses pseudo-random number generators, and the third uses cryptographic hashing and application-provided text strings. As a result, the UUIDs generated according to the mechanisms here will be unique from all other UUIDs that have been or will be assigned.	Dependent upon using a character-by-character comparisons after applying a small set normalization and comparison rules as defined in XRI Syntax2.0, Section 2.5 to discover equivalence between XRIs. To determine whether two XRIs identify the same resource, it would be necessary to resolve them to see if they return either: a) the same XRDS document, b) separate XRDS documents that reference each other as synonyms (see XRI Resolution 2.0, Section 5), or c) a redirect to the same actual resource representation. See Question 5 in the XRI 2.0 FAQ of May 2008: https://www.oasis-open.org/committees/xri/faq.php#What_is_an_i-name_and_an_i-number.	The uniqueness of the LSID is in part guaranteed by the use of Internet domain names, which are globally unique. Providing that the data source ensures that each combination of namespace and identifier is unique within that data source, the LSID itself will be a globally unique identifier.
	12. Is there a way to declare or describe a relationship between / among different formats of the same intellectual content within the ID itself? (Addresses semantic equivalence)	There are no restrictions on the naming of the resource after the required prefix / suffix of the DOI (10.1000/) so the DOI could include semantic information about the resource, if desired. The EZID service also provides a mechanism for automatic creation of an opaque identifier containing no semantic information that could become out of date and require maintenance, a recommend best practice.	Relationships such as variations or hierarchy can be included in ARKs by use of the optional "Qualifier" section of the ARK syntax. The Qualifier is a string that uses a slash (/) and a period (.) to designate relationships. See: "The ARK Identifier Scheme", Kunze & Rodgers, May 2008, Section 2.5; https://confluence.ucop.edu/dosearchsite.action?searchQuery.queryString=ancestorIds%3A13860983+AND+ARK+Identifier+Scheme+2008&searchQuery.spaceKey=Curation	No. Generally, OIDs are used for classes of objects rather than instances of classes or objects in a tree structure, so any relationships could only be hierarchical.	There are 2 concepts that could be used for this purpose: *sub-domains* under top-level domains (akin to a hierarchy of files), and *partial re-directs*. A partial redirect is a special-purpose PURL that acts like a domain. A regular domain has no associated URL. It is just part of a local name. While a partial redirect has a URL associated with it, that URL is not guaranteed (or even expected) to reference an actual resource. The URL associated with a partial redirect may only be a prefix common to the complete URLs of multiple resources, organized as the data creator or curator sees fit.	Recommended practice for the creation of a handle ID is to create an opaque ID in order to be persistent. That is, the numbers should preferably be 'dumb numbers' from which no potentially confusing meaning can be drawn, and from which no assumptions about ownership or use can be made . This would imply that there should be no declared or described relationship between intellectually equivalent resources related only by format.	No.	To discover equivalence between XRIs, character-by-character comparisons would be necessary after applying small set normalization and comparison rules as defined in XRI Syntax2.0, Section 2.5. Such testing would still not necessarily mean that the two XRIs, if equivalent, would be semantically equivalent. A better judgement to determine whether two XRIs identify the same resource could be made by resolving them to see if they return either: a) the same XRDS document, b) separate XRDS documents that reference each other as synonyms (see XRI Resolution 2.0, Section 5), or c) a redirect to the same actual resource representation.	As part of the identifier, it is possible to associate revision information using the "Revision-ID" part of the syntax.
Discovery Issues	**1. Who is using the scheme and for what purpose(s)?**	DOIs are most widely used for printed publications such as journals, but are beginning to be used more frequently for data sets.	Approximately 100 organizations are using for all kinds of digital resources including universities, national libraries, the Internet Archive, etc. See: http://n2t.net/ezid/home/community . Some ARKs were being used for unique identification & location of resources within digital repositories or archives.	Mostly used for registering organizations and names in protocols, but can also be used for countries, companies or projects, encryption algorithms, etc. See: http://www.oid-info.com/faq.htm#1 question #2.	Besides the OCLC PURL Server, the most notable PURL Server is run by the Government Printing Office of the U.S.	DOI system, Entertainment Identifier Registry, CORDRA / ADL, Global Environment for Network Innovations, Dspace, The National Digital Library Program at the Library of Congress.	Many scripting languages and operating systems (MAC OS, MS Windows) use UUIDs. They are usually used as identifiers of resources of all types, particularly for inventory or transactions.	OpenID Authentication 2.0 started using XRIs as well as URLs for their OpenIDs; OpenXRI -- a Java library that drives the @fullXRI services & tools; Higgins (open source) Project has Identify Services that enable websites to be OpenID compatible. See http://en.wikipedia.org/wiki/Higgins_project . All of these projects are using XRI for personal or organizational identification rather than for digital content resources.	Mostly used by the life sciences communities. It is supported by the Interoperable Informatics Infrastructure Consortium (I3C), and is recommended by the Biodiversity Information Standards (TDWG) which has also published an applicability statement on the use of LSIDs. LSIDs are the identifiers for the International Plant Names Index. LSIDs can be used to id scientific names, taxonomic concepts, species observations, specimens, collections, images, videos, and sound recordings of specimens.
