Committee on Earth Observation Satellites
Working Group on Information Systems and Services

Interoperable Catalogue System
User Requirements Document (URD)

CEOS

Working Group on Information Systems and Services

Protocol Task Team

Doc. Ref.: CEOS/WGISS/PTT/ICS-URD-B

Date: 12 March 1997

Issue: 2.2

AUTHORITY

Issue:	Issue 2.2
Date:	12 March 1997
Location:	Telecon

This document has been approved for publication by the Protocol Task Team of the Committee on Earth Observation Satellites (CEOS) and reflects the consensus of the Protocol Task Team technical panel experts from the CEOS member agencies.

This document is published and maintained by:

Gerhard Triebnig (CEOS PTT Chair)
European Space Agency/ESRIN
Via Galileo Galilei
00044 Frascati
Italy

E-mail: *gerhard.triebnig@esrin.esa.it*

Table of Contents

List of Figures

Document Status Sheet

Version	Date	Comments
-	15 May '95	Draft of PGRS URD skeleton presented at ESA/DPRS progress meeting.
-	23 May '95	Draft of EORP URD skeleton. Framework of the URD reworked to cover only EORP and Retrieval Manager.
-	23 June '95	Draft EORP capability requirements to date for preview by ESA.
0.1	17 July '95	First draft issue for formal review.
1.0	18 August '95	First formal issue. Name changed to Catalogue Interoperability Protocol (CIP).
1.1	26 January '96	Reissue to ensure consistency between the CIP URD 1.1 and CIP Specification 1.1. Include new requirements from NASA RIDs of Oct. 19 '96 plus minor edits.
1.2	27 March '96	Issue ratified by the CEOS PTT after updates required resulting from CIP Specification - Release A 1.1 formal review.
2.0/1	19 July '96	First draft for CIP Release B, input for the July '96 PTT co-location meeting. Name changed to ICS URD.
2.0	23 August'96	Draft ICS URD Release B
2.1	11 October '96	Issue following formal CEOS PTT review and incorporating updates from RIDs and review discussions at the September '96 Annapolis PTT meeting.
2.2	22 January 1997	Issue prepared for ratification by the CEOS PTT after updates agreed at the December 1997 Ispra PTT meeting
2.2	12 March 1997	Issue ratified by the PTT

Document Change Record

Change No.	Date	Changes in version 2.2 from version 1.2
1	11.6.1996	Document name change, editorial changes, outline update, document reorganisation.
2	19.7.1996	Inclusion of CIP-B topics (e.g. order and security issues.) and definition of new requirements.
3	23.8.1996	Incorporation of NASA inputs, inclusion of revisions from July '96 co-location meeting, renumbering of requirements.
4	11.10.1996	Incorporation of RID review updates from September PTT URD Review meeting. New requirements incorporated, some deleted and some moved, so many requirements renumbered.
5	22.01.1997	Incorporation of RID review updates from December PTT URD discussions. New requirements on timestamps incorporated, new text for document attribution, alignment with the CIP B specification 2.2. Encryption requirements moved to release C.
6	12.03.1997	Removal of draft status comments and modification of document date to ratification date of 7th of March 1997

1. Introduction

This is the User Requirements Document (URD) for an Interoperable Catalogue System (ICS). This document was developed by the Committee on Earth Observation Satellites (CEOS) - Protocol Task Team (PTT). The PTT is part of the WGISS Access Subgroup. The lead agency for compilation of PTT inputs and for the final preparation of this version of the document was the European Space Agency (ESA). A complete list of organizations participating in the PTT is provided in the PTT Terms of Reference [R45].

The remit of the CEOS Protocol Task Teams is to develop a protocol so that a number of international Earth observation archive agencies can make their data available in a coherent manner to the users of that data. Already many of the agencies have information servers that provide end user Earth observation data, but there is currently little formal cohesion between the various systems.

The document explores a number of fundamental conceptual ideas in the design of a generic Catalogue Interoperability Protocol (CIP) and from these develops textual requirements which will be used to define the protocol specification. Also the system requirements and architectural design of software to support and manage the Catalogue Interoperability Protocol are examined. Finally, the data structures necessary for the protocol, and their management and maintenance are examined.

This URD therefore contains the baseline requirements for the Catalogue Interoperability Protocol, the related middleware and client software and the data structures necessary to support it.

Inputs to the concepts and requirements for an Interoperable Catalogue System have resulted from analysis of existing systems, protocols and appropriate developments already performed (e.g. within the CCSDS and CEOS CINTEX groups). Results of the analysis phase of this work are contained in phased outputs; i.e. the initial analysis technical note[R1] produced by ESA, this URD, a technical note analysing the appropriateness of the Z39.50 protocol[R27] for the CIP, the CIP specification [R42] , the ICS SDD[R34] and the Collection Manual[R41]. The details of the development of the ICS are described in the PTT Plan[R39].

1.1 Purpose

The CEOS Protocol Task Team (PTT) is creating a Systems Design Document (SDD)[R34] as described in the PTT Development Plan[R39]. The ICS SDD defines the internal and external elements which comprise the CEOS ICS and their interfaces. The ultimate purpose of the SDD is to define a system which can be implemented and operated by the CEOS federation to provide data and services to users. The SDD is driven by the requirements in the ICS User Requirements Document (this document).

The purpose of this ICS URD is to specify the user requirements for the CIP, the software and the data that will be used for the location, retrieval and delivery of data products within the Earth observation domain.

The URD provides the results of the initial problem definition phase of the system life cycle, the User Requirements (UR) phase, as defined by the ESA Software Engineering Standards, PSS-05[R7]. The URD defines the scope of the CIP and ICS elements and details the specific requirements of a user of the CIP and ICS. A requirement is defined as ‘a condition or capability needed by a user to solve a problem or achieve an objective’[R6]. This leads to two categories of user requirements ‘capability requirements’ and ‘constraint requirements’, for further details of these categories and an overview of the URD sections see Section 1.5.

For a typical PSS-05 development, the UR phase normally precedes the Software Requirements (SR) phase for production of the Software Requirements Document (SRD), which will be traced back to the URD. The third phase, the Architectural Design (AD) phase would then produce the Architectural Design Document (ADD), which will trace back to the initial design and software requirements as defined in the SRD. The ICS definition builds on this approach, with some important modifications.

This URD will primarily be used for the derivation of a Catalogue Interoperability Protocol specification, which will then be traced back to this URD. As well as the requirements for the protocol itself, this document also includes high level software system requirements. In particular, there are requirements for a middle layer of management software - the Retrieval Manager - operating between the user's client software tool and the EO data providers server and requirements for CIP Client Applications. This URD will therefore also be used as the basis for a Retrieval Manager and CIP Client SRD and ADD, which will then be traced back to this URD. Finally, this document also includes the requirements for the management and maintenance of the collection structure required by the protocol, to be defined in the Collection Manual, which will then also be traced back to this URD. A parallel ICS SDD will define the high level system architecture of the ICS and be used by implementers to understand how to build and maintain ICS nodes.

In general, the term 'CIP' refers to both the specification of the protocol and to the facilities provided by the Retrieval Manager to support the protocol.

This document is produced for analysis by:

- CEOS PTT members for confirmation of the requirements,
- developers of the CIP specification,
- developers of CIP compliant client/server software,
- potential end users of a catalogue system built around the CIP.

The Detailed Design and Implementation Phases of a CIP Retrieval Manager and CIP Client are outside the scope of the PTT directly. However, this URD should be used as a reference during any subsequent CIP related development, in particular during the definition and performance of acceptance tests to ensure that all user requirements are satisfied.

1.2 Scope

The CIP defines the methods by which data retrieval, i.e. data location, requesting and delivery, shall be performed. In particular, it defines the processes and methods of interpretation of data requests or queries and interpretation of the results. It shall include the definition of a data dictionary that shall specify the common attributes that shall be used to describe, in a standard manner, the primary objects within a catalogue system so as to promote interoperability between the catalogue systems provided by different agencies. The ICS is the system domain within which the CIP operates, consisting of a distributed network of catalogues, catalogue translators, Retrieval Managers and CIP Clients.

The Retrieval Manager supports the protocol and provides a software layer between:

- Client software which supports a user in the entering of searches, queries and orders for EO data;
- Dedicated translator software accessing (existing) archives and inventory systems.

One of the key objectives of the ICS is to facilitate interoperability between catalogue systems. Catalogue interoperability can be defined as:

- Interoperability between the same types of service, e.g. inventory with inventory (the perception of all inventory systems as one single database, hiding the physical location of information);
- Interoperability between different types of services, such as, guide, directory and inventory (the integration of high-level services).

This implies the integration of existing and future services so that they appear as a single domain. A further key factor in interoperability is the integration of catalogue systems from different agencies. This will eventually lead to all data being available to all users from a single access point of their choice, without having to first know what is available and where to go.

To achieve interoperability of catalogue systems, it is necessary to develop a common protocol that can be used by all agencies as the common denominator between separately developed catalogue systems. The use of the common protocol does not effect local agency developments or requirements, but it does provide a means for achieving interoperability with other systems.

Inputs to this work are as presented in Figure 1-1:

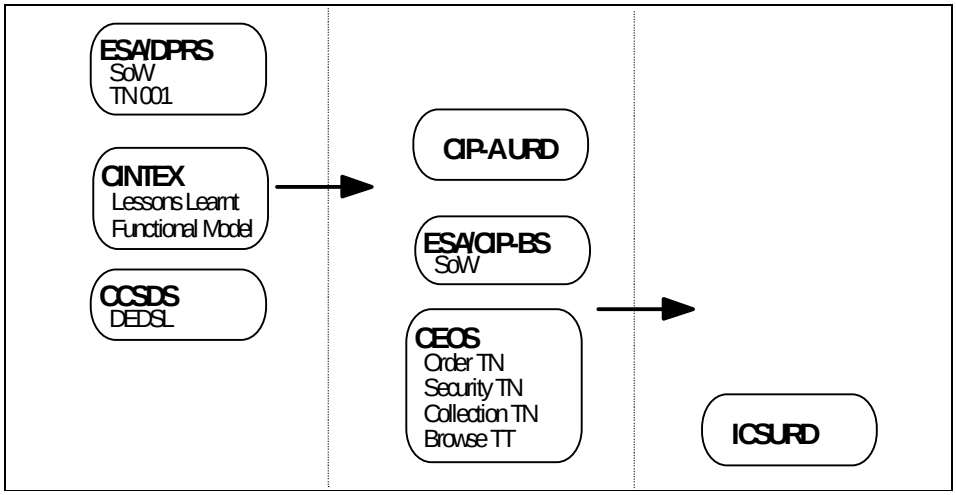


Figure 1-1: ICS URD Development

The specification of the CIP will be performed in the following three phases:

- Release A will include the core facilities of a catalogue, i.e. search and location, and introduce the concept of ‘collections’;
- Release B will include basic ordering facilities, security and user administration facilities, advanced collection facilities (i.e. hot collections, collection discovery) and full coverage of guide and browse;
- Release C will include other desirable features, such as additional order facilities (e.g. standing orders, collection ordering), automatic invoicing and accounting.

The first phase, termed Release A, was completed and ratified by the PTT in March 1996. The following two phases, termed Release B and Release C, are currently scheduled for PTT ratification in March 1997 and late 1997 respectively.

This release of the URD contains requirements for the three releases of the protocol specification, and each requirement is categorised according to whether it is intended for inclusion in Release A, Release B

or Release C of the protocol. Only requirements for Releases A and B are fully specified in this release of the URD. The requirements for release C are high-level requirements and will be refined in further releases of the URD.

1.3 Glossary

1.3.1 Acronyms

AD	Architectural Design
ADD	Architectural Design Document
ANSI	American National Standards Institute
ASCII	American Standard Code for Information Interchange
ASN.1	Abstract Syntax Notation One
AVHRR	Advanced Very High Resolution Radiometer
CCRS	Canada Centre for Remote Sensing
CCSDS	Consultative Committee for Space Data Systems
CCT	Computer Compatible Tape
CD-ROM	Compact Disc-Read Only Memory
CDF	Common Data Format
CEO	Centre for Earth Observation
CEOS	Committee On Earth Observation Satellites
CGI	Common Gateway Interface
CINTEX	CEOS Interoperability Experiment
CIP-BS	CIP-B Specification (project)
CNES	Centre National d'Etudes Spatiales
CORBA	Common Object Request Broker Architecture
CTN	Collection Technical Note
DAT	Digital Audio Tape
DDD	Detailed Design Document
DIF	Directory Interchange Format
DLR	Deustche Forschungsanstalt für Luft und Raumfahrt
DLT	Digital Linear Tape
DPRS	Data Packaging and Retrieval Study
DSR	Data Set Record
ECS	EOSDIS Core System
EO	Earth Observation
EOFS	Earth Observation Formatting System
EOIS	Earth Observation Information System (NASDA)
EORP	Earth Observation Retrieval Protocol
EOSDIS	Earth Observing System Data and Information System
ERS	European Remote Sensing Satellite
ESA	European Space Agency
ESOC	European Space Operation Centre

ESRIN	European Space Research Institute
EUMETSAT	European Meteorological Satellite Organisation
FDE	Format Definition Environment
FFT	Fast Fourier Transform
FTP	File Transfer Protocol
GCMD	Global Change Master Directory
GDS	Guide and Directory Service
GIF	Graphic Interchange Format
GSFC	Goddard Space Flight Centre
GUESS	Gateway to User Earth Observation Information Services
HCI	Human Computer Interaction
HDDT	High Density Digital Tape
HDF	Hierarchical Data Format
HTML	Hyper-Text Mark-up Language
HTTP	Hyper-Text Transfer Protocol
ICS	Interoperable Catalogue System
Id	Identifier
IEEE	Institute of Electrical and Electronic Engineering
IEF	Inventory Exchange Format
IMS	Information Management System
IPC	Inter-process Communication
IPI-IIF	Image Processing And Interchange - Inventory Interchange Format
ISIS	Intelligent Satellite Information System
ISO	International Standards Organisation
JERS	Japanese Earth Remote Sensing Satellite
JPEG	Joint Photographers Expert Group
LAN	Local Area Network
MMBS	Multi-Mission Browse Service
MMI	Man Machine Interface
MMIS	Multi-Mission Inventory Service
MPH	Main Product Header
MUIS	Multi Mission User Information Services
NASA	National Aeronautics and Space Administration
NASDA	National Space Development Agency of Japan
NCSA	National Center for Supercomputing Applications
NISO	National Information Standards Organisation
NOOA	National Oceanic and Atmospheric Administration
NSSDC	National Space Science Data Centre
ODL	Object Description Language
OMT	Object Modelling Technique
OORDBMS	Object Oriented Relational Database Management System
OSF	Open Systems Foundation
OTN	Ordering Technical Note
PAE	Product Access Environment
PDF	Portable Document Format

PGP	Pretty Good Privacy
PSS	Procedures, Specification and Standards
PTT	Protocol Task Team
PVL	Parameter Value Language
RD	Review By Design
RDBMS	Relational Database Management System
RID	Review Item Discrepancy
RP	Review of the Protocol Specification
RM	Retrieval Manager
SAR	Synthetic Aperture Radar
SDL	Semantic Description Language
SERC	System Evolution Release C (team)
SFDU	Standard Formatted Data Unit
SoW	Statement of Work
SPH	Secondary Product Header
SQL	Standard Query Language
SR	Software Requirements
SRD	Software Requirements Document
STN	Security Technical Note
SUITE	Shareware User Interface Terminal for Earth Observation
TBC	To Be Confirmed
TBD	To Be Decided
TCP/IP	Transmission Control Protocol/Internet Protocol
TN	Technical Note
UIT	User Interface Terminal
UR	User Requirements
URD	User Requirements Document
URL	Universal Resource Locator
URN	Universal Resource Name
WMO	World Meteorological Organisation
WWW	World Wide Web

1.3.2 Definitions

Note that this table contains general ICS related definitions. Where definitions overlap with Object Model definitions, these are referenced to the definitions in section 2.1.2.

Archive	An archive of EO data can hold various types of data ranging from satellite images and climatological products processed from the images, to observation data and climatological statistics. An archive may also contain information describing the EO data and also supplementary data such as design documentation, algorithm object and source code, technical reports user manuals, etc. There is likely to be a database management system for maintenance and low level access to the data. The archive will, in general, be accessed by a front end archive server that then presents the data as requested by the Retrieval Manager.
Attribute	An attribute is one of the features of an EO collection or product that is of interest to the user that can be presented or searched on using the CIP. For example, SATELLITE IDENTIFIER, INSTRUMENT, LATITUDE, etc.

	A set of special attributes, such as MEANING, UNITS, ALIAS, etc., is used to define the meaning of the attributes in a common and unambiguous manner. These attributes are called semantic attributes, The semantic attributes are interchanged by the CIP in the process of passing definitions of attributes between a CIP client and the Retrieval Manager. For further details on attributes, and their definition with semantic attributes, see Section 2.1.2: CIP Domain Object Model and Section 2.1.4: Attributes.
Browse data	Browse data is a derived representation or summary of data attributes that is provided by a catalogue system to facilitate user selection of EO products. The form and content of browse data is dependent on the nature of the EO data and the data selection criteria necessary for a science discipline to evaluate the EO data. A given EO product may be represented by several different browse data. For example with multi-channel data, browse data from one of several different channels or combinations of different channels may be required in order to represent different geophysical parameters and/or selection criteria. In addition a single large EO product may be represented by multiple browse data which depict specific regions or subsections of the EO product. Browse data is produced from the application of a browse service on an EO product, either dynamically at the time the browse data is requested by a user or as output which is stored as a system resource for retrieval at a later time. Examples of browse data include; 1 bit attribute maps (i.e., cloud mask), JPEG compressed images, subsampled reduced resolution images, data statistics and histograms).
Catalogue site	A catalogue site is a single physical location where catalogue systems are implemented. A catalogue site is typically an agency facility and there are many catalogue systems distributed across many catalogue sites. It is the aim of the CIP to bring these together so as to present them to the user as a single Interoperable Catalogue System.
Catalogue system	A catalogue system provides services such as inventory, browse, directory, order and guide, which may be supplemented by further services, but should contain at a minimum, inventory. The CIP is the protocol that shall enable the many services of many catalogue systems to interoperate. Usually a catalogue system resides at a particular agency or data provider facility but may be distributed across catalogue sites.
Child Collection	The Digital Collections Profile[R40] defines a child collection as follows: Collection A is a child of collection B if B is a Parent of A. A collection may have objects as well as subcollections as children
Client	Within the context of the CIP the 'client' is the software used by the user at their own site to communicate with the catalogue system. This client software will communicate using the CIP with the Retrieval Manager (see Section 2.1.1: Physical Domain Model and Section 2.5: Operational Environment). A CIP client should enable the user to take full advantage of the CIP supported functions, but this is not mandatory, i.e. non CIP clients (e.g. WWW clients) will also support interaction between the user and the catalogue system.
Collection	A grouping of item descriptors that have commonality. A collection consists of a number of attributes that describe the collective contents of the collection, the values of these attributes can then be searched on to select items of interest to the user. Collections also have members; these are the unique identifiers of the items that are grouped by the collection rather than their collective descriptions. As collection members can be identifiers of other collections, a hierarchy of collections and product/guide members can be established, therefore permitting a flexible and powerful organisation of data (see Section 2.1.2: CIP Domain Object Model and Section 2.1.3: Collections, for further details).
Data dictionary	The list of attributes and their definitions in terms of semantic attributes that the CIP utilises to dynamically describe collections or items. There may be a data dictionary for a single collection, catalogue site or even the complete CIP domain as currently known. A data dictionary will be a natural output of the CIP analysis and specification.
Directory	The term directory is not part of the CIP conceptual model and it is only used within historical perspectives in this URD as it has been superseded by the collection concept. Previously within CEOS work it was used to define a dataset which may comprise a listing of inventories, so that in the CIP model it is analogous to a collection at one level above a terminal collection, but with no collection overlap (see Section 2.1.3: Collections for further details).
Guide data	Data that is available to the user to enhance understanding of the EO data, spacecraft, instrument, etc. and hence make a detailed analysis of whether the product data will be of value

	for a particular application. Guide data may also contain information necessary for processing the product data further, such as calibration coefficients (see Section 2.1.2: CIP Domain Object Model for further details). It can also provide detailed information about collections, missions etc and thus be used as an ordering aid.
Guide entry	A human-readable (textual or graphical) description of an item within a catalogue system. Within this URD, guide entry is mapped to guide data.
Hot collection	A hot collection is a list of item descriptors that has been generated during the interaction between a user and a Retrieval Manager. It is is not deemed to be formally part of a previously established collection hierarchy and will be a user theme collection. Hot collections are created by the promotion of a result set, the primary difference being that hot collections are maintained across user sessions. Searches can be targeted at hot collections and results returned as for normal collections. Note that hot collections may be accessed by more than one user, if the location is made available, eg by use on a project. (see Section 2.1.2: CIP Domain Object Model for further details).
ICS log on	The term ICS log on (often abbreviated to log on) is used within this URD to mean the establishing of a user interaction session with a catalogue system within the ICS domain and which can be communicated with via the CIP. An ICS log on could be established with the exchange and acceptance of a username and password.
ICS log off	The term ICS log off (often abbreviated to log off) is used within this URD to mean the termination of a user interaction session with a catalogue system within the ICS domain that was established by an ICS log on.
Interoperability	Interoperability can be defined as the capability of the user interface and administrative software of one instance of a catalogue service to interact with other instances of catalogue services. Within CEOS, four levels of interoperability have been identified (as defined in [R44]). The following definitions are derived from those in [R44]. Level 1: A user accessing one service is routed directly to another related service. (For example, a user is routed from one inventory service to another to extend a search, the user interface differences between the routed services are not hidden from the user). Level 2: Similar to level 1 except that a user accessing one service is routed directly to another related service and contextual information is also transmitted. which may include information on the user, their interests and their activities at the original service. For example, search criteria can be passed, translated and loaded as a search query for the user to activate. At this level, the user is still exposed to the differences in operation between the two services, but related information can be shared. Level 3: At level 3, the user is hidden from the specific operations of each service. A query is routed automatically between services and the results from each returned to the original access point. At this level (and levels 1 and 2) each service is likely to use a different data model and the query may need translation to reflect these differences. Similarly, the query results may also reflect the individual service data model and may or may not be translated before they are presented to the user. At this level, the user is no longer exposed to the differences between the service operations. Level 4: At the highest level of interoperability, a single data model is assumed to apply to all services within an interoperable catalogue system. This a query entered at one service can be executed using a single distributed database. This level of interoperability permits direct database operations such as unions and joins between metadata held by different catalogue services and for operations. The interoperable system is thus seen as a single database system by the user. Within the CIP, interoperability includes the standardisation of dynamic client configuration to handle variable attributes from different catalogue systems, standardisation of attributes for common services, identification of common order procedures, etc. so that catalogue sites at different agencies appear to the user as a single site.
Interoperable catalogue system	A network of catalogue systems which provide users a view on each other. Each catalogue system is free to decide which collections of other catalogue systems are visible to its users, although some guidelines will have to be followed to ensure compatibility between collections and support commonality. Each individual catalogue system acts as an access point to the

