The International DOI Foundation (IDF) is a strong supporter of the Handle System and believes it to be the best infrastructure component available today for managing digital objects. That is why the DOI system uses Handles. Handles by themselves are necessary but not sufficient for the function of the DOI System, a complete framework for managing intellectual content and facilitating electronic commerce. It is sometimes asked: "If DOI is based on the Handle System, why not cut out the middleman and use Handles alone?" The answer is simple: "DOIs are more than Handles."

The Handle System is only one component of the DOI system
The Handle System provides a general-purpose global name service enabling secure name resolution over the Internet, designed to enable a broad set of communities to use the technology to identify digital content independent of location. The DOI System utilises the Handle System as one component in building an added value application, for the persistent, semantically interoperable, identification of intellectual property entities:

- The DOI system provides a ready-to-use system of several components: a specified numbering syntax, a resolution service (based on the Handle System), a data model system (including the indecs Data Dictionary), and policies and procedures for the implementation of DOIs through a federation of Registration Agencies.
- One component of the DOI System is the Handle system, and its implementation in DOI has been supplemented by expanded technical infrastructure and features specific to DOI applications.

Persistence
Handle software may be implemented by anyone who agrees to basic licensing terms; there is no requirement that a user’s implementation be persistent. The handle system technology provides persistence if used with appropriate social infrastructure. The International DOI Foundation (IDF) builds on the technical infrastructure of the Handle System a social structure guaranteeing persistence. Persistence is a function of organizations, not of technology; a persistent identifier system requires a persistent organization and defined processes:

- The International DOI Foundation (IDF) provides a federation of Registration Agencies. Dependency on any one RA is removed since the IDF mandates that should any RA go out of business, its DOIs subsequently will be “homed” in another RA; and that should the IDF cease to exist, the RAs will be able to continue to operate the DOI system.
- IDF mandates that its RAs provide processes to ensure that DOIs guarantee persistence.
- The IDF is designed to be a persistent organization through self-funding by balancing operational income (from a small fee per DOI assigned) against costs of ongoing infrastructure provision and development.
- Several major public companies stand behind the IDF as initial funders and/or Board members; the composition of the Board and IDF membership may change but the organization continues.
Consistency
Handle System protocols ensure interoperability for resolution purposes among a diverse set of handle system implementations. At the application level, there is no requirement that consistent rules must be in place for multiple applications. The DOI system adds such a requirement:

- The DOI Foundation determines rules to which all DOIs must adhere (what they may be applied to, restrictions on arbitrary and temporary assignment, restrictions on removal from the System, etc)
- DOIs are managed through a Directory Manager who ensures and implements quality assurance processes in assignment.
- A DOI API (application programming interface) for the Handle System defines consistent ways of accessing and managing DOIs, Application Profiles, and Services.
- The consistent use of the DOI prefix and numbering syntax provides numbering interoperability in the intellectual property sector, and brand recognition of what the number is for.
- The optional data model component provides semantic consistency for true interoperability.

Ease of use
The Handle System license does not include ongoing technical support; it typically is installed and managed by technical staff. The DOI system provides a turn-key application:

- The DOI system employs staff who manage the development and operation of the system, its relations with users, outreach to standards and other communities, and resolution of problems.
- The DOI system employs a Directory Manager who provides support to RAs in registering and managing DOIs, and who provides guidance, troubleshooting, statistics reporting, advice to and liaison with Registration Agencies and their customers.
- The DOI Handbook embodies policies, procedures and guidelines for Registration Agencies and application developers developed by the DOI federation of agencies, guaranteed by detailed legal agreements.

Expressing Relationships
Multiple resolution allows one entity to be resolved to multiple other entities; this can be used to embody relationships, e.g. a parent-children relationship, or any other relationship. Handle technology allows this; DOI provides a framework to achieve it:

- Multiple resolution is a feature of the Handle technology, but Handle per se (deliberately) has no pre-existing constraints to make a useful framework (think of it as like spreadsheet software): DOI is an application of Handle which adds this constraint (think of it as like a spreadsheet template already prepared to receive data).
- In DOI the constraints come from the metadata which defines the entities, which is the data dictionary approach: hence IDF’s role in MPEG-21 RDD and the indecs Data Dictionary. That enables one to express relationships. See the related factsheet “DOI and Data Dictionaries”.

