# The CNRI Handle System

The Handle System® is a comprehensive system for assigning, managing, and resolving persistent identifiers, known as "handles," for digital objects and other resources on the Internet. Handles can be used as Uniform Resource Names (URNs). The Handle System includes an open set of protocols, a namespace, and an implementation of the protocols. The protocols enable a distributed computer system to store handles of digital resources and resolve those handles into the information necessary to locate and access the resources. This associated information can be changed as needed to reflect the current state of the identified resource without changing the handle, thus allowing the name of the item to persist over changes of location and other state information. Combined with a centrally administered naming authority registration service, the Handle System provides a general purpose, distributed global naming service for the reliable management of information on networks over long periods of time. Details can be found at http://www.handle.net/.

Applications

The Handle System is currently in use in a number of advanced prototype projects, including efforts with the Library of Congress, the Defense Technical Information Center (DTIC), and the International DOI Foundation's DOI (Digital Object Identifier) project. The DOI project uses the Handle System as basic infrastructure, refers to the identifiers as DOIs, and will have its own set of policies and value added services.

Syntax

100.1/ADA319240

Naming Authority | **Item ID**
Prefix | **Suffix**
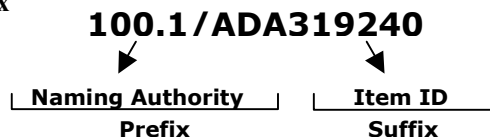
Every handle in the Handle System is defined in two parts: its naming authority, otherwise known as its prefix, and a unique Item ID under that naming authority, otherwise known as its suffix.

The prefix, or naming authority, identifies the administrative unit of the underlying handles. It is globally unique and persistent once obtained. Naming authorities can be created in a hierarchical fashion, i.e.,

the owner of a naming authority can create additional sublevels, but once a complete handle is created it is treated by the Handle System as an opaque string and not interpreted in any way. This does not, of course, prevent creators of handles from using meaningful strings and interpreting them in external applications which use the Handle System infrastructure.

There are very few syntactical constraints on the handle suffix, allowing most legacy naming systems to be used within the Handle System. A detailed specification can be found at http://www.handle.net/. When handles are used in specific contexts, e.g., embedded within an HTTP URL, they must of course follow the syntactical rules governing those contexts.
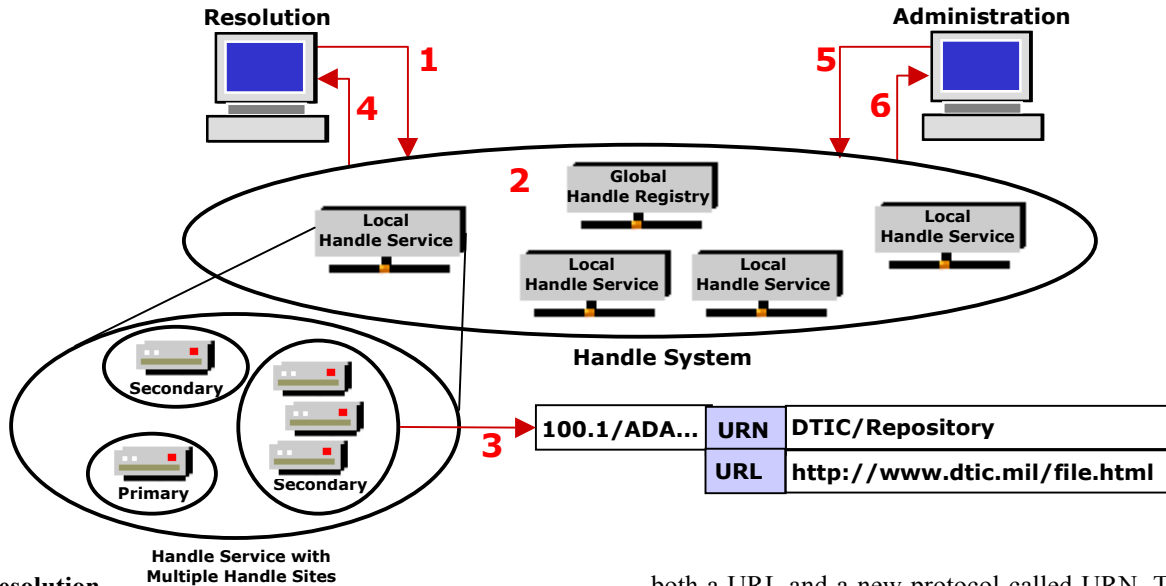
Handle Creation and Resolution

The Handle System allows handles to be both created and resolved in a distributed fashion (see the reverse of this page for an overview of the Handle System architecture). Both creation and resolution can be accomplished using dedicated clients, common clients such as web browsers using special extensions or plug-ins, or unextended clients going through various proxies. In all cases, communication with the Handle System is carried out using the Handle System protocol which has a formal specification and some specific implementations, all freely available from CNRI.

The protocol has a corresponding client library available in C and Java. The C client library has been used by CNRI in the creation of a handle-aware extension to the Netscape and Microsoft web browsers. The Java client library has been used to create an http-to-handle proxy and caching server.

Administration clients are used for the creation and editing of handles. Several have been implemented by CNRI in Java, which are used in various web servlets, batch input utilities, and other custom projects.

The diagram on the reverse shows the basic architecture and operation of the Handle System.

Handle Service with Multiple Handle Sites

Handle System

100.1/ADA...	URN	DTIC/Repository
	URL	http://www.dtic.mil/file.html

Resolution

1. A client such as a web browser encounters a handle, e.g., 100.1/ADA..., on the Internet or an individual intranet, typically as a hyperlink or other kind of reference. The client sends the handle to the Handle System for resolution. This can be done directly by a client which understands the handle resolution protocol natively or through a proxy server by a client which doesn't.

2. The Handle System consists of a collection of handle services. Each service consists of at least one primary site and any number of secondary sites, with each site containing any number of handle servers. One service, the Global Handle Registry, is responsible for knowing the locations and name space responsibilities of all of the public Local Services. Each of these Local Services knows how to access the Global Handle Registry. This allows a resolution query to enter the Handle System at any point and to be routed to the specific service and site which knows the answer.

3&4. Each handle can be associated with one or more pieces of typed data. In this example, the handle 100.1/ADA... is associated with, and so resolves to, both a URL and a new protocol called URN. This is the information which is returned to the client. Note that it would also be possible to associate multiple instances of the same data type, e.g., multiple URLs, with a single handle. The Handle System is a pure resolution system and carries no assumptions on what the client will or will not do with the resolution information, thus maximizing the flexibility of applications which use the Handle System as an infrastructure for naming. In the example shown, the client can presumably use either protocol to locate and retrieve the item, although again this is up to the client.

Administration

5. Administrative clients have the ability to create handles and to add and edit the associated resolution information. This can be done directly using clients that understand the Handle protocol natively or through a proxy service by those that don't.

6. The system returns success or error messages as appropriate. Batch formats have been defined for mass additions and edits.