	Interoperable Catalogue System and is generally served by a Retrieval Manager.
Inventory	An inventory holds information about the data held in an archive. An inventory and archive should not be assumed to be the same thing, although they may in some cases be synonymous. An inventory is effectively a register of the EO data that is available for retrieval; it holds inventory entries which describe the EO products themselves. These inventory entries should not be assumed to have a one-to-one relationship with the individual data items held in an archive as a product may be formed by combinations of archive data items after further processing and in different formats. Likewise there may not be a one-to-one relationship between the inventory entry and the delivered EO product, as the user may specify a number of parameters within the order process that can result in a number of products from a single identified inventory entry. Further, the relationship between inventory entries and archive data items may be, in some cases, less concrete as inventory entries may also exist for data that is not as yet in the archive, for instance, the data has not yet been acquired by the archive system. For example, the ESA ERS-1/2 system does not distinguish between archived data and data yet to be acquired. In the ERS-1/2 system, the products ordered by a user is labelled an 'Observation Set' such that the observation could have occurred or is yet to occur. Whilst inventories do and will exist they are not modelled explicitly within the CIP domain. This is because the CIP domain sees each inventory entry as a separate product descriptor and never accesses data as a single complete inventory. Collections can be established that directly map to existing inventories, but the collection concept is not restricted to such groupings only. Therefore, inventories will still exist physically but not at the logical level in the CIP model.
Inventory entry	The term inventory entry is not used explicitly within the CIP domain model and it is only used within historical perspectives in the URD as it has been superseded by the 'collection' and 'product descriptor' terminology. Previously within CEOS work it was used to represent a description of an inventory item (in general mapping on to an EO product) enabling product identification and retrieval. In the CIP model it is mapped to a product descriptor, primarily as the use of inventory entry logically makes little sense without the use of the term inventory.
Item	In the context of the CIP domain, an item is a piece of data that the user is interested in. An item may be an EO product as described in an inventory, some guide data or a collection. The term 'item' is used to generalise these different data objects so that general models for describing and searching for particular data objects can be developed. Each item in the catalogue system that the user may be interested in is described in some manner using an 'item descriptor'.
Item descriptor	An item descriptor is comprised of one or more attributes. The attributes describe the item in question in a consistent manner, therefore resulting in dynamically defined item instances. The item descriptor is used to represent a number of key objects in the CIP domain, such as a product, guide, etc. The attributes and their values, that constitute the item descriptor, can be searched on so as to identify a particular item or group of items (see Section 2.1.2: CIP Domain Object Model and Section 2.1.3: Collections for further details).
On-line order	An on-line order is an order which the user places interactively with the client software that is being used. The on-line order object must contain the identifier(s) of the items to be ordered, plus enough information about the user to verify authentication, price, etc. An on-line order does not necessarily imply that the communication between the user and the Retrieval Manager must be synchronous (i.e. that at the communication level, e.g. TCP/IP, a session is permanently maintained), as this is immaterial. The fundamental fact is that the user initiates the order only once and at one single time (as opposed to a Standing Order, which is likely to be repeated and independent of the User once established). See Section 2.1.2: CIP Domain Object Model for further details.
Order	An order is the physical item resulting from an order request. It can comprise one or more packages or products contained in delivery items. An order is the result of an order process occurring within the ICS domain, which may have involved multiple Retrieval Managers and be preceded by the use of other CIP services to establish the location and existence of the data required for the order.

Order request	An order request is placed by the user when the unique identifiers of EO products that are desired by the user have been obtained, possibly from the result of a search query. Also the user must have obtained/specified all necessary information relating to an order options, such as product type, price, format, media, delivery etc. An order request contains a unique identifier so that orders can be traced and progress can be reported. See Section 2.1.2: CIP Domain Object Model for further details.
Package	Frequently EO products are produced in advance and stored without any knowledge of what users may actually request. Due to the capacity of media it is often the case that more than one EO product is stored on the same physical media. These groups of products are called packages. Packages can be ordered by the user and also the user may receive a package as the result of a single EO product order, i.e. the EO product was only available along with a number of other items. See Section 2.1.2: CIP Domain Object Model for further details.
Options	Options define the framework in which the access by a user to the CIP domain is performed. Two kinds of options can be distinguished. The first, session options provide the framework for sessions between a user and a Retrieval Manager, for example through a user profile. The second type, service options provide the framework for the access of item descriptors by users. Service options are particularly important in the order process. Service options are related to the following: • the user placing the order (e.g. via the group membership used by the user for the definition of an order request) what is available to that user, the special discounts for a user, the pricing structure for a user, etc. • the item descriptors accessed for ordering purposes, i.e. an item's price, any special offers, the formats that the item is available in, the media that it can be delivered on, etc. • the data provider that provide the products to be ordered and defines the options for their access. In this respect, a set of service options are analogous to an order information database in which the service options contain data that relates order information to users and also data that relates order information to particular item descriptors (see Section 2.1.2: CIP Domain Object Model for further details.).
Parent Collection	The Digital Collections Profile[R40] defines a parent collection as follows: Collection A is a parent of collection B if A is immediately superior to B.
Product	See 'Product data'.
Product data	A unique aggregation of data generated from information held in, or to be held in an archive (for predicted products). It can be located and retrieved by a user via the CIP, possibly following further processing, such as map projection, sub-setting, band selection, etc., after or during extraction of the raw data as stored in the archive. Whilst the data may be stored in an archive in a quite different format to that delivered to the user, the user is not normally aware of this. Further, the data may not be present in the archive at the time of order or may be generated on the fly as a result of the order. The user only sees, from item descriptors, product data that may be delivered. Of course there may be further information that is required which will change the format of delivery, but to the user it is still the same product data (see Section 2.1.2: CIP Domain Object Model for further details.).
Query	There are two types of query: • **Search query**: a search query can be used to search a number of item descriptors as identified by the target of the query. The query acts as a filter on the item descriptors, therefore producing a more limited list of item descriptors. The matches that are made are returned to the user. A search query is not restricted to a single search query language but the unique names of the item descriptors should be supported by the search query language. • **Status query**: a status query is directed towards a Retrieval Manager to check the status of a previous request, such as an on-going order or an on-going search query. There are other services that can act upon queries, such as cancel query, suspend query, etc., these control the flow of information between user and Retrieval Manager.

	See Section 2.1.2: CIP Domain Object Model for further details.
Quicklook	The term 'Quicklook' is used within some systems to refer to specific types of browse data, however the term is not consistently defined from one system to another. Within this document Quicklook is considered a closed subset of browse data and is not considered independently in terms of requirement specifications.
Retrieval Manager	A Retrieval Manager services (and may be installed at) each catalogue site, it is used to integrate together the local catalogue systems and provide communication between users and other catalogue site Retrieval Managers. It is anticipated that each catalogue site would have at least one Retrieval Manager and that Retrieval Manager would 'know about' or 'own' a number of collections. The data within these collections would be the responsibility of that Retrieval Manager, with external collections referenced only and managed by their respective Retrieval Managers. The Retrieval Managers at each catalogue site would also communicate with each other using the CIP. The Retrieval Manager would then also communicate with local catalogue servers, such as archives and inventories, within its own site to services requests received from users. Another key function of the Retrieval Manager is to route search queries to other relevant Retrieval Managers and consolidate the search results before returning them to the user (see Section 2.1.2: CIP Domain Object Model and Section 2.5 Operational Environment for further details).
Semantic attribute	See 'Attribute'.
Server	Within the context of the CIP the 'server' could be seen as the Retrieval Manager, as this services the requests and results for the user. Also, however within the CIP domain there is the concept of local catalogue servers; these are the servers that must be attached to the front of existing catalogue systems, such as archives and inventories, so that they can in turn serve the Retrieval Manager (see Section 2.1.2: CIP Domain Object Model and Section 2.5 Operational Environment for further details).
Standing order	A standing order is an order that is not placed by a user, but by a simulated user such as a scheduler. These types of order are for situations when a user knows exactly the EO product that is wanted and knows that a new version of that product is produced on a regular basis. The standing order means that the user does not make repeated separate orders for each new product. Whilst a user will establish a standing-order and status queries can be made on the standing order, the same as any other order, there is no further user interaction apart from to cancel or stop the standing order. The same functionality as applied to on-line orders are applied to standing orders, such as user authentication, account checking, etc. (see Section 2.1.2: CIP Domain Object Model for further details).
Subcollection	The Digital Collections Profile[R40] defines a subcollection be direct reference to Child collection
Superior Collection	The Digital Collections Profile[R40] defines a superior collection as follows: Collection A is superior to collection if B is a node on tree whose root is A.
User	The user represents the combination of a real human user and the client software that the human user is using to interface with the Retrieval Manager. The CIP is not concerned directly with the client software, although the CIP has to be able to support the tasks that the user wishes to achieve, and it is anticipated that in general, the actual CIP should be transparent to the user. This is analogous to a human not directly interacting with TCP/IP, but being aware that it satisfies the task of data transfer. The only exceptions to this may be when the user is controlling a query or when error or state information is generated by the CIP under anomalous circumstances. The user has a number of important properties, such as a unique identifier, option, etc. (of course this does not exclude an anonymous user having a set of default properties). Generally, the user can perform three types of tasks, either place a query or place an order or control a session. Note that there is also a special type of user in the CIP domain and that is a non-human user such as another Retrieval Manager or a scheduler. These could for example place orders as required, without human interaction, apart from the initial set-up of the schedule (see Section 2.1.2: CIP Domain Object Model for more detail).
User session	A user session represents the interaction between a human user and an ICS node via the CIP

	(i.e. via a Retrieval Manager), which has in general been established by the user via a terminal which may be running a WWW client or a specific CIP client MMI. This, within CIP-B, will be an authenticated session following an ICS log on. In this context, the word 'session' should not be interpreted in terms of communications sessions or states. A user interaction session is independent of the underlying communications layer. Note further, that as physical communications layers can be broken, it is likely that a user identifier will need to be retained within the CIP domain and therefore, user identifiers will be exchanged.

1.3.3 Requirements Definitions

Within this requirements document, the following definitions shall apply:

'Shall' Requirements containing 'shall' are considered essential, i.e. mandatory.

'Should' Requirements containing 'should' are strongly recommended requirements although non-mandatory; a justification must be given if the requirement is not met.

'Will' The term 'will' is used only in describing assumptions or background information used in formulating the requirements, not the requirements themselves.

'May' The term 'may' is used only in describing assumptions or background information used in formulating the requirements, not the requirements themselves. Has less certitude than 'will'.

The following keywords refer to each requirement definition as each requirement has the following attributes:

'UR Id' The unique numeric identifier of the user requirement, used for traceability back to the URD.

'Source' This is the source of the requirement used for backwards traceability and may be a document cross-reference, the name of a body or organisation, a particular review meeting or the ESA/DPRS team.

'Priority' The level of requirement precedence. These are (in decreasing order of importance) 1, 2 and 3. They reflect the importance and urgency given to each requirement. The requirements with higher priority levels shall be satisfied first. Note, that a level 1 requirement worded using 'should' will still be a higher priority than a level 2 requirement worded using 'shall'.

'Need' Defines the phase of the project over which a particular requirement becomes applicable. For this URD, there are two phases corresponding to an initial protocol specification and then a full protocol specification, with a further long term phase for future extensions. These phases correspond to Release A, Release B and Release C protocols, so that the requirements applicable for Release A (and therefore also Release B) are labelled 'A' and those for only for Release B are labelled 'B' and so on for Release C. Release A requirements are applicable for all protocol specifications (initial, full and extended), release B requirements are applicable for full and extended protocol specifications, and release C requirements are applicable for extended specifications.

'Qualifier' Each requirement should be verifiable, i.e. a method can be devised for objectively demonstrating that the software (or specification) implements or satisfies it. For user requirements, only a small set of qualifiers are needed as design is usually traced back to an SRD, however, the following qualifiers will be used to aid the verification process:

'**T'** qualified by software Test, i.e. by execution of software (may be by testing at the System, Integration or Module level, etc., this would be made clear at the next level in the requirements phase);

'**RD'** qualified by Review of Design, e.g. by analysis of ADD, DDD, etc.;

'**I'** qualified by Inspection, e.g. of actual physical deliverables or by inspecting the actual implemented code;

'**RP'** qualified by Review of the Protocol Specification.

'Text' This is the formulation of the requirement. Each requirement attempts to be clear, concise and unambiguous, with each statement containing one and only one requirement. (Note that the text for each UR is not preceded by the 'text' label as this would be redundant).

'Note' For some of the requirements there is a following note that expands and clarifies the description of the requirement and any particular implications.

1.4 References

[R1] *DPRS Technical Note*, LUK.502.EC21317/TN001, Issue 1.0, 18 August 1995, Logica UK Ltd

[R2] *Generic Payload Data Access, Retrieval, Packaging and Delivery*, ESA SoW A02839, 9/9/94, ESOC

[R3] *CEOS-CINTEX Lessons Learnt*, Issue 1.0, 1 January 1994, M. Elkington/EOS Ltd

[R4] *Model of an Interoperable Catalogue System (CINTEX Functional Model)*, Draft Issue 0.4, 26 June 1995, Richard Goebel/DLR

[R5] *Standard Representation of Latitude, Longitude and Altitude for Geographic Point Locations*, ISO/IEC 6709, First edition, ISO, 1983-05-15

[R6] *IEEE Standard Glossary for Software Engineering Terminology*, ANSI/IEEE Std 729-1983]

[R7] *ESA Software Engineering Standards*, PSS-05-0, Issue 2.0, ESA(BSSC), February 1991

[R8] *Object-Oriented Design*, P. Coad/ E. Yourdon, Prentice Hall

[R9] *Object-Oriented Modelling and Design*, Rumbaugh et al., Prentice Hall

[R10] *Data Entity Dictionary Specification language (DEDSL)*, Red Book, November 1996, Consultative Committee for Space Data Systems

[R11] *Information Technology - Open Systems Interconnection - Specification of Abstract Syntax Notation.One (ASN.1)*, ISO/IEC 8824, 2nd issue, ISO/IEC, 15 December 1990

[R12] *Information Technology - Open Systems Interconnection - Specification of Basic Encoding Rules for Abstract Syntax Notation.One (ASN.1)*, ISO/IEC 8825, 2nd issue, ISO/IEC, 15 December 1990

[R13] *IEEE Standard for Binary Floating-Point Arithmetic*, ANSI/IEEE 754-1985, 21 March 1985

[R14] *The ESA Earth-Observation Guide and Directory Service*, ESA Bulletin 78, May 1994, G. Triebnig/ESRIN

[R15] *Model of an Interoperable Catalogue System (CINTEX Functional Model)*, Draft Issue 0.3, April 1995, Richard Goebel/DLR

[R16] *Time Code Formats*, CCSDS Recommendation for Space Data Systems, Issue 2, CCSDS 301.0-B-2, April 1990, Consultative Committee for Space Data Systems

[R17] *Information Retrieval(Z39.50): Application Service Definition and Protocol Specification*, ANSI/NISO Z39.50-1995, Final Text for Review, May 1995, ANSI/NISO

[R18] *ERS-1 Ground Stations Products Specification for Users*, ER-IS-EPO-GS-0204, 22 September 192, ESA Earthnet

[R19] *Getting Started with HDF*, version 3.2, May 1993, NCSA

[R20] *ISO/IEC Image Processing and Interchange - Part 3 - Image Interchange Facility (IIF),* ISO/IEC 120987-3, 1st issue, 23 September 1994, ISO/IEC

[R21] *EOSDIS IMS Messages and Development Data Dictionary*, IMSV0-PD-SD-002, Version 1.0, December 1994, Hughes STX

[R22] *Parameter Value Language Specification (CCSD0006),* CCSDS 641.0-B-1, Issue 1, May 1992, Consultative Committee for Space Data Systems

[R23] *Parameter Value Language - A Tutorial*, CCSDS 641.0-G-1, Issue 1, May 1992, Consultative Committee for Space Data Systems

[R24] *CEOS Inventory Exchange Format*, Version 2.1.1, February 1992, Committee on Earth Observation Satellites

[R25] *Inventory Exchange Format for Image Data Described by World & Fixed Reference Systems*, Version 2.0, January 1992, ESA/ESRIN

[R26] *Directory Interchange Format Writer's Guide, Version 5.0 a*, http://gmcd.gsfc.nasa.gov/difguide/difman.html

[R27] *Information Retrieval (Z39.50): Application Service Definition and Protocol Specification*, ANSI/NISO Z39.50-1995, Version 3., July 1995, Z39.50 Maintenance Agency.

[R28] *Catalogue Interoperability Protocol, CIP Release B*, ESRIN RFQ/3-8722/96/WE-I, ESA/ESRIN.

[R29] *Catalogue Interoperability Protocol, User Requirements Document (URD)*, CEOS/WGISS/PTT/CIP-URD, Issue 1.2, March 1996, Committee on Earth Observation Satellites.

[R30] *Catalogue Interoperability Protocol, CIP Specification Release A*, CEOS/WGISS/PTT/CIP-A, Issue 1.2, March 1996, Committee on Earth Observation Satellites.

[R31] *Interoperable Catalogue System, Order Technical Note (OTN)*, CEOS/WGISS/PTT/OTN, July 1996, Committee on Earth Observation Satellites.

[R32] *Interoperable Catalogue System, Security Technical Note (STN),* CEOS/WGISS/PTT/STN, July 1996, Committee on Earth Observation Satellites.

[R33] *Interoperable Catalogue System, Collection Technical Note (CTN),* CEOS/WGISS/PTT/CTN, July 1996, Committee on Earth Observation Satellites.

[R34] *Interoperable Catalogue System, System Design Document (SDD),* CEOS/WGISS/PTT/SDD, Issue 1.2, February 1997, Committee on Earth Observation Satellites

[R35] *Global Change Master Directory*, NASA/GSFC, http://gcmd.gsfc.nasa.go

[R36] *Application Profile for the Content Specification for Digital Metadata or ''GEO''*, Version 1.0 Draft, July 1995, U.S. Geological Survey

[R37] *GIS standard (TBC: GIS reference model, TC211)*

[R38] *Z39.50 URL definitions*, ftp://ftp.loc.gov/pub/z3950/defs/url.txt

[R39] *Protocol Task Team (PTT), Development Plan*, CEOS/WGISS/PTT/Plan, 19 July 1996, Committee on Earth Observation Satellites

[R40] *Z39.50 Profile for Access to Digital Collections, Draft 7*, May 3, 1996 (Library of Congress)

[R41] *Interoperable Catalogue System, Collection Manual (reference TBD),* Committee on Earth Observation Satellites

[R42] *Catalogue Interoperability Protocol, CIP Specification Release **B***, CEOS/WGISS/PTT/CIP-B, Issue 2.2, January 1997, Committee on Earth Observation Satellites

[R43] *Internet-Draft 'Uniform Resource Locators for Z39.50' <draft-ietf-uri-url-irp-05.txt>*, IESG, 19 June 1996, Uniform Resource Identifiers Working Group

[R44] *Guidelines for an International Interoperable Catalogue System*, 2.1, April 1993, CEOS Catalogue Subgroup

[R45] *PTT Terms of Reference*, http://ceos.ccrs.nrcan.gc.ca/taskteam/cip.html

1.5 URD Overview

The role of this document with respect to the PTT plan[R39] is described in the opening paragraph of Section 1.1. The structure of this URD follows the guidelines for a URD as given in the ESA Software Engineering Standards PSS-05[R7]. The document is divided into three sections:

- Section 1 (this section) describes the purpose of the URD, the scope of the URD and the ICS, contains glossary of acronyms, definitions, etc., and an overview of the URD.
- Section 2 describes the operational scope of the ICS, some of the fundamental concepts behind the ICS and general factors that affect the ICS, the specification of the CIP and potential implementation.
- Section 3 provides the specific ICS user requirements, split into capability requirements and constraint requirements. The capability requirements section is further subdivided into requirements pertaining to:
  - the specification of the CIP;
  - the software for the Retrieval Manager;
  - the software for the CIP Client;
  - the software for the Catalogue translator;
  - software relating to collection management.

For the constraint requirements, there are various categories (see explanatory text on constraint requirements in this section) which, if appropriate, are grouped as above.

This document does currently not include requirements for the catalogue translator software. Requirements related to this software component will be included in Release C of the ICS URD.

Capability Requirements

The capability requirements are those needed for specification and implementation of the ICS, which are specified in terms of ICS provided functions, i.e. what the ICS can support. Capability requirements will be analysed in the SRD phase to produce sets of functional requirements. Performance and accuracy characteristics should also form part of the capability specification, so that a capability requirement can be qualified with values of:

- capacity (e.g. number of users supported, number of terminals, etc.);
- speed (e.g. time taken to perform an operation, quantified with a figure);
- accuracy (prediction, reporting ,etc.).