	2. If used as citation for publication, are the citations counted by aggregators (e.g., ISI or Thomson's Web of Science)	Thomson-Reuters has just announced the creation of a Data Citation Index that would make use of DOIs for data sets. The new index was announced in June 2012.	It appears that A&I vendors will soon begin indexing ARKs per J. Kunze presentation of May 2012. See: http://n2t.net/ezid/home/community.	N.A.	No.	Handles as DOIs should be included in the Thomson-Reuters Data Citation Index.	N.A.	N.A.	No.
	3. Is it possible or recommended that descriptive metadata be associated with the ID? If so, how maintained?	Yes, the DOI Foundation recommends the creation of descriptive metadata for the resource identifide by a DOI. While there are many descriptive metadata schemes that could be used, the DataCite DOI that have been assigned in the testbed require 5 elements, and recommend many more. The EZID service allows & facilitates the creation of the descriptive metadata. Continued maintenance of the metadata is done by the current account holder for the resource which may be re-assigned if an identifier appears to be abandoned. DataCite also recommends the creation of a "landing page" that could display the descriptive metadata.	Yes, using the same mechanism as used for DOIs by the EZID service. If the EZID service is not being used, maintenance of the descriptive metadata would need to be done by the data provider or account holder.	Yes.	No.	Not explicitly recommended; depends upon the application.	No.	Originally, a fully implemented XRI should have included the assigned of a small subset of metadata based on the XRI Metadata 2.0 specification to aid cross-context interoperability. This specification has never been formally approved and is presumably now deprecated by virtue of the passage of XRD version 1.0 which superseded XRI Version 2.0. A draft version 3.0 of XRI does not include any reference to descriptive metadata. See https://www.oasis-open.org/committees/download.php/35972/xri-syntax-3.0-wd03.pdf.	Yes, descriptive metadata is recommended, but no specification is prescribed. What is required is that the default metadata response from a server must be RDF data serialized as XML for use by semantic technologies.
	4. Can the identifier have semantics? If so, what part / how?	There are no restrictions on the naming of the resource after the required prefix / suffix of the DOI (10.1000/) so the DOI could include semantic information about the resource, if desired.	An opaque identifer is strongly recommended for ARKs for persistence although the recommendation is relaxed for the Qualifier portion of the ID string which can include information about object hierarchies and variants at the discretion of the naming authority.	No.	Only within the restrictions associated with the URL syntax and the added restrictions mandated by the PURL syntax for the name part of the PURL structure. Hierarchy can be imposed by use of sub-domains and partial redirects.l	Recommended not to have semantics, but instead be opaque and locally unique.	A UUID could contain semantics, particularly if it is generated from a machine address (MAC). Generally, the recommendation is that the number generated be opaque.	An XRI starting with "=" is thought of as identifying a person. An XRI starting with "@" identifies a company or organization. A "*" marks a delegation. For example with "=family*name", "=family" delegates the resolving of its sub-XRI "name" to another resolver. This is analogous to DNS' delegating the subdomain resolution to other nameservers (name.family.de: after resolving de, the nameserver responsible for de delegates to the family nameserver, which delegates to the name nameserver).	Although the LSID is supposed to be considered opaque, it is not due to the requirement for an authority organization to be listed within the URN naming syntax. There is a Revision-ID option, but TDWG recommends that clients using the LSIDs do not infer identification for objects that are likely to be moved or part of the LSID. See http://www.tdwg.org/fileadmin/subgroups/guid/LSID_Applicability_Statement_draft.pdf .