Technical infrastructure
The Handle System provides a resolution service shared by all Handle implementations. The DOI System adds dedicated improved technical infrastructure:

- The Handle System consists of Global root servers, local handle servers, clients, and proxy servers. The scalable global root infrastructure enables users who install local handle services to interoperate with the root and each other, depending on permissions that have been established. The DOI System adds its own dedicated expanded infrastructure including replication servers for those IDF RAs that operate local handle services for their DOIs, secondary sites, mirrored servers and proxy servers housed at a secure commercial hosting service facility.
• The Handle System license provides the reference implementation of Handle System, the database component of which was not designed to scale above a few million handles. The DOI system employs a much more robust database implementation capable of scaling to any number of handles.

• The DOI Directory Manager provides technical infrastructure configuration and performance checks to ensure evolutionary growth of the DOI system.

Semantic interoperability
Handles (including DOIs) will be resolved by the Handle System, but there is no requirement in the Handle system for declaring what is being identified, or for ensuring semantic interoperability across several identified resources. The DOI adds this facility, specifically designed for its area of applications, which is now being implemented and will be a feature of advanced applications of the DOI:

• The DOI system provides a kernel of structured data upon which extended metadata schemes can be built if required, and a means of precisely specifying the entity identified.

• The DOI system provides an optional tool to map an existing metadata scheme through a structured standard ontology, thereby ensuring semantic interoperability so that DOIs from different sources may be used as the key in building multi-component media objects or managing multiple assets.

• The DOI Data Model embraces both a data dictionary and a framework for applying it. The data dictionary component is designed to ensure maximum interoperability with existing metadata element sets; the framework allows the terms to be grouped in meaningful ways (DOI Application Profiles) so that certain types of DOIs all behave predictably in an application through association with specified Services. This provides a means of integrating the features of Handle resolution with a structured data approach.

• IDF maintains the indecs data dictionary, the underlying tool for semantic interoperability, which integrates with the standard ISO MPEG21 Rights Data Dictionary (RDD). The IDF is also the chosen candidate to become the MPEG Registration Authority to manage the RDD.

Development activities
The Handle system provides upgrades of the global general-purpose naming service. DOI adds to this resources for active development of the DOI applications and advanced features:

• Through its working groups and technical support staff, the International DOI Foundation provides ongoing development support and shared resources for the community of DOI users.

• Through use of the DOI in commercial systems, individual Registration Agencies have an incentive to allocate their own resources to the development of new features, or to collaborate with other RAs to develop features that may be shared with the wider DOI community.

Costs
Costs for developing Handle implementations and DOI applications are not directly comparable since they relate to different things:

• To provide a comparable service to DOI, a Handle implementation would need to add the features listed above as these are not provided as part of the general-purpose software. The costs of implementing Handles include appropriate Licence costs for the Handle System plus internal costs necessary for creating one or more of these features in a working implementation with specific rules and services. The costs of implementing DOIs include all these as turnkey features, not simply DOI assignment as a Handle, and vary depending upon the application provided through Registration Agencies’ value-added services. The costs of assigning DOIs therefore vary from one Registration Agency to another depending on the business model chosen; DOIs may be free or charged for as part of a service offering.
• Use of the Handle System for any production operation requires a Licence from CNRI. The IDF already has a Licence for use of the Handle System, together with the ability to sub-license this for DOI assignment to all DOI Registration Agencies. Use of DOI therefore does not require a separate Handle System License.

**Governance**

*Governance of the Handle System and DOI are independent:*

• Policies and planning for the continued evolution of the Handle System are the responsibility of an evolving Handle System Advisory Committee representing major users and interested parties, established by CNRI, the organisation which developed the Handle System. The IDF is a Member of that Committee and so has a voice in the governance of the Handle System.

• The DOI system is managed by the International DOI Foundation, an independent, not-for-profit, open membership organisation. The IDF has an elected Board and nominated working groups which oversee all aspects of the development and implementation of the DOI System. CNRI is not a member of the IDF but provides services to it under commercial agreements. These agreements also ensure continuity of the resolution service provided to IDF.