At present the areas regarding the CIP Client and collection management are only covered at a relatively high level of detail. These areas will be investigated by the PTT and technical notes, which will serve as input for the definition of more detailed requirements in these areas, will be produced.

Constraint Requirements

The constraint requirements are those constraining the specification and subsequent implementation, e.g. existing protocols, quality standards and external interfaces.

Examples of interface constraints may include communications interfaces (e.g. network protocols), hardware to be used, compatible software and external software interfaces, HCI requirements (not directly applicable to the ICS).

Quality constraints include availability, adaptability, portability, security, safety, standards, resources and timescales. These categories are briefly described in the appropriate subsections of the constraint requirements.

2. General Description

The purpose of this section is to describe the factors which affect the specification, design and development of the Catalogue Interoperability Protocol, the Retrieval Manager, the CIP Client Applications, the collection management tools and the associated user requirements. This section does not contain any specific user requirements, but contains information which should aid the understanding of the individual requirements in Section 3.

This section contains the following subsections:

- Section 2.1 puts the CIP into perspective with the Interoperable Catalogue System and the Earth observation domain as a whole. It presents both a physical and an object model of the domain of the CIP and introduces the key concepts for the CIP.
- Section 2.1 introduces the characteristics of the users of the CIP and shows how the CIP will support users in interacting with a catalogue service.
- Section 2.3 presents the general constraints that may influence the development of the CIP.
- Section 2.4 presents the assumptions and dependencies which are made for the CIP.
- Section 2.5 presents the operational environment of the CIP by describing the physical architecture of a complete distributed Interoperable Catalogue System which would interoperate by virtue of the CIP. This includes a description of the Retrieval Manager and the CIP Client Applications.

2.1 Product Perspective

The aim of this section is to put the CIP into perspective with the Interoperable Catalogue System and the Earth observation domain, illustrating how the CIP will function within such a domain and the key factors, or objects, that constitute the domain.

Two different views of this perspective are provided:

- In Section 2.1.1, the physical context and scope of the CIP and the Retrieval Manager are introduced;
- In Section 2.1.2, a CIP domain object model is presented. This domain object model contains all the objects that are considered significant within the EO retrieval domain. By identifying each of the objects and their relationships a comprehensive analysis of the domain can be achieved and also a strict documentation of the dynamics of the domain. This domain object model is then used as the primary driver for deriving the specific requirements for the CIP and the Retrieval Manager.

These two views are complementary. The physical domain model provides insight into the boundary of the CIP related developments and the systems that will be impacted by its introduction. It also provides an insight into practical implementation issues, such as the distribution of software and hardware elements.

The object model view focuses on the data and elements that will be handled by the CIP. This includes both static structures (state information for requests of all types) and message structures used to exchange information.

The physical domain model is particularly useful for understanding the role of the Retrieval Manager, which is essentially composed of software, whilst the object model view will be particularly relevant to the development of the CIP which is essentially concerned with information exchange.

There are a number of fundamental concepts in the model used to develop the CIP, these are also addressed in more detail in Section 2.1.3 and Section 2.1.4 which follow the CIP domain object model.

2.1.1 Physical Domain Model

This section introduces a physical domain model for the CIP providing a high level introduction to the problem, with the following benefits:

- It illuminates the relationship between the CIP, the ICS and the real-world administrative environment managed by organisations such as ESA and NASA;
- It illuminates the relationship between the CIP and existing heritage systems and developments such as IMS, UIT and the CEO enabling services.

Through the application of some simple logic, it can then be shown that the overall structure of the Interoperable Catalogue System and the CIP elements are essentially dictated by these real-world constraints.

The CIP domain can be seen as a virtual 'CIP space' (see Figure 2-1) within which CIP messages, consisting of requests and responses, are exchanged between architectural elements: clients, servers and brokers. CIP is used by the physical elements of the ICS, therefore the CIP domain has the same extent as the ICS domain.

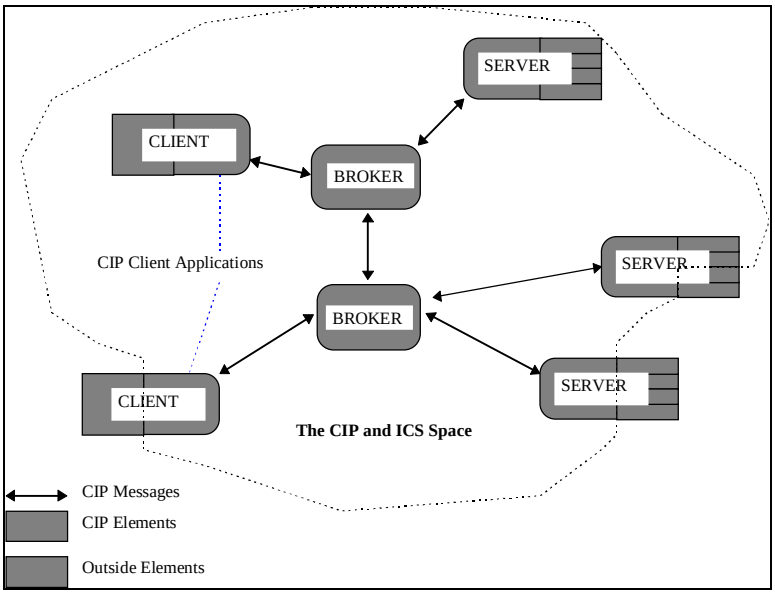


Figure 2-1: The ICS Domain and CIP Space

The CIP space is bounded by interfaces to client-mappers and server-mappers, that is, software that converts CIP messages into external formats. The external formats may be the protocols of other computer systems, or MMI packages where information is received from and returned to a user. Future client and server developments may not require mappers, as the clients and servers may be designed to interface directly using the CIP (as indicated by the non-shaded client and server components). The diagram also indicates that a single instance of a CIP server may map onto more than one instance of an external system.

Clients and Servers

The clients will in general be the sources of user requests and are associated with human users.

The servers will be the sources of products and related information retrieved from physical catalogues and archives.

Both clients and servers are in general associated with particular organisations such as ESA, NASA, etc. Traditionally, the systems of these organisations have had little interoperability, so that each organisation's clients (i.e. users) would only interact with that organisation's own server(s). This situation was partly the result of incompatible technical systems and partly from administrative problems such as conceptual differences with common user registration and authentication. Historically, the lack of interoperability has been addressed through bilateral and multilateral agency exchange agreements, but this solution can be rather error prone and inefficient.

For the order process within an authenticated domain, the issue of data provider agreements and collaborations are however particularly relevant and these must be established for interoperability within the ICS to be successful.

Providing a seamless interoperable environment whereby users can conveniently access all available data, whoever it belongs to, requires both the technical and administrative problems to be addressed. It also requires a greater degree of management of data access; addressing user authentication, user interaction session management, etc., and the problems of routing (sending client requests to the correct server) and collation (accumulation of different sets of results). This leads to the concept of a broker, which sits between the client(s) and server(s).

Brokers

The broker can be seen as a gateway to the servers of an organisation or of a facility within an organisation. Accessing the system through a controlled entry point such as a broker rather than directly to the servers provides greater security as well as more flexible access and control of session management.

The broker also provides a convenient basis for interoperability, in that the brokers associated with different organisations can talk to each other in a common language even if the underlying servers are disparate in nature.

For the CIP, an appropriate starting point is that organisations provide brokers acting as gateways to their servers. The users that belong to an organisation access their own servers via their own broker and can also access the brokers (and hence servers) of other organisations via broker to broker communications.

It is inappropriate to assume that all clients and servers could be updated to use a single standard protocol internally, particularly given the financial commitments already provided for existing heritage systems. This leads to the 'CIP space' concept introduced above. The servers and clients (which may be other systems, possibly substantial in their own right) may have their own native protocols internally, but both will talk to the brokers (and the brokers will talk to each other) in the standard language of the CIP protocol.

CIP Space

The servers and clients will therefore consist of a mixture of CIP compliant software which can talk to CIP brokers, application specific software dealing with native formats and protocols, and translation or mapping software which can translate between the two. This is in fact a familiar model as well as a natural one, as it has already been used in interoperability experiments and demonstrators such as with the ESA UIT and the NASA IMS. From the experiences gained with these systems, it could be that a practical solution will be for libraries of CIP compliant routines (including skeleton translation routines)

to be provided to client and server developers as a starting point for integrating new client and server systems into the CIP space.

Therefore, the CIP space will support a number of request/response services between clients and servers, facilitated by brokers which enables the systems developed and operated by different organisations to interoperate. The specific services provided are defined at the level of a URD (i.e. in this document) only in terms of end to end functionality, i.e. what the client and server input and receive back from the CIP space.

The issue of how the functionality needed to support the CIP is divided between the ICS specific components of the client, the broker, and the ICS specific component of the server, is not something to be resolved at the level of the ICS URD. A range of architectural solutions can be envisaged, with different distributions of functionality and emphasis, and these should be traded off and evaluated and the resulting solutions shown in lower level system requirements and architectural design documents ie at the level of ICS components..

The three pieces of software shown in Figure 2-1 above, the client, broker and server elements, should therefore be considered as black boxes. The client and server boxes may be completely new developments or extensions to existing developments. The broker within the context of this URD and CIP development shall be called the Retrieval Manager, as it manages all protocol data flow within the CIP space.

Further details of a proposed physical architecture for Retrieval Manager and catalogue site interaction are presented in Section 2.5: Operational Environment.

2.1.2 CIP Domain Object Model

This section presents a set of object oriented models of the CIP domain relevant to an ICS. The key objects within the domain are identified at the logical level and their relationships with one another are shown. This model is the key method of analysing the interaction between objects within the CIP domain and hence deriving the specific CIP requirements. These requirements can then be used to derive the Retrieval Manager, CIP Client Applications and collection management requirements.

For this ICS URD, which builds on the modelling performed in the CIP URD[R29], a set of complementary object models has been produced, which focus on particular areas i.e.:

- domain data;
- attributes;
- collections;
- sessions;
- ordering.

This avoids the complexity that would occur within one single object model and facilitates the requirements analysis process.

Following the object models is a definition of each of the objects within the model and their relationships with any other associated objects. A clear understanding of the objects in the models are important in understanding the complete CIP domain. The object definitions are provided in alphabetical order following the object model for easy reference.

The domain model presented here uses the notation as per the OMT (Rumbaugh) method[R9]. See Appendix A for a detailed overview of the notation, but for quick reference the following is a summary guide to the notation:

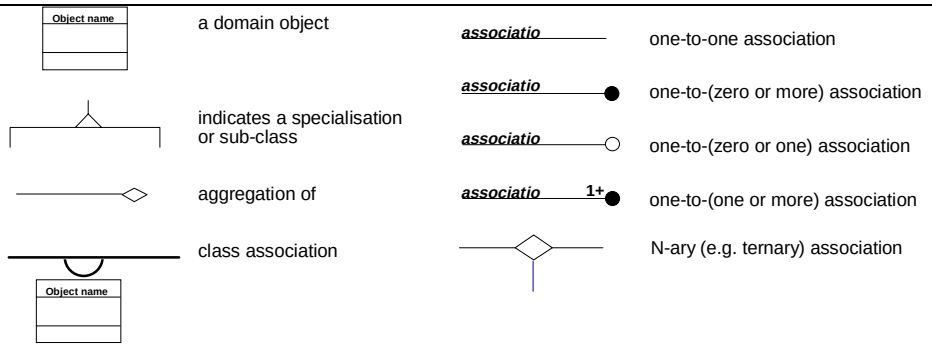


Figure 2-2: OMT Notation Overview

In reading the following domain model the following techniques may assist the reader:

- When an object is a specialisation of another object, the full name of the specialised form should be read as the 'name of the specialised object' followed by the 'name of the generalised object'. For example, a generalised object is labelled **item descriptor** and a specialisation of that object is labelled **product**, therefore the specialised object should be considered a **product-item descriptor.** In some cases, the same base label appears to be used (eg Browse, Guide, etc), but these, when expanded into the full label, to get Browse Simple Attribute or Browse EO Data, or Guide EO Data etc
- When an object is associated with another object, there is a label on the association line indicating the type of association. The association should be read following the name of the closest object, so as to relate it to the farthest object. For example, the association label ***comprised of*** is nearest to the object **collection**, therefore the model should be read as a '**collection** is ***comprised of*** (one or more) **item descriptors';**
- In the domain model, the term 'item' actually represents a 'CIP item', and this should be assumed when referring to an 'item'. If the CIP prefix was used throughout, the labels for each object would be too cumbersome and reduce the readability of the diagram and accompanying text.