Archival Issues	**1. How is the association between the ID and the resource maintained when transferred from one archive or repository to another (e.g., embedded within object?)**	The mechanism will change depending on the service provider, but is dependent upon updating the descriptive metadata to record the changes in the responsible organization. (Is this true?) Maintenance of the identifier can be changed by the EZID Service by request or by ddefault if an identifier is "abandoned."	Because the syntax of the ARK is location neutral, an information object can change "location" from one archive to another as long as it is still being managed by the same Name Mapping Authority Hostname (NMAH). If that is not the case and the object and its ID is abandoned, maintenance policies can still be discovered by appending "??" at the end of a query for the ARK (aka an "inflection").	Not specified.	It's possible to modify a PURL by changing the underlying location of a resource; the PURL itself should remain unchanged.	Design principles for the Handle IDs include not basing the ID string on any changeable attributes of the entity itself (location, ownership, etc), and on Identify both opaque, i.e., w/o semantics that may cause conflicts, and unique within each system. Ea entity is managed as a 1st class object, rather than as a packet of bits w/ dependency on other attributes such as location. (wikipedia source)	Not done by virtue of the UUID itself; would be necessary to associate the UUID with the resource in a "local" management system.	Presumably, the i-number for each XRI is unique and goes along with any and all i-names associated with a given XRI since it is possible to transfer and reassign the i-names, but not the i-numbers. XDI.org which is the sponsoring organization for XRIs has a "Global Survivability Policy" that describes the approach to protecting XRI related data from unforeseen circumstances. @fullXRI has inherited this policy and also subscribes to a "Community Survivability Policy" that further defines the terms under which data and communications related to their registry service are kept and maintained. See: https://www.fullxri.com/policies/SurvivabilityPolicyV1/ .	LSIDs are dependent upon the domain names of the authority that assigns the LSIDs. TDWG recommends that the authority use domain names that will remain effective thru organizational changes, i.e., at the highest level or use separate authority identification for objects that are likely to be moved or transferred to new owners. An authority ID can be requested from TDWG.
	2. What are the outright charges or costs involved in assigning the IDs or using an associated service? (initial and ongoing on annual basis)	There are no charges for the creation or maintenance of a DOI on a per ID basis. The EZID service does charge an annual fee for creation and maintenance of an unlimited number of DOIs, based on organization size.	There are no charges for the creation or maintenance of an ARK on a per ID basis. The EZID service does charge an annual fee for creation and maintenance of an unlimited number of ARKs, based on organization size. See: http://n2t.net/ezid/home/pricing .	Substantial costs in building the necessary infrastructure.	No charge for PURL creation or maintenance.	Overall Handle system infrastructure is supported by a public license, and service aggrement that includes prefix registration & service fees. If a prefix (e.g., "doi") is set up, there is a one time $50 registration fee plus an annual service fee of $50 per prefix. Using an existent service provider may involve fees at the discretion of that service provider.	None.	Depends upon the service used. There is a free service for the creation and registration of an XRI, as well as several fuller service models. One of them, 1id.com offers broker and reseller solutions for creation, registration and management of the IDs.	None per se, but there could be charges made by an authority service that creates & maintains LSIDs.
	3. What kind of staff resources are required to implement the scheme, associated software or service? (type, knowledge needed)	If the choice is made to create one DOI at a time, the only requirement is to be able to define & differentiate what is to be uniquely (and separately) identified, and create / add descriptive metadata for the resource. If the API is to be used, a staff person would be required to configure the API and make it available for broader use.	If the choice is made to create one ARK at a time, the only requirement is to be able to define & differentiate what is to be uniquely (and separately) identified, and create / add descriptive metadata for the resource. If the API is to be used, a staff person would be required to configure the API and make it available for broader use.	User assumes all responsibility; there is no central infrastructure.	If the choice is made to create one PURL at a time, the only requirement is to be able to define & differentiate what is to be uniquely (and separately) identified. Batch creation of modification of PURLs would require knowledge about how to interpret an XML schema and create an instance of it in RELAX NG.	The Handle System is not an end user system, and it is not off-the-shelf software. It's an underlying infrastructure for identifying resources whose location and other basic information, e.g., ownership, needs to be updated from time to time. Handle servers should be installed by system administrators on a machine with an Internet presence . Other staff may be necessary to create policies and procedures to define, delineate, and describe unique resources.	Once a mechanism is set up and identified, anyone could generate a UUID.	None for simple ID creation; there are tools available for single sign-on, etc. for web sites from both 1id.com and @fullXRI.net.	An LSID service would need a system developer to implement the software and develop a resolution service, someone to manage an underlying database, and staff to create or re-use a data model for the resources that the organization creates.
	4. Does the identification scheme have a mechanism for association with related data objects, such as physical documentation or an associated spreadsheet? handle data that is not on the web? What about physical objects?	The DOI can be associated with any kind of object, whether physical or digital. It is described within the DOI Handbook as a "digital identifier for an object not an identifier for a digital object".	The ARK can be associated with any kind of object, whether physical or digital.	No.	Theoretically, a PURL could be used to locate any type of object accessible via the WWW.	There does not appear to be any restriction on the type of resource to which an XRI could be applied, but no real mechanism for distinguishing a physical object either. Most common use is for digital content identification.	Can be done inherently.	There does not appear to be any restriction on the type of resource to which an XRI could be applied, but no real mechanism for distinguishing a physical object either. Most common use is for person and organizational identification.	Can be done inherently; no distinction is made among types of resources to be identified.