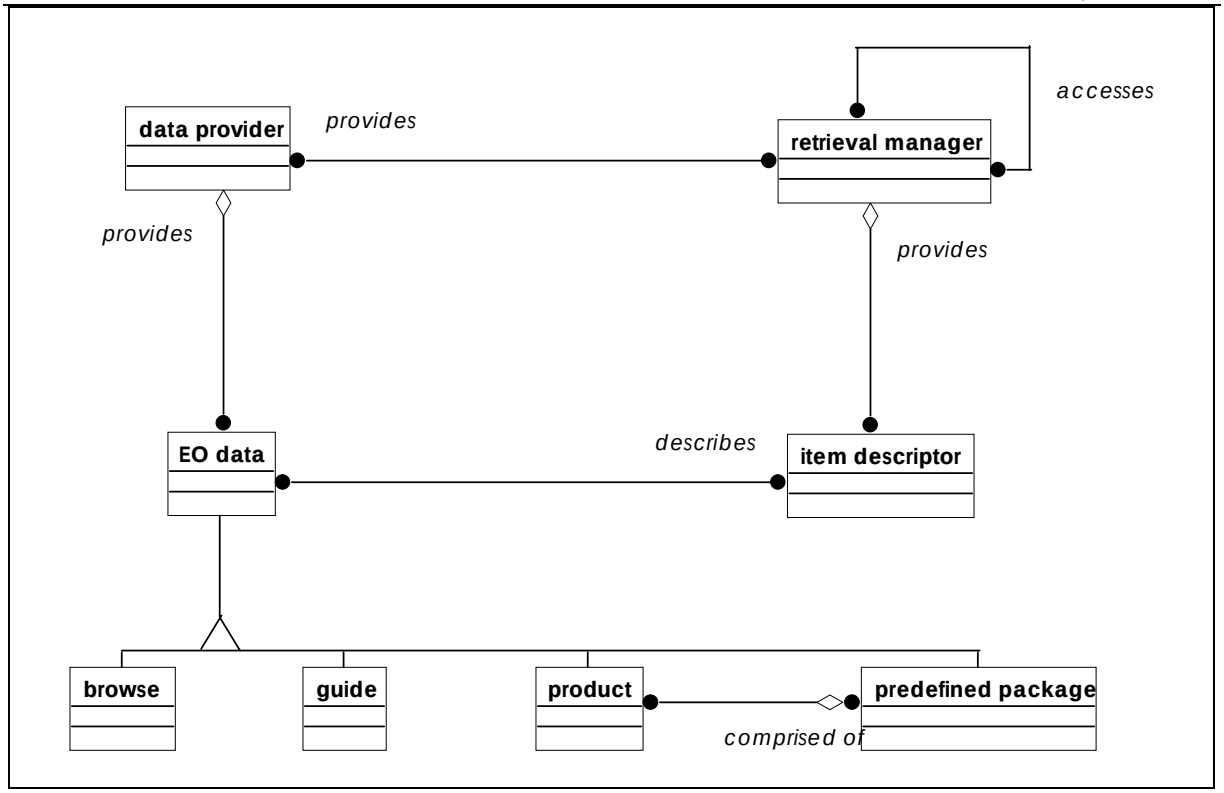


Figure 2-3: Data Object Model

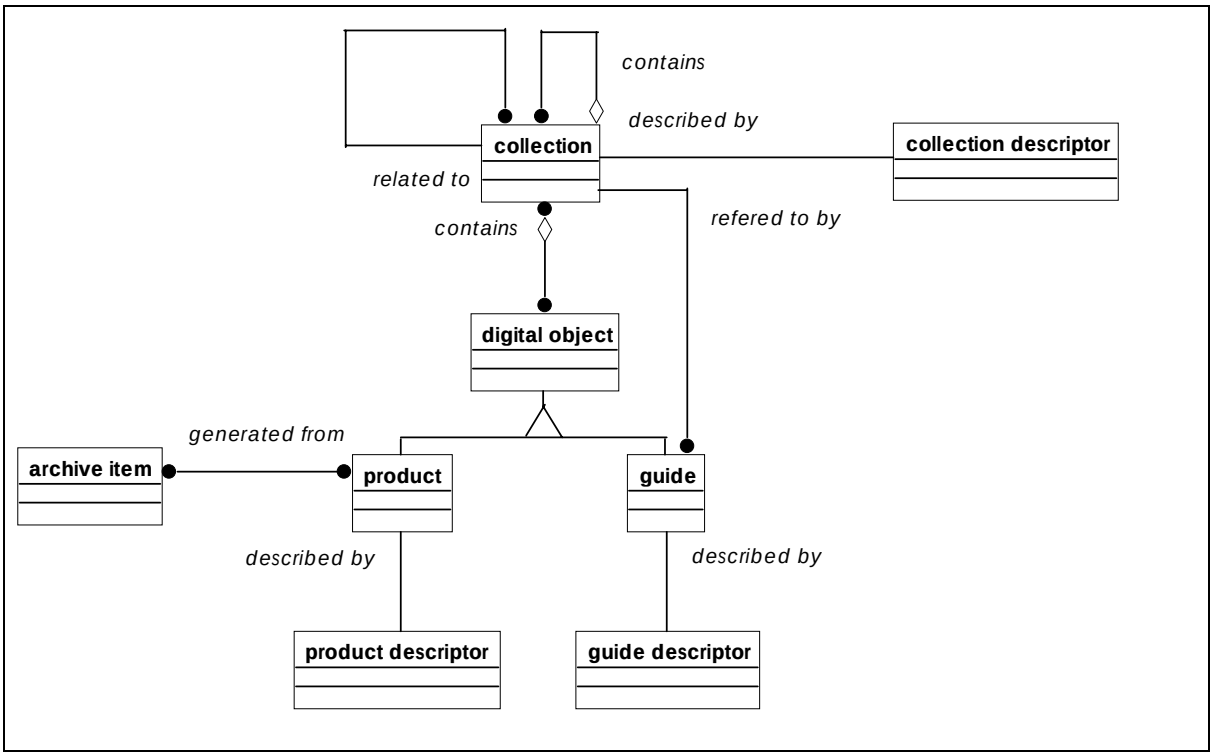


Figure 2-4: Physical Object Model

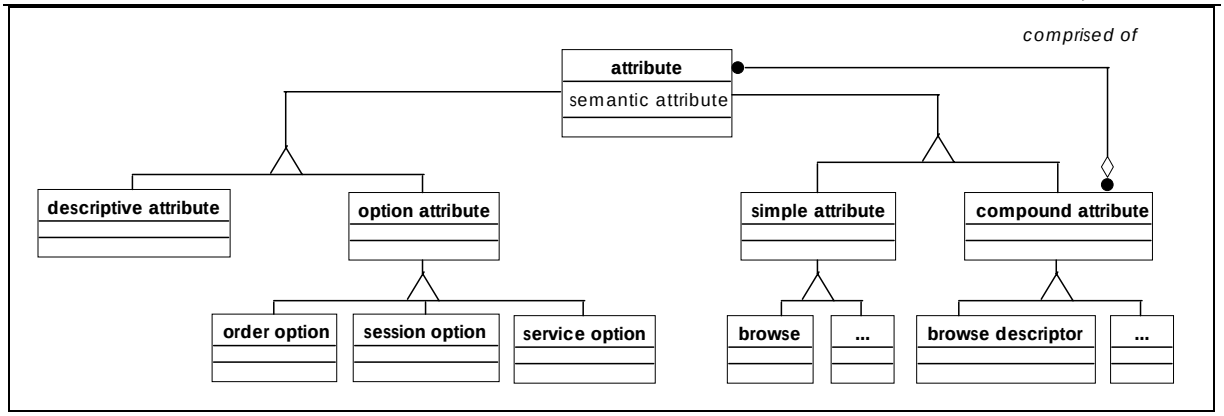


Figure 2-5: Attributes Object Model

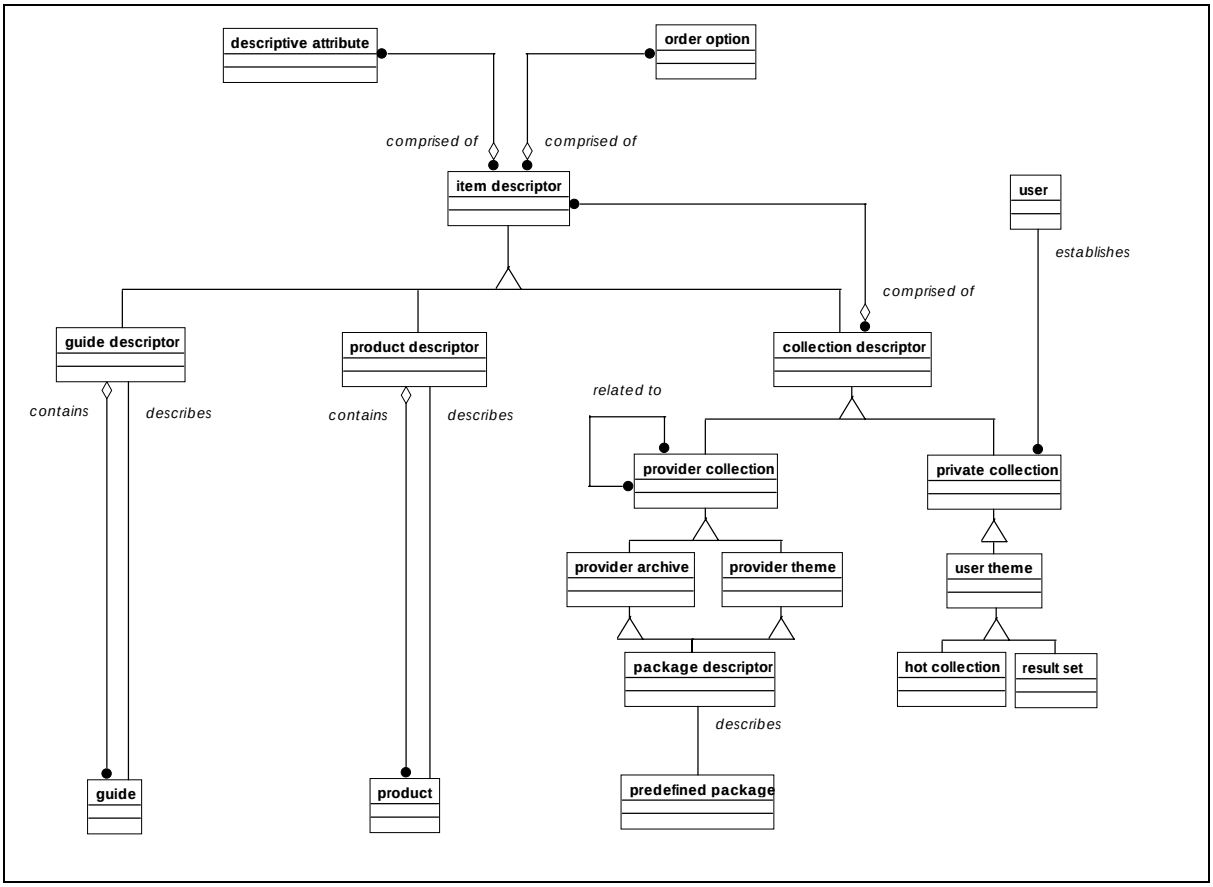


Figure 2-6: Collections Object Model

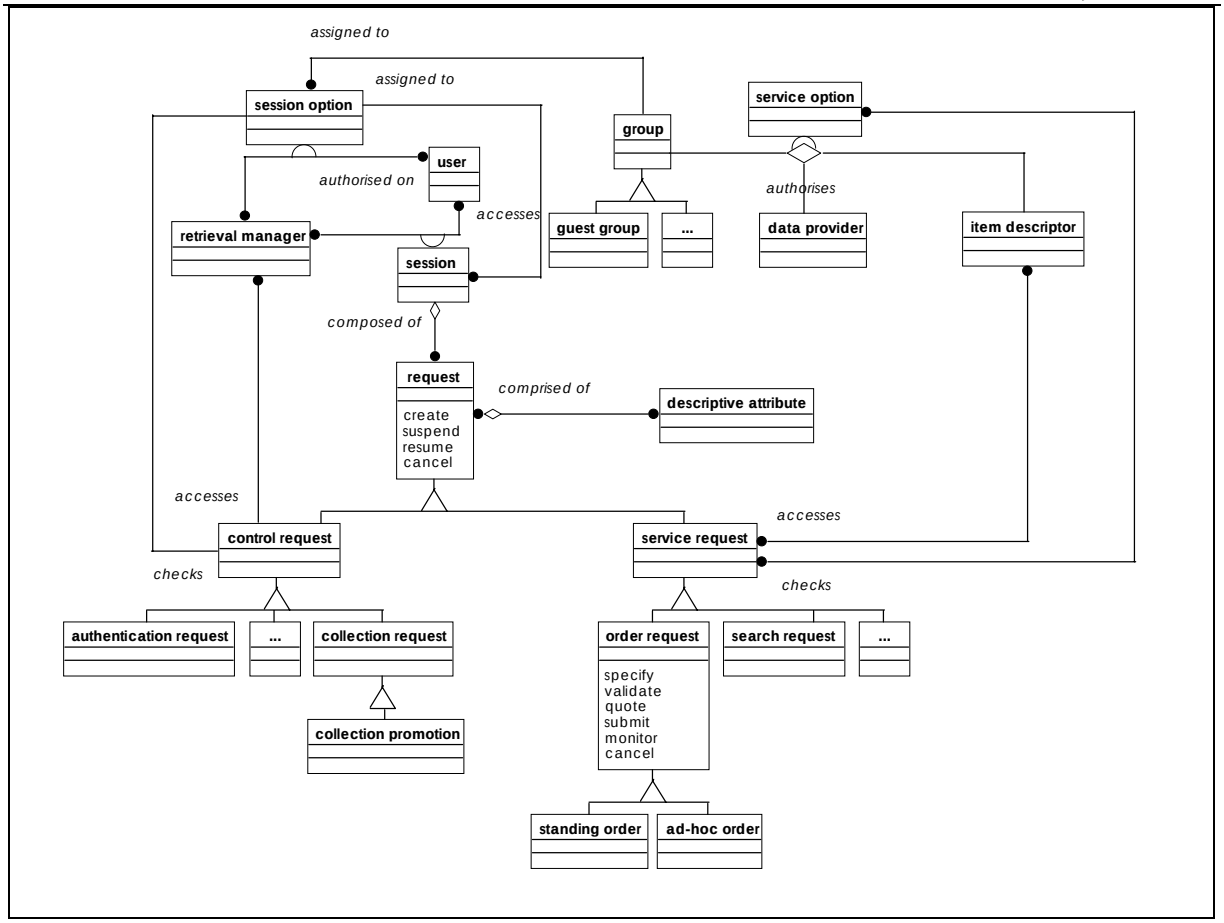


Figure 2-7 Session Object Model

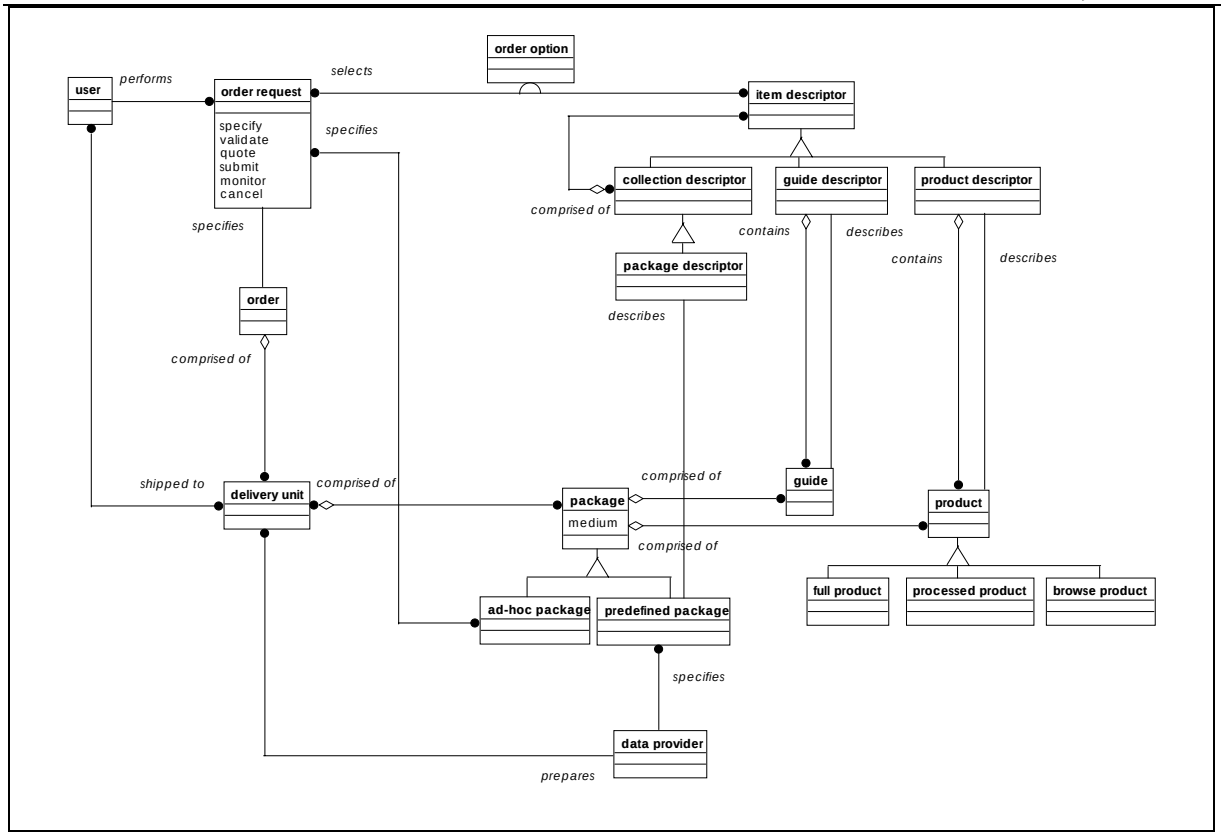


Figure 2-8: Order Object Model

The definitions related to the CIP Domain Object Models are listed below in alphabetical order. When appropriate, the name of the object (as used in the Object Models), is followed by the full name (in italic) of the Object according to the naming convention introduced at the beginning of this section.

ad-hoc package	The **ad-hoc package** object is a specialisation of the **package object**. An **ad-hoc package**, (contrary to a **predefined package** which is prepared in advance by a **data provider)**, is prepared on the fly according to the specification provided by a **user** as part of an **order request**.
ad-hoc order **ad-hoc order request**	The **ad-hoc order** object is a specialisation of the **order request** object and represents an **order request** which the **user** performs interactively with the client software that is being used.
attribute	The **attribute** objects are the building blocks which are used to define other objects in a consistent manner. Two kinds of **attributes** are distinguished: **descriptive attributes** are used for the description of an item, while **option attributes** are used for the description the options applicable to an item. An **attribute** object is either a self-contained **simple attribute** (i.e. the meaning of the attributes is fully contained in the **attribute** itself), or it is defined in terms of other **attribute** objects, in which case it is defined as a **compound attribute** (i.e. the meaning of the **attribute** object is defined in terms of the **attributes** it is comprised of).

	To unambiguously define an **attribute** object a number of further attributes, called semantic attributes, are required, such as, the NAME, the MEANING, the UNITS, possibly an ALIAS, the abstract SYNTAX of the **attribute's** value, etc. The domain model explicitly shows this relationship in that the **attribute** objects are themselves described by attributes (referred to as semantic attributes). Whilst the set of **attributes** that describe **item descriptors** may be extensive and vary between catalogue sites, the semantic attributes that describe them, must be of a pre-defined set so that a client and server can communicate with an agreed level of understanding.
authentication request ***authentication control request***	The **authentication request** object is a specialisation of the **control request** object. It allows a **user** to log onto a **retrieval manager** and ensures that the **user** is authorised to do so by checking the **user's session options** on that **retrieval manager**.
browse ***browse simple attribute***	The **browse** object is a specialisation of the **simple attribute** object. The **browse** object represents a reduced resolution or summary of a **product** object. It is modelled as an **attribute**[1] as it summarises or describes a characteristic of the **product** object, the same as any other **attribute**. The **browse** object can not be ordered in the same manner as a **product**, but can only be accessed by virtue of a **product descriptor** (via a **browse descriptor**). (Note that if the **browse** was an image and could be searched for and ordered by a **user**, then that piece of data would be modelled as a **browse product** object, in a similar manner as any other higher resolution **product)**. Whilst there are many other **simple attributes** that could be included in the model (as shown by the dotted specialisation of the **simple attribute** object), only the **browse** is shown as it is an important object within current catalogue systems, often provided via a separate service.. The other **simple attributes** tend to be textual or numeric in nature, rather than binary.
browse descriptor ***browse descriptor compound attribute***	The **browse descriptor** object is a specialisation of the **compound attribute** object. The **browse descriptor** contains all the attributes, in particular the **browse** object(s) (i.e. the actual browse data), that specify a reduced resolution or summary of a **product** object. The **browse descriptor attribute** can not be processed in the same manner as an **item descriptor**, as it can only be accessed by virtue of the **product descriptor**. If the **browse descriptor attribute** contained a **browse** object that was an image and could be searched for and ordered by a **user**, then that piece of data would be modelled as a **product descriptor** object the same as any other **product descriptor** describing a higher resolution **product**. Whilst there are many other **compound attributes** that could be included in the model (as shown by the dotted specialisation of the **compound attribute** object), only the **browse descriptor** is shown as it is an important object within current catalogue systems, often provided by a separate service.
browse product	The **browse product** object is a specialisation of the **product** object. The **browse product** object is very similar to the **browse attribute** object, in

[1] Note that, whilst this is not explicitly shown in the model, the **browse attributes** (i.e. **browse simple attribute** and **browse compound attribute**) are **descriptive attributes**.

	that both represent reduced resolution or summary representation of a **full product**. The fundamental difference is that the **browse attribute** is handled like any other **attribute** (i.e. the methods applicable to an **attribute** are applicable to the **browse attribute**), whereas the **browse product** is handled like any other **product** (i.e. the methods applicable to a **product** are applicable to the **browse product**). A **browse product** can therefore be ordered, whereas a **browse attribute** cannot.
collection descriptor	The **collection descriptor** object provides the facility for groupings - or collections - of **item descriptors**. This is shown in the model by the association that a **collection descriptor** is comprised of one or more **item descriptors**. As **item descriptors** can be either **product, guide-** or **collection descriptor** objects, a recursive relationship, which defines an **item descriptor** hierarchy, can be established. It also means that a single **collection descriptor** can contain a mixture of different **item descriptor** types, therefore providing a means of grouping heterogeneous **item descriptors** that relate to a single theme.[2] Furthermore, modelling the domain in this way means that **requests** (such as **search** or **ordering requests)** that can be used to access single **item descriptors** can also be applied to groups (or collections) of **item descriptors**. Two kinds of **collection descriptors** are distinguished, depending on the owner of the collection, the scope and purpose of the collection and the requests that can be performed on the collection.: • A **provider collection descriptors** is established by a **data provider** in order to provide access to the **collection descriptor** to a wide community of **users** (i.e. the whole CIP domain), usually for a rather general purpose and in the long term. As **provider collection descriptors** are defined for a large community, services such as collection discovery are provided. A **private collection descriptor** is established by a **user** for their own needs, usually with a rather narrow purpose and for a short term. If a **user** desires that a **private collection descriptor** be made available to a larger community, they can request that this **private collection descriptor** be promoted (with the approval of a **data provider**) to become a **provider collection descriptor**. The model also illustrates that if any service results in a list of **item descriptors** (such as the results from searching a **collection descriptor**) then that list of **item descriptors** (i.e. a **result set**) can be considered a new **collection descriptor** (as a **collection descriptor** is just a list of **item descriptors**). As the concept of collection is fundamental to the CIP domain, it is examined in more detail in Section 2.1.3.
collection promotion ***collection promotion request***	The **collection promotion** object is a specialisation of the **collection request** object. A **collection promotion** allows a user to promote a **result set** (i.e. a **collection descriptor** belonging to the **user** for the duration of a **session**) to a **hot collection** (i.e. a **collection descriptor** belonging to the **user** and which duration spans **sessions**).
collection	The **collection request** object is a specialisation of the **control request** object.

[2] Note that for Release B of the CIP, it is not a requirement to support 'mixed collections' and their searching. Therefore CIP Release B shall only address collections where the item descriptors are of a single type.

request ***collection service request***	A **collection request** allows a **user** to perform collection management operations.
compound attribute	The **compound attribute** object is a specialisation of the **attribute** object and represents a type of **attribute** that is defined in terms of other **attributes**. The full semantics of a **compound attribute** is not included in the **attribute** itself; instead, it is defined in the various **attributes** of which it is comprised.
control request	The **control request** object is a specialisation of the **request** object. The **control request** is used by a **user** to manage a **session** on a **retrieval manager**.
data provider	The **data provider** object represents the organisation that owns (or holds or manages) the **EO data**, and which provide the collections that allow users to access their **EO data** in the CIP domain via the **retrieval managers**.
delivery unit	The **delivery unit** object is comprised of one or more **packages**. It also contains all the information necessary for the actual delivery of those **packages** (such as delivery address) to the **user**. A **delivery unit** is part of an **order**, and is effectively specified by a **user** via an **order request**.
descriptive attribute	The **descriptive attribute** object is a specialisation of the **attribute** object. **Descriptive attribute** are used for the uniform description of **item descriptors**.
EO Data	The **EO Data** object represents all the EO domain data accessible via the CIP. The **EO Data** object is specialised in the various kinds of data in the EO domain, i.e. **browse**, **product**, **guide**, and **predefined package**, and is provided by **data providers**. Each piece of **EO data** accessible via the CIP is described by corresponding **item descriptors**.
full product	The **full product** object is a specialisation of the **product** object, It represents the full resolution and full size EO data **product**.
group	The **group** object represents the groups of **users** that are recognised within the CIP domain. Not all groups need to be supported by all **retrieval managers** and **data providers**. However, it is essential that common groups be defined. One such common group is the **guest group**. The **group** is used both for the assignment to a **group** of the **session options** that a **user** has on a specific **retrieval manager** and the definition of the **service options** that a **group** of **users** has for the access of **item descriptors** provided by a specific **data provider**. It is important to note that the assignment of **session options** to a **group** provides the means to link **session options** (which are **user** based) with the **service options** (which are **group** based).
guest group	The **guest group** object is a specialisation of the **group** object. The **guest group** should be supported by all **data providers** and all **retrieval managers** to define the default (and probably minimum) **options** used for both authentication (i.e. for the definition of default **session options**) and authorisation (i.e. for the definition of default **service options**) when no **user** specific information is available. Note that a guest user will not normally need to supply authentication details (eg username/password), but they will still be able to access ICS services and hence their session is viewed from the model as being authenticated.
guide	The **guide** object is analogous to the **product** object in that it represents the

	actual **guide** data that is described by a **guide-descriptor** object. As for **products**, the **user** can select the **guide** data of interest by searching on the **guide descriptor** object and then requesting the actual **guide** data. In the case of **guide** data it is anticipated that the order function is very simple and requires no authentication. Due to the recursive model employed it means that any **product descriptor** may include pointers to **guide-descriptors**, therefore associating certain **guide** data with a particular **product descriptor** and hence a **product**. It is anticipated that the **guide** data can also be directly accessed via simple protocols such as HTTP. Note that one **guide-descriptor** can only describe one piece of **guide** data and one piece of **guide** data can be described by only one **guide-descriptor**. However, this does not mean to say that one **guide-descriptor** cannot appear in more than one **item descriptor**.
guide descriptor	The **guide-descriptor** object is a specialisation of the **item descriptor** object, where the **attributes** that constitute the object describe **guide** data that is available to the **user** to enhance understanding of available **products**, (e.g. by specifying the spacecraft, instrument, etc.) or collections that may be accessed by a **user** or provided services. The **guide-descriptor** object does not in general, include the actual **guide** data itself. The **guide-descriptor** may also indicate that different formats of the **guide** data are available, such as, word processor format, ASCII text, postscript, paper document, etc.
hot collection ***private user theme hot collection descriptor***	The **hot collection** object is a specialisation of the **user theme private collection descriptor** object, and can be viewed as a **result set** whose existence spans **sessions**. A **hot collection** is belongs to and is managed by a **user** using **collection requests**.
item descriptor	The **item descriptor** object is the lynch pin of the conceptual model and hence the CIP domain. An **item descriptor** is comprised of **descriptive attribute** objects and **order options** objects: • The **descriptive attribute** objects describe the **item descriptor** in a consistent manner, therefore resulting in dynamically defined **item descriptor** object instances. Also, the **descriptive attribute** objects that constitute the **item descriptor** can be searched on so as to identify a particular **item descriptor** or group of **item descriptors**. • The **option attribute** object describe the order options applicable to the **item descriptor** for its ordering. The specialisations of the **item descriptor** object, i.e. **collection descriptor**[3], **product descriptor,** and **guide descriptor**, represent the key objects in the CIP domain.

[3] Note, that to simplify terminology throughout this document, whenever the term **item descriptor** is specialised, as in **collection item descriptor**, then the word 'item' will be omitted for clarification, therefore resulting in, for example, **collection descriptor**, **product descriptor**, etc.

medium	The **medium** object represents the actual physical **medium** (such as tape, CD, etc.) on which a **package** is stored.
option attribute	The **option attribute** object is a specialisation of the **attribute object**. Different kinds of **option attributes** can be distinguished: **order options** are used for the description of the ordering options applicable to **item descriptors**, **session options** are used for the description of the options defined for a **user** at a specific **retrieval manager** and **service options** are used for the description of the options provided by a **data provider** to **groups** of **users** for the access of **item descriptors**.
order	The **order** object represents the actual physical **products** that are packaged and delivered to a **user**. An **order** is specified by a **user** via an **order request**, and is comprised of **delivery units**.
order option ***order option attribute***	The **order option** object is a specialisation of the **option attribute** object. **Order options** are used to describe the options that are applicable to an **item descriptor** and that may be selected by a **user** when performing an **order request**. The choice of the **order options** available to a **user** when performing an **order request** may be restricted by the **user's service options**.
order request ***order service request***	The **order request** object is a specialisation of the **service request** object. An **order request** allows a **user** to specify an **order**. The **order request** specifies the **item descriptors** which are used to define the **order**. Moreover, it contains all the **order options** that permit to fully specify the elements defining the **order**, such as **delivery units** and **ad-hoc packages**.
package	The **package** object represents **products**, and possibly related **guide** data, that are prepared on a **medium** for delivery purposes. A **package** is either a **predefined package**, which is specified and prepared in advance by a **data provider**, or an **ad-hoc package** which is specified on demand by a **user** as the result of an **order request**.
package descriptor ***package provider collection descriptor***	The **package descriptor** object is a specialisation of the **provider collection descriptor** object. In particular, a **package descriptor** is also a specialisation of both a **provider archive collection descriptor** and a **provider theme collection descriptor**. A **package descriptor** describes a **predefined package** which contains the actual **products** on the physical instance of a **medium**. **Packages** can be ordered via the location and order of **package descriptors**.
predefined package	The **predefined package** object is a specialisation of the **package** object. Frequently EO **products** are produced in advance by **data providers** and stored without any knowledge of what **users** may actually request. It is often the case that more than one EO **product** is stored on the same physical medium. These groups of **products** are called **predefined packages**. An example of a **predefined package**, could be when three **products** from the same satellite pass have been put on a single medium and are available collectively for a reduced price or when all **products** over a particular geographical area are included in a single group of CD-ROMs and can be ordered via a single identifier. In fact the recursive nature of this model means that a **package-collection-descriptor** can mix **full products**, **guide** and **browse** in a single **predefined package**.

private collection ***private collection descriptor***	The **private collection** object is a specialisation of the **collection descriptor** object. A **private collection descriptor** is established by a particular **user** and is managed by that **user**. The duration of the validity of the grouping of the **item descriptor** it represents can either be a single **session** in the case of a **result set**, or span across different **sessions** in the case of a **hot collection**. Note that a **private collection** object is private in the sense that it is owned and managed by a user, however, it can be made available to others if that user desires, eg by publicising the URL, for use within a project.
processed product	The **processed product** object is a specialisation of the **product** object. It is very similar to the **full product** object, except that a number of parameters have been included in the **order request** information that have requested that the **full product** be used to generate a derived or **processed product.** This is the product that is then delivered. There are various examples of **processed product** that can be formed such as subsample (reduced resolution), subset (reduced size), sampled subset (reduced resolution, reduced size), and sub-products eg from band selection.
product	The **product** object represents the actual EO product data that can be ordered and delivered to the **user**. Whilst the data may be stored in an archive in a quite different format to that delivered to the **user**, the **user** is never aware of this. Furthermore, the data may not be present in the archive at the time that the **order request** is placed or it can be generated on the fly as a result of the **order request**. The **user** only sees, from **item descriptor** objects, **products** that may be delivered. Of course there may be further information that is required which will change the format of delivery or perform subsequent processing before delivery, but to the **user** it is still the same **product**. There are various instantiations of **product** depicted in the model - **full product** (full size, full resolution), **processed product** (result of processing on a full product) and **browse product**.
product descriptor	The **product descriptor** object is a specialisation of the **item descriptor** object, where the **descriptive attributes** that constitute the object describe an **EO data product** that may be delivered to the end **user** and the **order options** describe the ordering options that are available for the **product**. The **product descriptor** object does not in general include the actual **EO data** itself (although this is not precluded). There may be further processing on the EO **product** that is described before delivery to the **user**, such as band selection, etc. This is achieved by the selection of the appropriate **order options** in the **order request** during the order process. This selection may be restricted by the **session options** defined for the **user** and by the **service options** defined for the **group** in which the **user** belongs.
provider archive ***provider archive collection descriptor***	The **provider archive collection descriptor** object is a specialisation of the **provider collection descriptor** object, which represents a homogeneous grouping of **item descriptors**. A **provider archive collection descriptor** is established by a **data provider** and is analogous to the inventory of currently existing catalogues. A **provider archive collection descriptor** will contain **item-descriptors** which identify locally available data and will not contain any **item-descriptors**

	describing remote data.
provider collection ***provider collection descriptor***	The **provider collection descriptor** object is a specialisation of the **collection descriptor** object. A **provider collection descriptor** is established by a **data provider**. It represents either a **provider archive collection descriptor** (a local homogeneous grouping of **item descriptors**) or a **provider theme collection descriptor** (a distributed and/or heterogeneous grouping of **item descriptors**).
provider theme ***provider theme collection descriptor***	The **provider theme collection descriptor** object is a specialisation of the **provider collection descriptor** object, which represents a heterogeneous grouping of **item descriptors**. A **provider theme collection descriptor** is established by a **data provider** in order to provide a more focused or themed grouping of data, e.g. for a geographical region or climatic investigation. This themed group may be of particular interest to other organisations and **users** and may contain sets of **item descriptors** with varying definitions. A **provider theme collection descriptor** may contain **item-descriptors** describing remote data.
request	The **request** object represents an action that a **user** can instruct a **retrieval manager** to perform . Two kinds of **requests** can be distinguished: **control requests**, which allow the user to manage a **session**, and **service requests**, which allow the **user** to access data in the CIP domain. Some operations for the management of the **requests** themselves are also defined, such as creation, suspension, resuming and cancellation of **requests**.
result set ***private user theme result set collection descriptor***	The **result set** object is a specialisation of the **private user theme collection descriptor** object. A **result set** represents a temporary list of **item descriptors** that has been generated as the result of a **search request** targeted at a **collection descriptor** during the interaction between a **user** and a **retrieval manager** in a **session**. This temporary list of **item descriptors** can be uniquely identified and operated upon, e.g. enabling the searching on a set of search results rather than repeating a search on the original **collection descriptor**. The actual contents of a **result set-** is a list of pointers to other **item descriptor** objects within the CIP domain. The term **result set** is analogous to the concept of 'working set' or 'scratch pad list' found within other domains. A **result set** is intended as a transient **collection descriptor** belonging to a **user** that only a local client MMI (e.g. a CIP Client) that initiated the **collection descriptor** creation would be aware of (i.e. no other client would be able to interact with it) and that lasts only for the duration of a **session**. When a **result set** is to be used across **sessions**, it has to be promoted into a **hot collection**.
retrieval manager	The **retrieval manager** object serves as an interface between the **data provider**, which provides the **EO data**, and the **user**, who wants to access this **EO data**. **Retrieval managers** are maintained within the CIP domain by the **data providers**, and they contain the **item descriptors** which describe the **EO data**. **Users** are registered and authorised on **retrieval managers**. This enables the **users** to establish **sessions** on the **retrieval managers**, controlled and managed by **control requests**, and access the **item descriptors** provided by the **retrieval**

	managers via **service requests**.
search request ***search service request***	The **search request** object is a specialisation of the **service request** object. A **search request** allows a **user** to search for and retrieve **item descriptors** that match search criteria defined by the **user**. A **search request** result in a **result set**, which is a collection of the **item descriptors** which satisfy the search criteria.
service option ***service option attribute***	The **service option** object is a specialisation of the **option attribute** object. **Service options** specify the options available to a **group** of **users** (the grouping of **users** is achieved by the assignment of **users** to a **group** via their **session options**) for the access of **item descriptors**. **Service options** are defined by a **data provider** and are assigned to **groups** (not individual **users**) for each **item descriptor**. **Service options** can be used for the definition of access rights (e.g. defining whether or not a **group** can order a particular **item descriptor** at a defined **data provider**); they can also define the conditions at which the **item descriptor** can be accessed, e.g. specifying the price, special offers, the available ordering options (such as format and medium for a **product**), etc. with which a **group** can order a particular **item descriptor** at a defined **data provider**). The **service option** object will therefore be useful for two purposes: it will support the formulation of requests (in particular **order requests**) by providing **users** with information that will assist them to formulate the **request**, and it will support the validation of **requests** by allowing a check that the **request** matches the **service options** available to the **user** that formulated it.
service request	The **service request** object is a specialisation of the **request** object. A **service request** allows a **user** to access **item descriptors** for which they have the appropriate **service options**.
session	The **session** object represents the **session** that takes place between a **user** and a **retrieval manager**. A **session** consists of **requests** that are performed by the user on the **retrieval manager**. Note that the **control requests**, are performed for the control and management of a **session** (e.g. the checking of the **session options** via an **authentication request**), whilst the **service requests**, are performed to access and manage the data during a **session**.
session option	The **session option** object is a specialisation of the **option attribute** object. **Session options** specify the options available to a **user** for a **session** on a **retrieval manager**. This includes user profile information. A **session option** is usually derived from a group option template but the profile for a particular **user** may override those of the **group** to which they are allocated, as required by the catalogue site.
simple attribute	The **simple attribute** object is a specialisation of the **attribute** object and represents a type of **attribute** that is self-contained. In other words, the full semantics of a **simple attribute** is included in the **attribute** itself.
standing order ***standing order request***	A **standing-order** object is a specialisation of an **order request** object; it is an **order request** that is not placed by a **user**, but by a simulated **user** such as a scheduler. These **order request** objects are for situations when a **user** knows exactly the EO **product** that is wanted and knows that a new version of that **product** is produced on a regular basis. The **standing order** means that the **user** does not need to interact with the system each time to get the new **product**.

	Whilst a **user** will establish a **standing-order** object and status queries can be made on the **standing-order**, the same as any other **order request**, there is no further **user** interaction apart from to cancel or stop the **standing-order**. The same methods as apply to **ad-hoc-orders** are applied to **standing-orders**, such as user authentication, account checking, etc. In terms of implementation, **standing order requests** are likely to be made by a scheduler (eg within the Retrieval Manager) without the Retrieval Manager knowing whether the product is available or not. It is not currently envisaged that the RM will be aware of collection updates in order to check standing orders. (As standing orders are a Release C requirement, there is still analysis to be performed in this area).
user	The **user** object represents either a real user, i.e. the combination of a real human user and the client software that the human user is using, or a **retrieval manager** acting as a user (e.g. by proxy). A **user** may be authorised on several **retrieval managers**, with different **session options**. This will enable a **user** to access a **retrieval manager** in order to establish a **session**, which will allow the **user** to perform **requests**.
user theme ***user theme private collection descriptor***	The **user theme private collection descriptor** object is a specialisation of the **collection** object, which represents a heterogeneous and potentially diverse grouping of **item descriptors**. A **user theme private collection descriptor** is established by a **user** (as opposed to a **data provider**), as a result of a (series of) directed **search requests**, in order to provide a focused or themed grouping(s) of data that may be relevant to his/her particular field of interest. It may contain various **item-descriptors** from various collections, that a **user** can then examine without having to make repeated **search requests**. It is likely that a **user theme private collection descriptor** could be located locally to a **user** (e.g. on their local server or even client PC), whereas a **provider collection descriptor** would be located at a **data provider's** site. A **user theme private collection descriptor** is likely to contain descriptors for remote data. Note for sessions involving communication between Retrieval Managers, e.g. when a User is performing interactions involving distributed data providers a Retrieval Manager will act as a proxy User of another Retrieval Manager, i.e. the Retrieval Manager initiating the request is a proxy User of the target Retrieval Manager.

2.1.3 Collections

2.1.3.1 Collections Structure

Historical Earth observation data retrieval systems have in general been based around four fundamental concepts; in CEOS terminology referred to as: 'directories', 'inventories', 'guide information' and the 'EO products'. A directory (sometimes called a 'dataset' in CEOS terminology) can comprise a list of all inventories that are at a single data providers site and an inventory contains inventory entries that each describe a single EO product (which can be derived from archive data - sometimes called 'data granules' in CEOS terminology). (Directories, can also contain dataset descriptions without any associated inventories). The guide information is ancillary information that is useful to give background

context to a spacecraft, instrument, domain, etc, and can be used as an ordering aid and for educational and information purposes.

The three levels of 'directory'-'inventory'-'inventory entry' can be seen as a hierarchy, similar to a file system hierarchy. This is demonstrated in Figure 2-9 below:

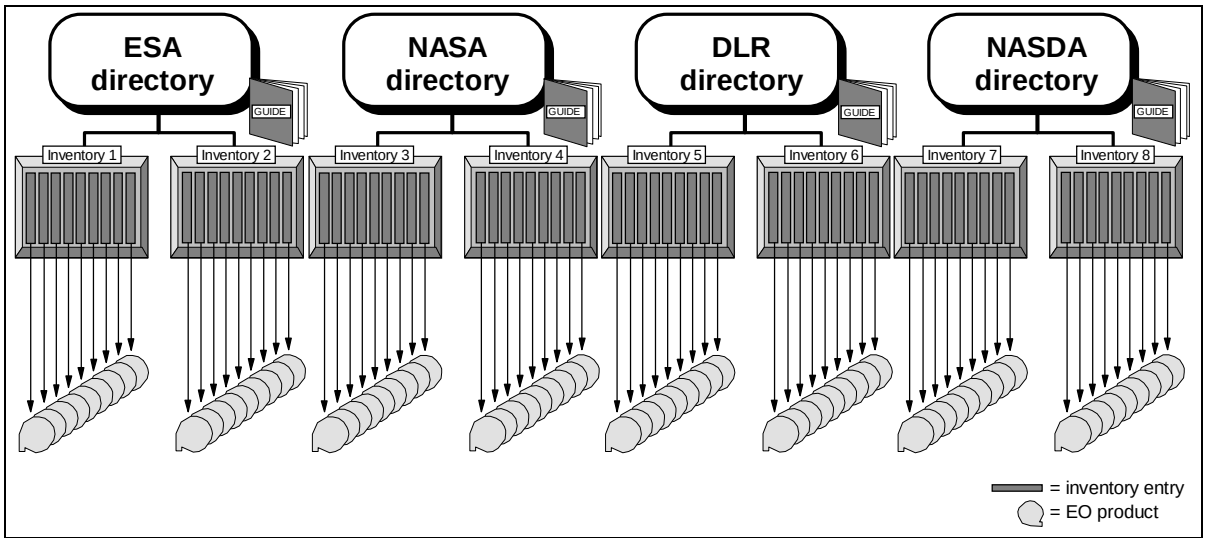


Figure 2-9: Traditional EO Data Retrieval

Directories contain dataset descriptions which may or may not have inventories associated with them. The directories in contain lists of inventories and the inventories contain a number of inventory entries, finally each inventory entry points to an EO product, (although the EO product may not itself exist in an archive as yet, as it may be a product that is predicted to be received in the future). The guide information is usually available as a separate information base, although it can also be linked to a particular inventory.

As an extension to this hierarchical philosophy, the concept of 'collections' permits an extra degree of flexibility in EO product organisation. The model used, still has the EO products (of course) and inventory entries (termed 'product descriptors', see Section 2.1.4) that characterise (or describe) these products. These product descriptors are then grouped into what are called 'collections'. This sounds very similar to an inventory, but the one of the key differences is that collections can overlap, that is a product descriptor can be in more that one collection, hence, collections can then span catalogue sites.

This means that it is possible to arrange groupings of data in a more flexible manner. For example, rather than just arranging data according to EO product type, they could be arranged according to agency, spectral range, instrument, processing level, geographical area, etc. This means that the user can direct a search in a more structured manner, by including or excluding particular collections.

Another primary difference between collections and inventories is that a collection can contain either product descriptors or a list of other collections. This means that it is possible to group a number of collections under a single 'title' as the data provider or user finds convenient. It also means that it is easy to include an existing set of product descriptors which are in a previously named collection in a new collection by just referring to the complete collection name.

The collection concept is visualised in Figure 2-10 below, where the term 'inventory entry' is used for comparison with the historical view. In the CIP domain, however, this is the 'product descriptor'.

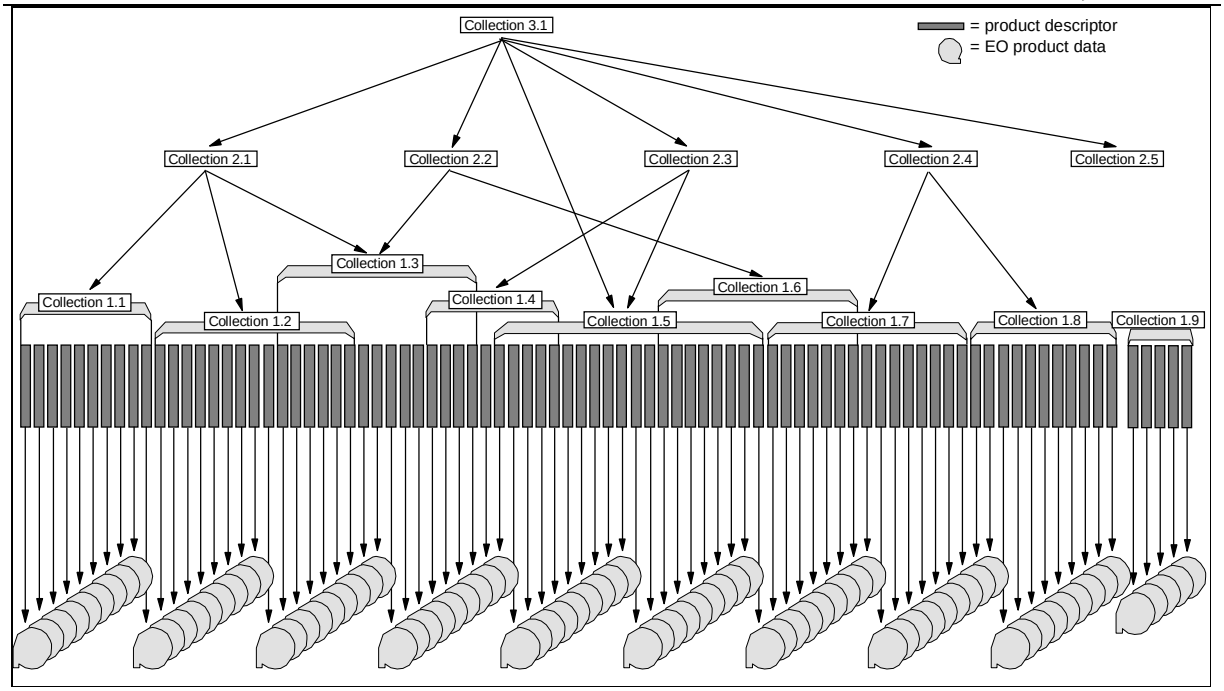


Figure 2-10: The Concept of 'Collections'

The collections in the diagram are numbered so that their relationship can be easily seen, they do not represent the naming of collections in an actual implementation. The terminal collections (labelled '1.x') group the product descriptors (inventory entries) as is appropriate. As can be seen the collections can overlap each other and product descriptors can appear in more than one collection. Above the terminal level collections, there are non-terminal collections that group together any number of other collections. The grouped collections do not all have to be at the same hierarchical level and this grouping of collections can continue to any hierarchical level, with existing collections being included at any other arbitrary level.

There is no restriction on the grouping within collection tree levels, therefore a non-terminal collection could group together terminal collections and other non-terminal collections (as the link between collections 3.1 and 1.5 shows). Also, a terminal collection could exist without a relationship to a higher collection (i.e. collection 1.9), or a non-terminal collection could exist with no relationship to lower collections, in other words a collection without members (i.e. collection 2.5). These conditions could occur in particular circumstances, for instance when a catalogue site has only one single collection, or when a collection is under construction. Note also that the figure represents a hierarchy fragment, i.e. the collection 3.1 may be a child of one or more parent collections, but for simplicity, this is not shown. Note that collection 1.9 can not be reached by a hierarchical search, but could be located if its URL was made public (an example of such a collection may be a hot collection or a collection under construction).

It can simply be seen that the concept of collections can exactly represent the conventional situation shown in Figure 2-9, therefore it is possible to use the collection concept with present day systems, but still have the flexibility for greater functionality in the future.

The concept of collections can be defined under the following headings:

Commonality:

By definition a collection is a grouping of items that have something in common. A collection may have members that have many or fully common attributes (provider archive collection or

provider theme collection), or a collection may have members that have a common semantic theme, though only a small subset of common attributes (user theme collection).

Further the CIP specifies a list of standard attributes that can be searched upon, some are mandatory for all collection members (different mandatory sets for different descriptor types), whilst some are optional (although commonly understood), finally some can be locally defined.

The collection tree may also have commonality in its branches. This means that branches lower in the collection tree can have some consistency with its ancestors. This commonality could be through any theme, whether physical, instrument, temporal or spatial. However, it is not feasible to enforce the consistency of collection branches generated against a theme through automated software. The three primary reasons for this are:

- collections can be pointed at from any Retrieval Manager;
- remote collections can be changed by owners as they desire;
- automated consistency checks would be subjective and inaccurate, particularly for semantic themes.

Therefore it is the responsibility of the Retrieval Manager administrators to ensure this consistency is maintained. It may be possible to support consistency of certain themes, through automatic consistency checking of certain attributes, for example, temporal location, but this would be performed by catalogue specific software which is external to the Retrieval Manager.

Individuality:

A collection member may be a member of two (or more) collections, but duplicate members are not supported within a single collection.

Member Type:

A collection member may be a collection descriptor containing a reference to another collection descriptor or another member type, such as product descriptors or guide descriptors. A collection is therefore a description of itself plus a list of its members.

Collection Trees:

As collections can contain pointers to other collections there exists the concept of a ‘collection tree’ (see Figure 2-10), the leaves of the branches being product or guide descriptors. The collections that contain only product or guide descriptors are termed ‘terminal collections’. The collections which contain only other collections (i.e. no product/guide descriptors) are termed ‘non-terminal’ collections.

Identifier: *(In the following text, item descriptor covers product, guide or collection descriptor):*

Each member of a collection (i.e. item descriptor of any type) must have an identifier unique within all the collections in the Retrieval Manager’s collection tree. This unique identifier can be seen as the name of the item descriptor. In particular, it will be a single unique identifier which includes the Retrieval Manager identifier, the collection identifier and the collection member identifier. For a collection descriptor, the collection identifier refers to a collection of any category (provider archive, provider theme or user theme), whereas for product descriptors, the collection identifier must refer to a provider archive collection.

Uniqueness:

By virtue of the unique identifier, every collection existing can be uniquely identified in the domain of all collections (relevant for multiple-site operations). This is particularly important when considering the case of the collection which is a child of two or more collections. Any

operation which traverses the collection tree will end up repeatedly visiting the child collection. The unique identifier provides a means of preventing repeated operations on the same collection by noting which tree nodes had been visited and then restricting access to those nodes for the same search. This reduction in revisiting will be performed by the Retrieval Manager.

Remote Members:

Normally, a collection tree would be held in one place (say, as a database on a computer). A logical collection tree is where one or more member's collections are held elsewhere - the complete collection tree thus spans multiple sites. The collection member that maps onto the collection at the remote location is termed a 'remote member'.

Remote members do not have to maintain information about which pointer members refer to them; remote members are indistinguishable from normal collection members from the user's point of view. This concept can be handled by the consistent use of URLs to identify collections, in the same manner as the complete WWW is seen by the user as a single database. A Retrieval Manager 'owns' those collections that it stores the attributes for locally and only stores the pointers to remote members, not their attributes and values.

Within the complete ICS domain, attributes of collections, products and guide data should only be stored once, and controlled by the Retrieval Manager that owns the items. The only exception to this will be with the members of user theme collections.

No attribute or value of a remote member (or the pointer to the remote member) can be considered as guaranteed. The Retrieval Manager where the remote member is situated may not be available; the remote member may have changed its data structure (adding, changing or deleting attributes), or even the remote member may have been deleted from the collection tree at the remote Retrieval Manager.

Related collections:

Collections may be related to one another without the need for a "parent-child" or "contains" construct. The relation may be through content or purpose for example and allows the spanning of one collection tree to another. A collection will contain a list (possibly empty) of related collections as part of its content.

2.1.3.2 Collections Usage

The concept of collections and collection structures was described in the previous section. Collections structures are a data model which are the basis of the distributed data model in ICS. This section describes multiple methods a user will have available using the CIP to discover items in ICS collections, e.g. products, guide, browse, etc.

Four methods for using the collection structure are described in the following (see Figure 2-11): collection discovery, collection navigation, collection searching, and collection locating. These methods differ based on what the user needs to know before using the method and they differ based on what element of the collection structure data model is used by the method. An example of the former difference is that for collection discovery the user needs to know very little of ICS, compared with collection locating in which the user must have a specific collection URL to use the method. An example of the later difference is that collection searching examines the contents of the collection tree which lies below the targeted collection, whereas collection navigation allows the user to wander the web of collections using the attribute of related collections.

These methods are depicted in Figure 2-11 which schematically shows each collection usage method relative to a collection node which is buried in the collection structure. Each of the collection usage methods are described in the remainder of this section.

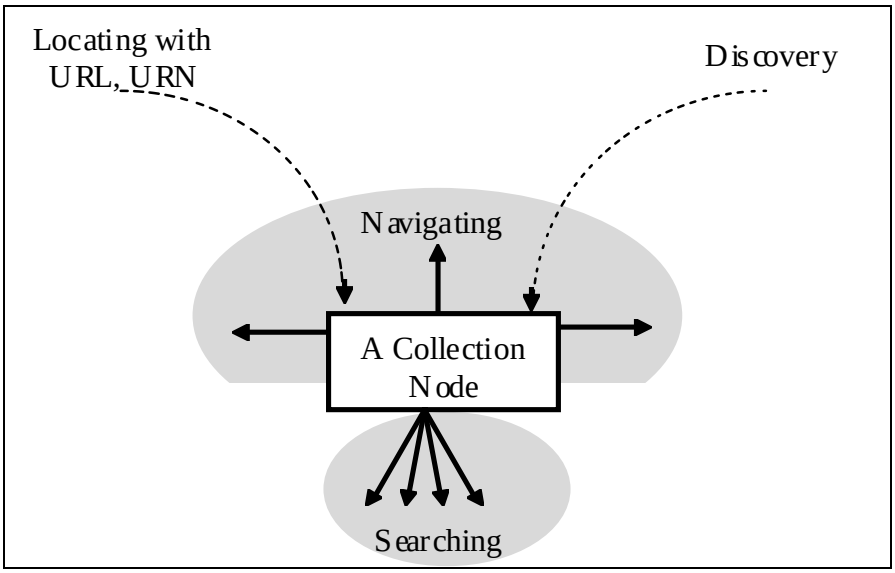


Figure 2-11: Collection Usage Methods

Collection Discovery:

Collection Discovery allows a user of ICS, having no prior knowledge of the collection structure, be assured that all collections of interest to the user are found. It is assumed that the user will know of at least one Retrieval Manager. This method provides a user with an exhaustive method to determine all collections which may be of interest. The discovery of collections makes no assumptions about the user knowledge of any existing collections or other Retrieval Managers. It is this discovery of a collection from outside of the near neighbourhood of the collection which is shown in Figure 2-11 as Discovery.

Several concepts for accomplishing collection discovery are discussed in the PTT Collection Technical Note [R33]. The concepts range from centralised services to distributed indexing and agents. For CIP-B, the PTT decided that collection discovery will be accomplished by the relatively simple method of searching a global collection. It is anticipated that information discovery methods currently being researched in WWW community may have value for accomplishing collection discovery in later releases.

Collection Navigation:

Collection Navigation allows the user to examine collections related to a collection and switch context to that collection. For a given collection of interest, the user may retrieve a list of related collections, including parent, superior and context collections, brief descriptions of these collections, and descriptions of their relationship to the subject collection. The user might select one of these collections, determine it's parent, superiors and collections. Navigation is similar to surfing WWW links from page to page where using the CIP a user can surf from collection to collection..

Collection Searching:

Collection Searching is the core function of the CIP. The user knows of a collection of interest as well as the Retrieval Manager where the Collection Descriptor for the collection resides. The user establishes a session with the retrieval manager and targets a search at the collection. A

collection can be targeted for either a Collection Search or a Product Search. The CIP and Retrieval Managers then provide searches descending in the collection tree returning a hierarchical result set to the user.

Collection Locating:

Collection locating assumes that the user has a collection URL in their possession and wishes to find the collection, examine the collection elements, and perhaps target a search at the collection. Having a URL, the user can examine the URL and determine information about the collections location, the user can submit the URL to a Retrieval Manager which is able to find the collection or determine that the collection no longer exists.

2.1.4 Attributes

As can be seen in the Object Models in the preceding section, a key object in the CIP model is the 'item descriptor'. This item descriptor is used to dynamically describe other key objects used within the protocol. Depending upon the object being described, the item descriptor will contain different information, but the basic philosophy is exactly the same.

The specialised forms of item descriptor and the objects that they describe are:

- **product descriptor** describes **product data**
- **guide descriptor** describes **guide data**
- **collection descriptor** describes **collection**

In the future the item descriptor may be extended to describe other types of objects if required.

These item descriptors do not describe the physical format of the data objects, such as the fields in the objects, the byte layout, the sign conventions, etc., but describe the objects in a similar manner to a catalogue or index; that is, they provide a list of the attributes of the data objects and values for each of the attributes.

At the level of the 'item descriptor' the model, and hence the protocol, is generic for any similar domain featuring data retrieval, such as astronomy or astrophysics. What makes the protocol specific to the Earth observation domain is the specialisations of the item descriptors, which describe not a generic item, but a specific item within the field of interest. For example, a 'guide descriptor' describes specific guide data that is relevant to the field of Earth observation. Further, an item descriptor is specialised as a particular domain object descriptor via the set of attributes that are selected to carry the description information. For any of the EO domain objects, a standard set of agreed attributes will be defined. Not all catalogue systems will support all attributes, but the selection shall be from a standard set. In the case of product descriptors, which as based upon currently existing inventory entries, there may be attributes that are local to a particular catalogue system and the protocol will have to handle these in a consistent manner, i.e. permit the transfer and searching of these attributes while not actually 'understanding' their real world meanings.

For example, the list of product descriptor attributes that might describe an AVHRR data product and the corresponding values for a single instance of that product, might be:

Product Descriptor Attribute	Example Value
SensorName	AVHRR
StartDate	1994-07-10
StartTime	13:51:45
MissionId	NOAA-09
Passage	SOUTH-NORTH
SpatialCoverage	-32.27, -79.39, 62.55, 65.32
CloudCoverage	63
ArchivingCentreId	OBERPFAFFENHOFEN
ItemDescriptorId	cip://ciprm.noaa.gov/PID.103.47c6dec1

Similarly, a list of the guide descriptor attributes and their values that might describe a guide entry explaining how the related AVHRR instrument works, could be:

Guide Descriptor Attribute	Example Value
Author	Dr. J. Smith
Title	NOAA AVHRR Data User's Guide
Abstract	This NOAA AVHRR Data Guide was prepared by the Canada Centre for Remote Sensing, 588 Booth Street, Ottawa, Ontario, K1A 0Y7. It provides the following information for the NOAA AVHRR sensor: - satellite/sensor points of coverage; - details on the acquisition of data and processing steps; - technical information on calibration details, accuracy and product format; - ordering information and user assistance; - contacts for other related products available internationally. All inquiries, references to omissions or additions should be referred to the address above.
PublicationDate	1994-07-10
VersionId	1.0
Reference	CCRS/MSD/TD/AVHRR/DUG/1.0
GeneralKeyword	AVHRR, CLOUD, IMAGE, GLOBAL, LAND, NOAA, RADIATION, VEGETATION INDEX
Format	HTML
URL	http://www.ccrs.nrcan.gc.ca/gcnet/guides/avhrr/avhrr.html

Finally, the EO product may be grouped in a collection that contains all AVHRR data covering the European continent, a list of the collection descriptor attributes and their values that might describe such a collection could be:

Collection Descriptor Attribute	Example Value
ItemDescriptorId	**cip://ciprm.esrin.esa.it/121**
ItemDescriptorName	**AVHRR EUROPE**
CreationDate	**1994-05-01**
CollectionType	**NON-TERMINAL**
Purpose	**This collection is a grouping together of all known AVHRR data that is available via the ESRIN and DLR EO data centres.**
RevisionDate	**1995-01-15**
VersionId	**2.3**
Originator	**ESA/ESRIN/DPE/OD**
GeneralKeywords	**AVHRR, CLOUD, IMAGE, GLOBAL, LAND, NOAA, RADIATION, VEGETATION INDEX, EUROPE**
SpatialCoverage	**-10, -70, 35, 70**
Progress	**IN WORK**
BrowseId	**http://gds.esrin.esa.it/avhrr/collections/europe.jpg**
GuideId	**http://www.ccrs.nrcan.gc.ca/gcnet/guides/avhrr/avhrr.html**
CollectionContents	**cip://ciprm.esrin.esa.it/226** **cip://ciprm.dfd.dlr.de/125**

It is important to note that the same technique is used to define the attributes and their possible values for the different object types, therefore it is easier to achieve interoperability between EO systems from different sources and agencies.

In the examples above, there is the potential for ambiguity due to the lack of a formal description of the attribute's values. If human intuition and experience is removed, then hardly anything is comprehensible. For example, the value of **CloudCoverage**, is this a percentage, or pixels per image? So that attributes can be defined unambiguously it is required that a common set of 'semantic attributes' is defined, which themselves consist of standardised names and values. Taking **CloudCoverage** as an example, and semantic attributes derived from the CCSDS draft standard for providing basic semantic definitions[R10] (this defines a standard set of semantic attribute terms to be used), the following definition can be produced:

Semantic Attribute	Example Value
NAME	**CLOUD_COVERAGE**
MEANING	**A measurement of the amount of the image that is covered by cloud at the time of acquisition of the image in terms of percentage geographical area obscured.**
SHORT_MEANING	**Percentage cloud coverage**
UNITS	**%**
SPECIFIC_INSTANCE	**(0, Clear)**
ALIAS	**(CC, Equivalent attribute name used in another catalogue system)**
VALUE_SYNTAX*	**INTEGER(0..100)**

Using this technique all the attributes that have to be interchanged by the CIP can be handled in a uniform manner. Note, the above examples do not define how the information should be encoded for transmission. It is frequently useful in paper documentation, intended for human consumption, to represent data such as this as 'keyword = value' statements, but this may not be the most efficient for transmission by a protocol that is largely transparent to the human user as it is between a software client and server. A technique designed for protocol implementation between heterogeneous systems, such as ASN.1[R11][R12], may be more suitable.

Therefore, for each attribute there must be a formal definition using the semantic attributes defined by the CIP as shown in Figure 2-12 (note, not all attribute definitions are included for clarity):

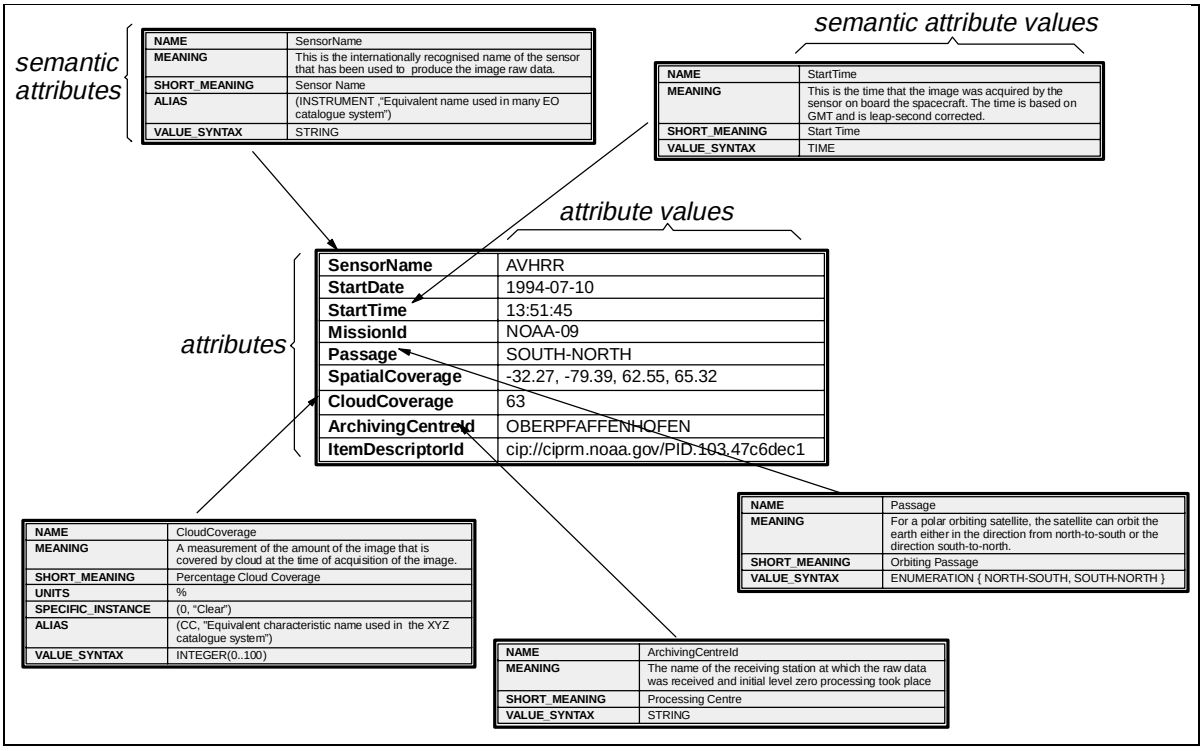


Figure 2-12: 'Attribute' and 'Semantic Attribute' Usage

The list of attributes for each of the three item descriptor objects (product descriptor, guide descriptor and collection descriptor) will be different, as the information carried by the three objects is inherently different. It is also unrealistic to assume that the list of attributes for any one object within one agency will be exactly the same within another agency; this is especially true for the product descriptor objects, where existing archives and inventory entries are very different.

The CIP specification shall specify a standard list of attributes for describing collections, not all servers must support all standard collection attributes, but they shall be selected from a defined list. For product descriptors there is a number of core attributes that are specified in the CIP specification that shall ensure basic (at least level 3) interoperability between inventory systems. It is recognised that there are likely to be many product descriptor attributes that are local to a catalogue site or common to only a small number of catalogue sites. The CIP shall be able to interchange the descriptions of these attributes and perform distributed searches on them where possible, i.e. if two sites do not share the same attributes then a search of both sites will return results with matches from only one site or neither site.

Using attributes and semantic attributes means that client software can be configured dynamically using the protocol. The term configured dynamically is not intended to mean local client preferences, such as window colours, screen layout, etc., but the set of attributes that can be searched upon. When a client receives a description of a attributes using the standard semantic attribute technique, it can interpret the semantic attributes and set-up its own windows and selection fields for the user to analyse or search the attributes.

The dynamic configuration of the client greatly enhances interoperability between catalogue systems as they exist now and enhances future flexibility, as the client does not need to know anything about a particular catalogue service to interact with it. It can also be seen that a very similar (if not the same) client could be used for a totally different domain, just by defining different attributes. Of course the semantic attributes used to describe the attributes would have to be the same and hence will be part of the protocol specification.

2.1.5 Guide

Guide information is ancillary information that gives the user a background context to a spacecraft, instrument, domain, etc. The level of detail provided can be detailed enough to provide an aid to ordering product from data providers. Guide information is therefore used to help the user gain maximum benefit from the data providers services and for educational and information purposes.

An appropriate analogy for guide is that of a bibliographical database where guide descriptor is a bibliographical reference (title, author, publisher: keywords) and the guide data is abstract text or a full document. Guide services differ in so far from current bibliographical systems, since guide services support multi-media features (e.g. hyperlinks, sounds, videos) and allow full text searches (‘data mining’). Current bibliographic system implementations allow only the search of documents via their descriptors. Another difference is that the keywords in guide services are specific to the EO domain to which the documents belong and cover a very limited area in comparision to bibliographical systems which cover a large number of subject areas, e.g. music, literature, arts, mathematics. Also, guide documents can be pointed to from specific product collections.

A guide service is characterized by the following features:

- Guide data is usually freely retrievable documentary information about a data provider's missions, services and available data products;
- A guide service has a set of guide descriptors which describe and 'point' to the guide documents;
- The guide documents can then be retrieved, possibly in different languages, and the method of retrieval can vary;
- The searching of the guide descriptors can be via keyword or free text searches in the documents themselves;
- One or more guide documents can be referenced from a specific product collection, thus providing the user with background information related to the data products contained in the collection;
- Guide documents can also be located via hyperlink navigation.

Guide is a core catalogue service that is supported in CIP-B. However, much of the Guide facilities overlap significantly with the data served by traditional Z39.50 (e.g. bib-1) servers.

In CIP Release B, the provision of hyperlink features to locate guide documents and full text search in the documents themeselves is not available.

The ordering of distributed products that have been located via metadata (i.e. product descriptors) is the ultimate objective of the CIP. For CIP-B, the Order service has been analysed in great detail, the results of this analysis being reflected in the CEOS/PTT Order TN [R31].

The ordering of data products is the subject of a number of detailed capability requirements, supplemented by explanatory text.

The key features are:

- order specification and validation
- obtaining of order quotes
- order management.

Order also provides non-trivial problems in terms of administration between data providers. In particular, there are issues associated with provision of data from remote sites and the mechanisms for billing the originating users. Hence, the issues are connected significantly with authentication and levels of trust between data providers. This is explored in the following section.

2.1.6 Security and Authentication

Within the ICS domain (and therefore CIP-B), the ordering of data products is a key function and therefore the issue of security and authentication is significant. The Security TN[R32] explores the issues of Retrieval Manager to Retrieval Manager communication with respect in particular to data order. These concepts are reflected and developed in the requirements in this URD.

For the ICS, there are a number of authentication cases, summarised as follows:

CIP Client to local Retrieval Manager

An authenticated session can be established between a CIP Client and a local Retrieval Manager in the following ways:

1. *ICS log on - RM Local User Database:* user information is passed in (eg username and password) and validated by the Retrieval Manager against data held in a local user database, if validated, an authenticated session is established and the user has the access rights of the groups that they are a member of.
2. *ICS log on - RM External User Database:* user information is passed in (eg username and password) and passed on to an external user database by the Retrieval Manager. This is then validated externally and if valid, the Retrieval Manager is informed and an authenticated session is established and the user has the access rights of the groups that they are a member of.
3. *ICS log on - Guest:* an anonymous or guest log in occurs, where the user does not have to supply any personal details (they may optionally be asked to supply (eg) an e-mail address for logging purposes), no validation of the data occurs and a guest session is established

Retrieval Manager to Retrieval Manager

As remote queries and data requests between service providers, can be performed within the ICS, authentication must be performed between Retrieval Managers. The scenarios are similar as for a Client log-on, although privileges for remote order are more significant as complications can arise between agency to agency billing.

The following user related information will be passed from the local to the remote Retrieval Manager when attempting to establish an RM to RM authenticated session:

1. User information as passed in to establish the local authenticated session
2. User profile information (if applicable) as per user database
3. Local service provider ICS identifier (so the other Retrieval Manager can recognise the origin)
4. (Other information relevant to RM to RM authentication, but not related to the user)

This results in the following scenarios:

1. *RM to RM with Valid User Information :* The user information that is passed to the remote RM is checked at the remote RM (either by a local or external user database), the user is recognised at the remote site and a valid session is established where the user has privileges at the remote site as per the remote site's user profile. This includes the Guest and Group log ons (items 3 and 4 in previous subsection).
2. *RM to RM with Invalid User Information :* The user information that is passed to the remote RM is checked at the remote RM (either by a local or external user database), the user is not recognised at the remote site, the following may then occur, dependent on procedures at that site:
   - the user is rejected and no RM to RM session is established (should not happen between ICS nodes)
   - the session is established with the user having guest privileges at the remote Retrieval Manager
   - the session is established with the user having an appropriate ICS group or default privilege (depending on the service to service provider agreements).

Note that for remote ordering, it is likely that guest privileges will be insufficient to enable the user to perform order requests.

2.1.7 Additional Services

For the ICS and CIP-B, additional services are envisaged. These are primarily derived from existing Z39.50 facilities. These are now incorporated in the ICS-URD in recognition of the definition of the CIP specification as a Z39.50 profile.

The additional services are:

- Segmentation - enabling data records transferred by the protocol to be packetised for more efficient and incremental transfer. This would be particularly useful during transfer of, e.g. Browse data
- Extended Services - there are a number of Z39.50 services within the Extended Services facility, these would supplement the CIP/Retrieval Manager and include persistent result sets, persistent queries, item order and database updates.
- Result Set Management - allowing control of the size and contents of search result sets.

These additional services are supplementary to the core CIP services (inventory, browse, order etc.) and are more concerned with improving the efficiency and functionality of the search and retrieval process.

2.2 User Characteristics

As explained in Section 1.1, there is no direct human user of the CIP, the CIP is envisaged to provide the communication between a client interface tool (CIP Client) used by an end human user and a CIP compliant broker - the Retrieval Manager - that would in turn interface with the internal catalogue server systems of an EO provider, such as archives and inventories.

This section, however, shall describe a possible scenario of a human interaction with a CIP compliant system; from the point of view not only of the human user, but also describing some of the potential functionality of the ICS software architecture to illustrate typical usage

This scenario is not designed to illustrate the ICS architecture, which is described in more detail, along with additional scenarios, in the ICS SDD [R34].

2.2.1 User Scenario

A user starts their CIP compliant client software and the client connects to the nearest Retrieval Manager as specified by the client ‘preferences’. The user may be required at this stage to log into the CIP domain (or possibly at any stage during the user interaction session, depending upon the services used or client functionality) by provision of a user name and password. Note that all CIP compliant servers should support a ‘guest’ or ‘anonymous’ user, so entry via this method will also be possible.

For a user brand new to the ICS/CIP domain, they are unlikely to be aware of the existence or location of very many collections of potential interest. The initial step therefore is to establish potential collections of interest by initiating a collection discovery. A request for collections of ERS-1 data may discover a number of collection nodes relevant for ERS-1 data at which searches may be targeted.

The user, guided by information about the collection tree provided by the client or via discovery, selects a particular collection at which their search will be targeted. They also indicate, i.e. with a radio button, if they wish to search for collections or product descriptors. In this scenario, the user selects the collection at the root of the collection tree and indicates a product descriptor search.

The client then asks the Retrieval Manager which attributes are available for searching. The Retrieval Manager retrieves the definitions of the relevant attributes from the collection tree targeted by the search and returns them to the client. In this process, attributes are not repeated if they appear in more than one collection.

The client displays the available search fields (attributes), with appropriately formatted entry fields. This is possible as the attributes definitions (provided by the semantic attributes) include information about the attribute value formats. Furthermore, to the right of each input field is the units that the field must be entered in; this information is also part of the attribute definition. The search specification windows may look something like:

ATTRIBUTE	SEARCH VALUE	UNITS	
SouthBoundingCoordinate	+20	degrees	⇐?
WestBoundingCoordinate			⇐?
NorthBoundingCoordinate	+35	degrees	⇐?
EastBoundingCoordinate			⇐?
SensorName	SAR		⇐?
TopicKeyword	atmospheric science, land surface, ocean		⇐?
MissionId			⇐?
ArchivingCentreId			⇐?

SUBMIT

Only those fields that the user wants considered in the search are completed. If any of the meanings of the attributes is not clear to the user, then they can select the **⇐?** symbol at the end of each row and a window will pop-up that will display the value of the MEANING semantic attribute for the attribute in question. This means that attributes can be added by data providers without undue concern that users may not understand the meaning or purpose of the attributes.

The user selects the 'SUBMIT' button and the search is sent to the Retrieval Manager.

The Retrieval Manager then navigates the collection hierarchy and searches the product descriptors that are members of collections below the target collection. If a collection within the collection tree is a remote collection, then the Retrieval Manager forwards the search query onto the remote Retrieval Manager, targeting the remote collection. At this stage, sessions between the Retrieval Managers will be established, in general, this will be transparent to the user. (The exception to this is those cases where the remote Retrieval Manager cannot accept the authentication information or proxy Retrieval Manager request. In this case, the user will be accepted as a guest, where some of the privileges may be reduced - we will assume that the user has the same remote privileges for this scenario).

The results from the searches are a list of product descriptors, these are returned to the user's local Retrieval Manager and merged together into a single result set. This result set is then returned to the user's client. With the results set, the Retrieval Manager also returns the definitions of the attributes used in the product descriptors. (Note for collections that contain remote descriptors, the result sets produced from remote results are likely to be returned individually or even referenced remotely and not combined into one large result set, primarily for reasons of efficiency).

Using the returned attribute definitions and the product descriptors, the client presents a suitable display of the results. This may be a table showing only the attributes common to all product descriptors, but with a feature where the user can select any single product descriptor and get the full list of attributes and their values, e.g.:

MissionId	CentreLatitude	CentreLongitude	StartDate	StartTime	Browse	ArchivingCentreId	
JERS-1	+24.57	+73.29	1994-12-14	12:45:23	YES	DLR-DFD	⇒
JERS-1	+26.21	+78.14	1994-08-24	08:55:12	NO	GSFC	⇒
JERS-1	+23.43	+76.29	1994-11-02	02:47:34	NO	GSFC	⇒
ERS-1	+22.67	+77.89	1993-01-01	05:25:56	MULTI	ESRIN	⇒
ERS-1	+27.23	+72.24	1993-03-27	11:12:02	YES	ESRIN	⇒

The user would select the ⇒ symbol to get the full list of product descriptor attributes and their values for any single product.

One of the attributes that is common to all product descriptors returned is **`Browse`**, this is a compound structure that contains zero or more browse images and associated metadata, therefore the user display indicates either **`YES, NO`** or **`MULTI`** (for more than one), indicating if browse data is available for this particular product. The user selects the two **`YES`** fields in the **`Browse`** column and upon selecting the '**`SUBMIT`**' button the browse images are requested by the client from the Retrieval Manager.

The required browse data is returned from the data source to the Retrieval Manager, which then forwards them to the user's client and they appear within pop-up windows. In this manner the user perceives browse images as simply a value of an element of the product descriptor, this alleviates the need of accessing a separate browse index or inventory (even if that is how the browse data is handled internally by the catalogue site).

Similarly, there may be attributes that point to guide information that would be useful in understanding a particular product, this could also be selected from the list by the user and the information returned in a similar manner to the browse data.

From examining the browse data, the user decides that these are the two images that are required for his analysis, and therefore selects the two entries and the 'ORDER' button. Upon receipt of the order, which contains the unique product identifiers, the Retrieval Manager forwards the order to the data provider. At this stage, if authentication has not already been established, an authentication process must be gone through which may involve an exchange of data objects between the data provider and the user to validate their identity, etc. Even if an authenticated user interaction session has already been established, dependant upon the nature of the requested data, there may need to be some checking of the user's EO data service options prior to further order processing.

As part of the order, the user will be asked a number of questions by the data provider (via the Retrieval Manager) concerning, for instance, the required delivery method, media for delivery, required data formats (maybe CEOS Superstructure, HDF, CDF, etc.), confirmation of price, etc. Once all this information has been confirmed then the order will be processed, at the same time a unique order identifier will be sent to the user. This order identifier shall identify the data provider servicing the order as well as the order within that provider.

At this stage the user could continue with further orders, browse requests or start a new search query from scratch.

A little later the user wants to know the progress of his order and so selects at the highest level the option to query the status of on-going orders. To do this, they submits a status query to the Retrieval Manager that includes the unique order identifier that was provided when the order was originally submitted.

From the identifier format, the Retrieval Manager knows to which data provider Retrieval Manager the status query must be targeted. Depending upon the sophistication of the actual order processing system, the reply may be as little as 'order being processed' or more comprehensive such as 'order 72% complete, estimated delivery in 4.2 hours', this information will be passed back to the user's client for display.

2.3 General Issues

This section summarises some general areas that may influence the ICS development, or need to be taken into account during the analysis and development phases. The section title (General Issues) is derived from PSS-05 (The User Requirements Document), and we have interpreted the title to enable two subsections - one on general constraints (eg timescale, international collaboration) and another on future related developments, which may influence the ICS design and development.

2.3.1 General Constraints

This section differs from the constraints requirements section which contains requirements which define constraints on the functionality, development etc. of the ICS, CIP, protocol specification definition and the Retrieval Manager. It also differs from Section 2.4 which lists key assumptions and dependencies derived from the CINTEX Functional Model[R4] that must be taken into account when developing the ICS.

The factors that influence or constrain the ICS URD development are listed below with a brief accompanying description.

Timescale

One of the key drivers in the ICS URD production is the need for completion of the second release of the ICS URD by November 1996 and of the subsequent release of the CIP-B Specification by January 1997, for approval by the CEOS/PTT.

International contributions

The ICS URD and CIP-B protocol specification production is envisaged to be a collaborative venture between CEOS/PTT members. Active CEOS/PTT members include ESA, NASA, DLR, NASDA, BNSC, CCRS, CNES, EUMETSAT and the CEO.

Contributions will vary through the following:

- Production of focused technical notes on key areas (e.g. Order, Security, Collections);
- Participation in the definition of the ICS URD, with responsibility of particular sections;
- Review and analysis of the ICS URD;
- Provision of appropriate reference material (design documents, standards etc.);
- Provision of practical and theoretical knowledge and experience.

A similar approach will be taken with the definition of the CIP-B specification.

Phased production

There is a phased production for the CIP specification with three phases corresponding to Release A, Release B and Release C. The ICS URD reflects this with each protocol requirement set to a particular release. The phase allocation will need careful consideration to ensure that the requirements have the appropriate priorities and so that Release B and Release C functionality can be added with little or no

modification to Release A functions. Note that the CIP-A specification is now complete and ratified by the CEOS/PTT, the CIP-B specification will trace to the protocol parts of this ICS URD.

Note that this document is the ICS URD version 2.x, which encapsulates CIP-B requirements. (Version 1 of the ICS URD corresponded to the CIP-URD version 1).

Experience from existing archive and information retrieval systems

A number of related developments have been carried out or are being carried out, which may have useful inputs to the ICS analysis and development. There are particular systems and standards referenced in the constraints requirements section, but they are listed here for completeness.

Existing or ongoing relevant systems include:

- ESA: MUIS and ENVISAT;
- NASA: ECS and IMS;
- NASDA: EOIS;
- DLR: ISIS.

Practical experiments in interoperability have also been carried by the CINTEX group, in particular, providing levels of interoperability between some of the above systems. The lessons learnt from the CINTEX activities will be important inputs to the ICS.

Standards

Significant related standards activity has already been carried out by the CCSDS, eg in producing the DEDSL[R10] from which the CIP semantic attributes are derived.

The Z39.50 information retrieval standard is also particularly important to the ICS/CIP, as the CIP specification , as derived from the CIP-URD Version 1, is defined as a CIP profile. There are a number of existing Z39.50 implementations and continuing developments.

2.3.2 Future Developments

There are a number of related EO and non-EO current and future activities which may influence the ICS design and CIP requirements. The most significant are summarised in this section.

Future developments in the EO domain

The areas of interoperability and information retrieval, particularly of existing data, are becoming of increasing interest to the scientific and business community. The amount of existing data is large and the potential for data accumulation in the Earth observation area is great, with increased satellite contributions, etc., so that future archives are likely to become more abundant with greater volumes of data. A coherent method to obtain interoperability and data access is therefore becoming increasingly important.

There are also already plans within Europe for new system developments in the EO domain that will be interested in the CIP (such as the CEO's Enabling Services programme) which is likely to base its information retrieval approach on the CIP if it is appropriate in terms of schedule and functionality. Further, in the USA, the large ECS development already has key components in information data management and retrieval and future releases are looking to provide ICS gateways. In Canada, CCRS are looking to develop the CEONet and are also examining ICS requirements with the aim of bridging to the ICS domain.

Non EO Domain developments (GIS, Z39.50)

There is currently a great deal of activity in information retrieval within non EO domain, but related areas, in particular, concerning GIS (Graphical Information Systems), geo-spatial information query and information retrieval from environmental systems.

GIS standards are planned to be developed and it is likely that there will be overlaps with the CIP/ICS objectives, so harmonisation where possible will be important.

Technological DevelopmentsOf course, the rapid increase in awareness and use of the Internet, WWW, etc., bringing easy access to all types of data in many locations to many individuals and organisations is also a strong influence. The use of the CIP to access data via a standard WWW or Java client is extremely important.

Future Standards

The CCSDS activities are continuing and their outputs will continue to be important references for the ICS and CIP definitions.

The Z39.50 Implementors Group are currently defining updates to Z39.50 Version 3 (eg to include facilities to aid batching of requests and closer interfaces to the WWW).

A number of Z39.50 profiles are also under development, in particular the GEO profile, the STARTS profile, the Digital Collections profile and the Museum Collections profile. All of these profiles will have useful inputs for the CIP definition and ICS model.

The GIS model is planned to be specified in the form of the ISO TC/211 standard.

2.4 Assumptions and Dependencies

During the CIP and associated Retrieval Manager and ICS architecture it is important that existing development and data providers are considered to avoid nugatory work. Existing EO catalogue systems and their structures have to be taken into account. This section summarises assumptions dealing with this situation.

This section is derived from the list of assumptions stated at the front of the CINTEX Functional Model[R4].

(A1) There will not be a central access point to an overall catalogue system for ICS domain data (including Earth observation data) data. There will be different access points instead, probably one for each catalogue site. From there the user will have access to the ICS without needing to know that the data source may not be the located at the original access point. The user will have the same look and feel when using any part of the distributed catalogue system, irrespective of which access point is chosen or is currently being used.

(A2) There will be at least a single top level collection that incorporates all data products within each catalogue site. This does not imply that the top level collection shall be a terminal collection (see Section 2.1.3.1), just that the top level collection at each site shall incorporate, through virtue of a collection tree, all product descriptors available.

(A3) Different catalogue systems may provide different levels of service, i.e. guide, collection, browse, sub-selection, etc. It is not required that all data providers must provide all possible levels of service, although at least an equivalence to an inventory level service should be provided.

(A4) Assuming that assumption A2 is satisfied, each catalogue site is free to define arbitrary collection trees and collection contents, including references to collections at other catalogue sites.

(A5) The internal structure of existing catalogue systems must not be required to be changed.

(A6) Every catalogue system, which is part of the distributed catalogue system is incorporated into the ICS domain via one (or more) Retrieval Managers. Complementing the Retrieval Manager should be a site specific catalogue translator which translates CIP searches into internal searches required by that catalogue site's internal servers and internal search results from the catalogue site's internal servers back into CIP search results. Translator functions are also likely to be needed for data retrieval requests (eg order and guide) and user profile interactions.

(A7) Any changes to an existing catalogue system component (i.e. existing inventory, browse databases, etc.) should not require any change in the CIP or a generic CIP Client developed to support the CIP. This includes:

- Changes to the physical representation of the information;
- Modification of the set of attributes of existing collections;
- Changes to the collection tree structure, such as the creation of new collections, deletion of collections, references to collections, etc.

However, a CIP Client is subject to change if the CIP is changed in some manner.

(A8) The protocol should not take into account existing client limitations (the 'perfect client' is assumed during protocol development).

(A9) A user should be able to arrive at the information needed to order a product with no prior knowledge (except that required to connect the user's client to the ICS domain).

(A10) The generic protocol shall be defined in terms of a recognised formal data description language (such as ASN.1[R11][R12]) and use elements of existing data description techniques and standards whenever applicable

(A11) Any ICS domain data provider should support at least a 'guest' user which will support a minimum range of CIP services.

2.5 Operational Environment

2.5.1 Introduction

This section outlines a proposed physical architecture of a complete distributed catalogue system that would interoperate by virtue of the CIP. Obviously at this stage, this design can only be considered preliminary, but it does provide a framework for the reader to visualise how the objects in the domain object model could interact within a physical architecture and also how current agencies could be expected to be integrated.

The CIP would be used to integrate into a single system (as far as the user is concerned) the current EO services provided by different agencies and also provide a standard framework for the design of future EO systems.

Figure 2-13 shows a possible architectural design of a distributed EO interoperable catalogue system that operates using the CIP. Note that it is demonstrative in that it only shows three agencies (Site A, B and C) as part of the Interoperable Catalogue System (ICS), this of course could be expanded to any number of agencies and facilities providing that they are designed (or are adapted) to support the CIP.

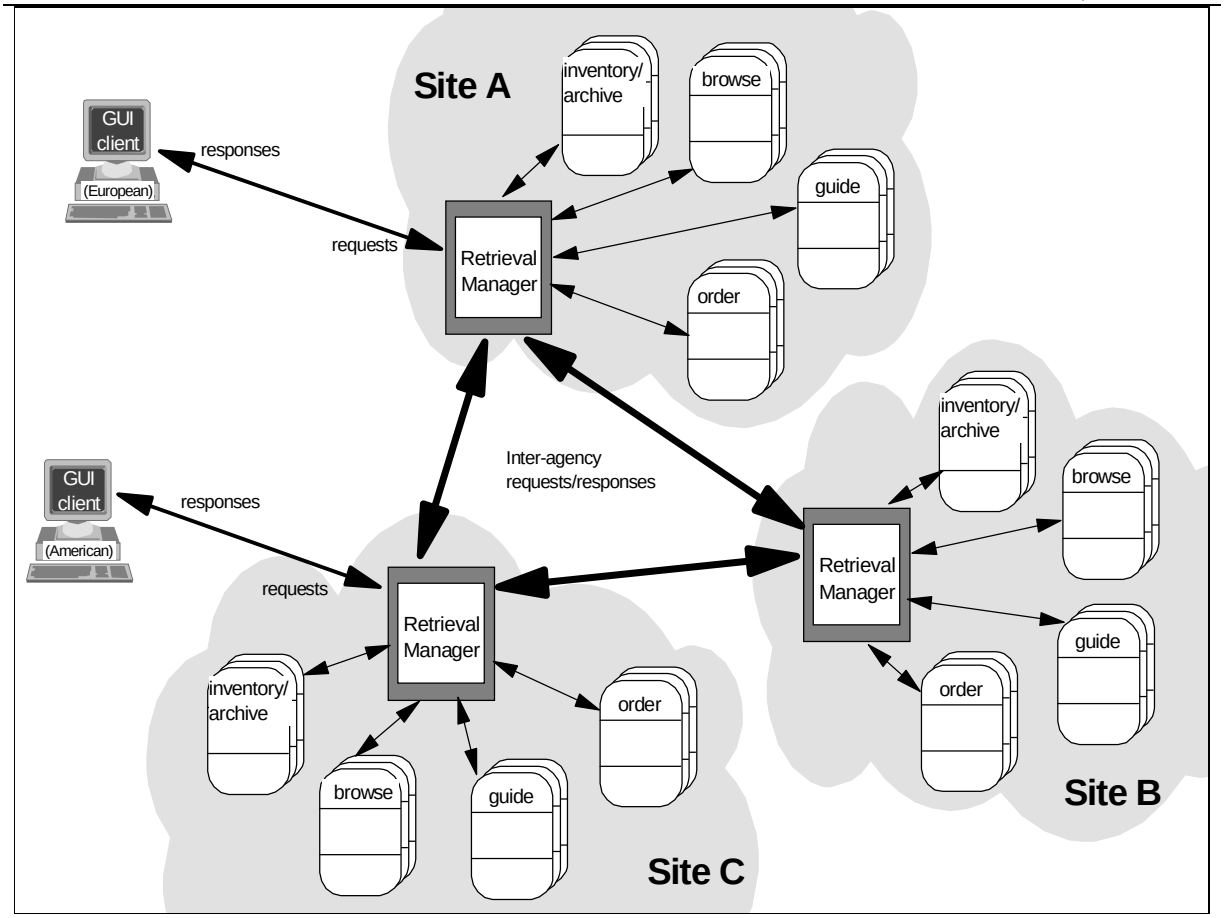


Figure 2-13: Potential Physical CIP Architecture

In this environment the user has a single client that is used to interface with the nearest (or most appropriate) Retrieval Manager. The protocol in use between the client and Retrieval Manager is the CIP.

The following subsections summarise key functions of the ICS, the Retrieval Manager, the CIP Client interface and the Collection maintenance functions.

2.5.2 Retrieval Manager

Retrieval Managers at each catalogue site communicate with each other also using the CIP; in other words a Retrieval Manager acts as though it is a client to other Retrieval Managers. (Note that it may be necessary, in the architectural or detailed design of the Retrieval Manager to be able to identify if communication is coming from a user client or another Retrieval Manager).

The Retrieval Manager accepts search queries from clients and upon analysing them distributes them to the relevant Retrieval Managers at the various catalogue sites. Within the Retrieval Manager this means that there must be a routing function and also the necessary logic to overcome recursive searches, where a collection may include a collection at another site, which in turn includes the first collection.

The local catalogue site systems which interface to the Retrieval Manager consist of collection archive systems, browse systems, guide systems and order systems. Collection archive systems are analogous to existing inventory systems and provide the key means of searching and retrieving the data of interest. Browse systems contain, for instance, a browse database with the appropriate index information. Guide systems provide guide data about product collections. Finally, order systems manage various order

parameters and are responsible for retrieving data from the archives and packaging and delivering the products.

Further components of the Retrieval Manager are not shown in this diagram, but these could include the aforementioned router, a system log, a user authentication and session manager system, a message handler, request scheduler, standing order manager, collection tree parsing algorithms, etc. These terms are not prescriptive, but indicate the possible functions within the Retrieval Manager software.

As many of the catalogue systems within a catalogue site already exist or will have certain design limitations which makes their interfaces not directly compatible with the CIP, it may be necessary to have small local catalogue servers for each of the internal catalogue systems. A potential architecture within a single catalogue site is shown below in Figure 2-14:

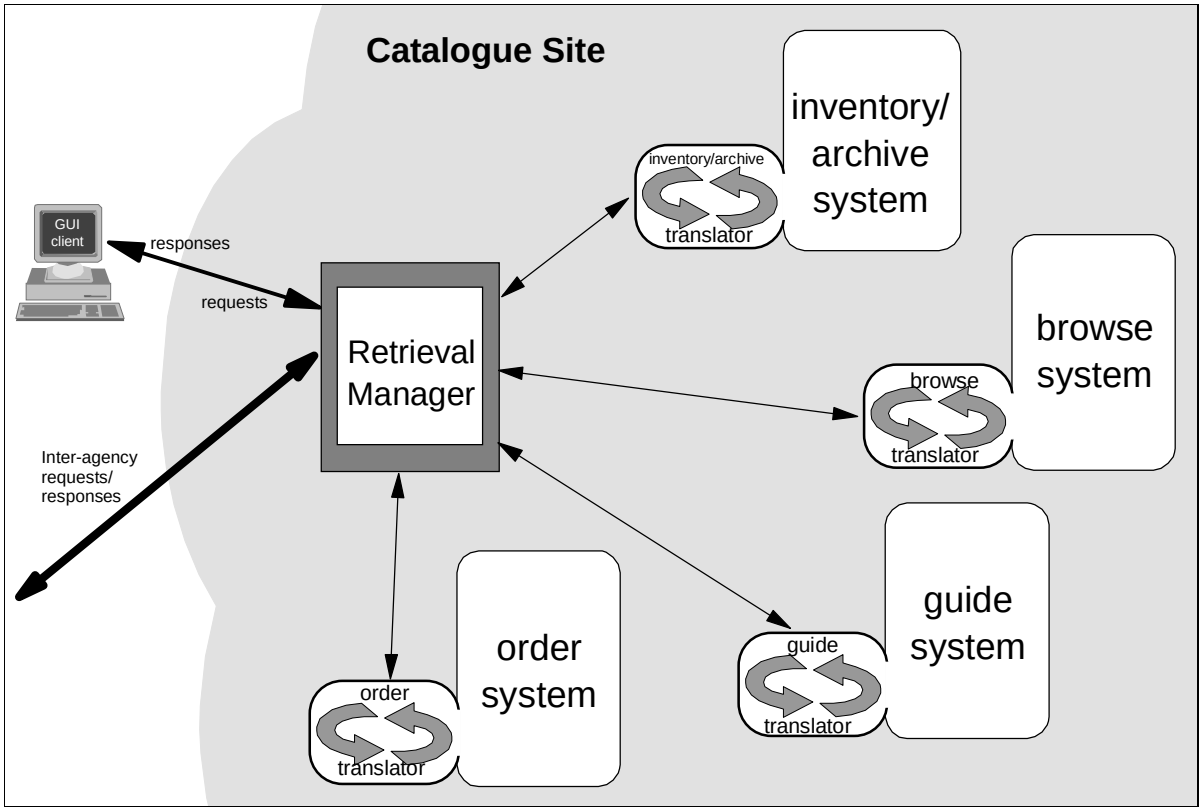


Figure 2-14: A Catalogue Site Internal Architecture

The Retrieval Manager deals with user and external Retrieval Manager communication by virtue of CIP objects. Internally the Retrieval Manager sends searches, requests, etc. to a particular internal catalogue system. As most internal catalogue systems will probably accept input and generate output in a different format to that specified by the CIP, it will be necessary for each sub-system to include a translator on the front end. This translator will take CIP objects for searching and CIP objects for results and translate them to the local format for the internal catalogue system. Note that the diagram depicts translators per service, clearly this may be implemented as one generic translator for all catalogue services at a particular site.

Using this architecture should permit greater flexibility for heritage and new catalogue systems to be accessible within the CIP domain. Also, new catalogues wishing to be CIP compliant could be implemented so that a Retrieval Manager could communicate directly with the catalogue system. There would then be no need for a CIP translator and all communication would be performed via the CIP.

This architecture is also applicable for small data providers, such as university research groups, who are unable to provide a Retrieval Manager at their site but still wish to join the CIP domain. Their local catalogue can be made available to the CIP community by its inclusion within another agency's Retrieval Manager. The communication would be over a WAN, instead of a LAN, and the remote Retrieval Manager would communicate with a CIP translator serving the local inventory of the small data provider.

Within current operational environments, an interface to the CIP domain via the World-Wide-Web (WWW) is an important consideration due to the wide availability and popularity of this interface mechanism. In this situation it will be necessary to provide a WWW server for each Retrieval Manager within the CIP domain (physically one WWW server may act as the WWW server for more than one Retrieval Manager). The WWW server shall communicate with the users WWW client software (such as Mosaic or Netscape) using the standard HTTP protocol and MIME document types, such as HTML. What is required to produce the necessary HTML pages for display at the WWW client is a translator between the CIP objects and the WWW server which is feeding the WWW client. This is architecturally shown below in Figure 2-15.

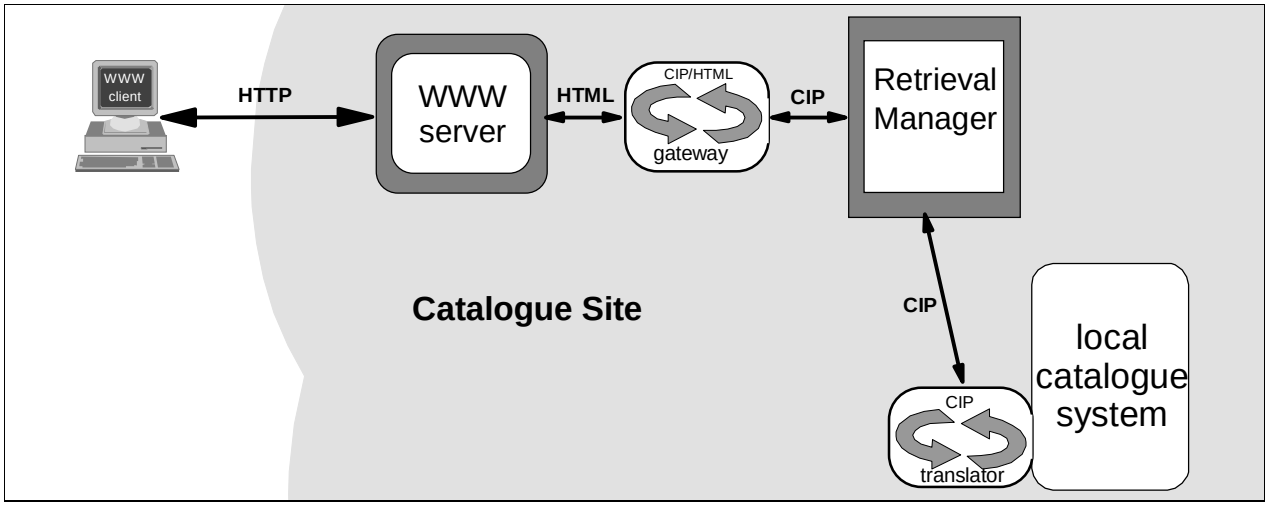


Figure 2-15: Architecture of a WWW-CIP Interface

The WWW server receives HTML generated by CGI (Common Gateway Interface) scripts, as is the standard method for dynamic HTML generation with WWW servers. The CGI programs analyse the CIP objects as received from the Retrieval Manager and translates the contents into HTML pages that can be displayed by the user's WWW client software. As much of the CIP's task is to transfer requests and results, the HTML pages generated will contain many forms for the user to fill in, plus pages listing results.

Using this WWW interface to the CIP domain substantially increases the users who will be able to access the domain, but it does have the potential drawback that not all services supported by the CIP may be available from the WWW client. This architecture effectively uses the WWW client as a dumb interface terminal and such a client may not be powerful enough to support the full range of CIP services.

A similar architecture could be used to provide a method of interfacing an existing user client, such as the NASA IMS client, to the CIP domain.

2.5.3 CIP Client and CIP client applications

The functions of the CIP Client are not within the scope of this document, but it is important to note that there are a number of implications for the CIP Client gateway (and hence on the Client) as a result of the CIP and Retrieval Manager functions. However, CIP Client Applications are within the scope of this document as they lie within the scope of the ICS. An example of a CIP client application would be the utilities to allow the user to construct hierarchical collection queries.

These CIP Client Application requirements are specified in Section 3.1.3.

2.5.4 CIP Catalogue Translator

The functions of CIP to local catalogue translators are not included in this Release of the ICS URD, but ICS URD Release C will define the CIP Catalogue Translator Application requirements. As a result of the CIP and Retrieval Manager functions there are a number of implications on the CIP Catalogue Translator Applications.

The translation functions will be dependent on the catalogue services provided at the catalogue site, but are likely to include:

- CIP attributes to local attributes (eg for product, guide and collection)
- CIP query elements to local query elements
- CIP order objects to local order handling system objects
- CIP user profile to local user profile

The translator will also need to perform translations back (eg search results, request status and user profiles) from the local catalogue format to the CIP format.

2.5.5 Collection maintenance

Key to CIP users finding items of interest in the ICS is the maintenance, including creation, of the ICS collection structure. Collection maintenance will be done by Retrieval Manager (human) administrators at each Retrieval Manager. This means that collection maintenance is likely to be done in a distributed fashion, whereas, one key to the user's success in finding items of interest will be the uniformity of collections across Retrieval Managers. This section addresses the activities which all ICS Retrieval Manager administrators will perform in order to achieve a high quality ICS Collection Structure.

Collection maintenance will be performed by the Retrieval Manager administrators using the Collection management capabilities of the Retrieval Manager and Collection Management Tools, with reference to the ICS Collection Manual, and by participating in CIP Attribute maintenance. Each of these are described in the following paragraphs.

Retrieval Manager Collection Management:

The Retrieval Manager collection management capabilities (see Section 3.1.2.2) provide basic DBMS functions, collection creation and population functions, as well as collection structure consistency checking capabilities. The emphasis in CIP-B is on Collection management supported by Retrieval Manager administrator intervention. More automated approaches (e.g. without human Retrieval Manager administration) will be considered in CIP-C.

ICS Collection Manual:

The ICS Collection Manual will be prepared by the PTT to support performance of uniform collection maintenance procedures across Retrieval Managers. The Collection Manual will describe the typical procedures that a Retrieval Manager administrator will need to conduct to create collections, as well as periodically check the collection structure held by in the local Retrieval Manager. Typical procedures include the following:

- Establishing a Provider Archive Collection;
- Mapping a local schema onto the CIP schema;
- Establishing Higher Level Collections;
- Establishing Key Access Nodes for the Retrieval Manager;
- Referencing Remote Collections;
- Supporting the Global Collection;
- Periodically review the consistency of local collection structure;
- Periodically verify Key Access Nodes;
- Periodically check for stale links to remote collections;

Collection Management Tools:

Collection Management Tools will be used to populate the Retrieval Manager collection structure. The tools will support conversion from other formats (DIF, HTML, SGML, flat ASCII file) and checking of data to be imported against the CIP attribute and schema definitions. The Retrieval Manager Administrator will use these tools which are external to the Retrieval Manager. It is anticipated that these tools will be somewhat unique to the various sites which are hosting a Retrieval Manager and therefore are not part of the Retrieval Manager, per se. On the other hand to support the reuse of common Collection Management Tools across the ICS, they are identified here and in the ICS SDD.

CIP Attribute Maintenance:

Maintenance of the CIP attribute set and schema is critical to addressing the evolving needs of the data providers. The CIP Attributes are defined and controlled by the CIP Specification. The CEOS plans continued maintenance of the CIP specification through future releases of the CIP Specification on a regular/as needed basis. Although the CIP Specification will remain as the definitive source on CIP attributes, two other mechanisms for supporting attributes in the CIP domain on a more frequent basis are envisioned: local attributes and ICS sub-group attributes. The CIP and Retrieval Manager will support definition of local attributes for a given Retrieval Manager which are under the control of a local site and unlikely to be supported in other sites. It may serve the needs of a sub-group of the CEOS to define an agreed set of attributes, (e.g. based on common local attributes). This set of ICS sub-group attributes could then be implemented identically as local attributes at each of the Retrieval Managers in the sub-group. Over time, a sub-group attribute set may gain acceptance across the CEOS agencies and become prime candidates for the next issue of the CIP Attribute set in the CIP specification. It is through these three classes of attribute sets that the CIP Attribute set will evolve.

3. Specific Requirements

This section provides the core of the URD. Each requirement is uniquely identified (by the 'UR id'), to support forward traceability to subsequent phases. In particular for traceability from the CIP specification and Retrieval Manager SRDs to this document.

The requirements are prioritised in terms of the release (A, B or C, as indicated in the 'Need' entry of each requirement) of the protocol specification to which they are applicable. All the requirements for Releases A and B of the protocol have been identified and are included in this section. For Release C, only the high-level requirements have been identified.

There is also a further priority assigned to each requirement, ranging from 1 which is mandatory, through 2 which is important but not essential to 3 which is desirable. This priority is included in the 'Priority' entry of each requirement.

Requirements that require confirmation, e.g. relying on feedback in a subsequent phase (e.g. SR, AD) are marked as 'TBC' and those requiring confirmation of a dependency are marked 'TBD'.

Each requirement has a source stating the origin of the requirement. This may be:

- a reference document;
- standards;
- the ESA DPRS project SoW[R2];
- name of a recognised body (such as the CEOS or CCSDS);
- CINTEX/PTT meetings;
- a formal review meetings;
- 'DPRS team', for requirements defined during the development of CIP Release A;
- Technical Notes produced for CIP-B analysis;
- 'CIP-BS team', for requirements defined during the development of CIP Release B.

This is to support backwards traceability from the URD.

3.1 Capability Requirements

This section contains the ICS capability requirements, i.e. the scope and functionality requirements for the ICS. The ICS capability requirements have been divided into the following categories:

- The CIP requirements, which specify the capability and functions of the protocol as defined in the CIP specification;
- The Retrieval Manager requirements. Note that, most of the ICS requirements logically apply to both the CIP and the Retrieval Manager. The majority of the ICS requirements are identified against the CIP only, so as to avoid duplication. This is appropriate as the fundamental requirement on the Retrieval Manager is to support the protocol.
- The CIP Client gateway requirements.
- Collection maintenance requirements.

3.1.1 Catalogue Interoperability Protocol

This section contains the capability requirements for the CIP. These are the core requirements of the URD as they formulate the fundamental functions of the CIP to be addressed by the CIP specification These capability requirements are primarily those that are derived from the CIP focus of the ICS domain object model.

The capability requirements include the following areas:

- key services of the CIP;
- CIP object attributes and semantic attributes;
- the CIP search query language and catalogue queries;
- product ordering;
- privileges (i.e. authentication);
- protocol control.

3.1.1.1 Catalogue Interoperability Protocol - Key Services

The rules, data objects and services will be described in the CIP specification. The first requirement summarises the requirement to produce a Catalogue Interoperability Protocol specification, baselined to this URD.

UR Id : 1
Source : SoW [R2, Section 4.3.1]
Priority : 1
Need : A
Qualifier : RP

The CIP specification shall specify the rules by which the retrieval of Earth observation data can be supported, where retrieval includes the location, request and delivery of Earth observation products and it shall be produced with this URD as a baseline document.

This section summarises the requirements in terms of product retrieval that the protocol must provide to support the key user interactions with an EO catalogue system. These requirements are therefore general requirements associated with:

- Collections;
- Guide;
- Browse;
- Order;
- Attributes.

Note that high level requirements associated with search queries are in Section 3.1.1.4.

In general, the source for these functions is the ESA/DPRS produced Technical Note[R1], with a given section number. The section number is usually a sub-section within TN Section 4.1 which contains version 0.3 of the CINTEX functional model[R15].

UR Id : 2
Source : DPRS TN [R1, Section 4.1.5]
Priority : 1
Need : A
Qualifier : RP

The CIP shall support collections (i.e. groupings) of item descriptors.

Note : This requirement effectively provides CIP support for the grouping together of related EO items.

UR Id : 3
Source : DPRS TN [R1, Section 4.1.5] / URD 0.1 Review [RID 96]
Priority : 1
Need : A
Qualifier : RP

The CIP shall support collections of product descriptors.

Note : This requirement effectively provides CIP support of the CEOS 'inventory' concept, where the inventory entries provide descriptions of EO products that can be located via the inventory identifier.

UR Id : 4
Source : DPRS TN [R1, Section 4.1.5] / URD 0.1 Review [RID 96]
Priority : 1
Need : B
Qualifier : RP

The CIP shall support collections of guide descriptors.

Note : The retrieval of Guide data can already be performed from many data providers via standard HTTP/WWW access methods, but this UR recognises the importance of integration of Guide within the ICS domain.

UR Id : 5
Source : DPRS TN [R1, Section 4.1.5] / URD 0.1 Review [RID 96]
Priority : 1
Need : A
Qualifier : RP

The CIP shall support collections of other collections.

Note : This requirement effectively specifies CIP support of a top-down hierarchical tree of collections within collections, therefore permitting a powerful degree of flexibility in the organisation and viewing of data available. (A hierarchical layer comprising of a collection of one or more collections, each of which contains only EO product descriptors, maps onto the CEOS 'Directory' concept).

UR Id : 6
Source : DPRS TN [R1, Section 4.1.5]
Priority : 2
Need : C
Qualifier : RP

The CIP should support collections comprised of both collection descriptors and product and/or guide descriptors at the same level and in a hierarchy.

Note : *This 'mixed collections' requirement may have significant implications for the design and implementation of the CIP and the Retrieval Manager. From a service view it would provide extra flexibility for the user and it satisfies the object model, however the implications, e.g. for inheritance, may be non-trivial, in which case the need can be reassessed. Further, it may be difficult to devise meaningful searches of mixed collections as their attributes are inherently different. If there are no common attributes between the collection descriptors and the product descriptors then the search results will either contain only one type of descriptor or nothing.*
There is a possibility that attempting to meet this requirement in a late version of the protocol may lead to 'breakage' of protocol versions. This possibility should be assessed during early prototyping of the CIP and Retrieval Manager.

UR Id : 7
Source : DPRS TN [R1, Section 4.1.5]
CIP-BS Team
URD 2.0 Review [NASA/LR/13]
Priority : 2
Need : B
Qualifier : RP

The CIP shall support the creation, maintenance and search of search result sets.

Note : *Result sets are lists of collection descriptors or product descriptors resulting from search queries of collections, upon which further queries can be performed during a session. The result set is analogous to the concept of 'working set' or 'scratch pad list' found within other domains.*
It is recognised that for the full support of result sets, specific resource and performance requirements may need to be specified within a separate subsystem requirements specification for the Retrieval Manager.

UR Id : 8
Source : DPRS TN [R1, Section 4.1.5]
PTT [Tokyo] / CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support hot collections.

Note : *Hot collections are special instances of result sets (i.e. lists of collection descriptors or product descriptors resulting from search queries of collections) whose validity spans the duration of a session, and upon which further queries can be performed.*
It is recognised that for the full support of hot collections, specific resource and performance requirements may need to be specified within a separate subsystem requirements specification for the Retrieval Manager.

UR Id : 9
Source : DPRS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support collections of product descriptors which completely contain their product information i.e. no further EO product exists.

Note : *This UR is to cover those EO products that are contained within their descriptions, e.g. Observation data, where no further processing such as product order or browse can be performed on such product descriptors.*

UR Id : 10
Source : CTN [R33] / CIP-BS
Priority : 1
Need : B
Qualifier : RP

The CIP shall support related collections.

Note : *This requirement effectively specifies CIP support of a network of collections, within which collections can be related to other hierarchically independent collections therefore permitting cross navigation of the collection hierarchy.*

UR Id : 11
Source : CTN [R33] / CIP-BS
Priority : 1
Need : B
Qualifier : RP

The CIP shall support definition of a reference (i.e. authoritative) version of an item descriptor if the item descriptor is duplicated within the CIP domain.

UR Id : 12
Source : CTN [R33] / CIP-BS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the discovery of any collection within the ICS domain with only minimal User prior knowledge of the ICS domain

Note : *A corollary of this requirement for CIP-B is the potential existence of a global collection maintained at a particular Retrieval Manager site. This requirement is aimed so that a user can find out about collections without needing to know details of collection structures, key access nodes, collection names or identifiers and details of ICS nodes.*

UR Id : 13
Source : CTN [R33] / CIP-BS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the location of collections.

Note *Location, in this context, means the searching for collections within the ICS domain and retrieval of relevant identifying information.*

UR Id : 14
Source : CTN [R33] / CIP-BS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the navigation of collections.

Note *Navigation through ICS collections is likely to be performed via the 'related' attribute, part of the collection descriptor, used to link associated collections.*

UR Id : 15
Source : DPRS TN [R1, Section 4.1.5]
Priority : 1
Need : A
Qualifier : RP

The CIP shall support the searching of collections.

UR Id : 16
Source : DPRS TN [R1, Section 4.1.5]
Priority : 1
Need : B
Qualifier : RP

The CIP shall support a guide service such that lists of guide descriptors can be searched.

Note : The lists of guide descriptors may also be hierarchical.

UR Id : 17
Source : DPRS TN [R1, Section 4.1.5]
Priority : 1
Need : A
Qualifier : RP

The CIP shall support the retrieval of guide data using guide descriptors.

Note Guide data is not usually subject to an order process as it is usually freely retrievable documentary or bibliographic information designed to help the user gain knowledge about a data provider's services and/or data products.

UR Id : 18
Source : DPRS TN [R1, Section 4.1.5]
URD 2.0 Review [BTT/NASDA/SS/GM/4]
Priority : 1
Need : A
Qualifier : RP

The CIP shall support the access and retrieval of browse data (eg as derived from Browse products).

UR Id : 19
Source : DPRS TN [R1, Section 4.1.5]
Priority : 1
Need : B
Qualifier : RP

The CIP shall support an order service so that ad-hoc orders can be placed for EO products.

Note : Here, ad-hoc refers to a user initiated order request and is not meant to imply that the service is synchronous.

UR Id : 20
Source : DPRS TN [R1, Section 4.1.5],
URD 1.0 Review [NASA RID 2]
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the access and retrieval of information concerning the services provided at a catalogue site.

Note : For instance, if a site contains an ordering service, information may be provided to assist the order process, and may include product prices, special offers, discount rates for particular users etc.

The sub-requirements of UR 21, on access of the attributes and semantic attributes of the various CIP objects are to enable a user to retrieve the data descriptions of CIP objects as they are defined and understood within the CIP domain. Note that these requirements are not for the retrieval of the actual values of the attributes or of CIP objects, only their definitions.

UR Id : 21
Source : DPRS TN [R1, Section 4.1.6]
Priority : 1
Need : A
Qualifier : RP
The CIP shall support the access and retrieval of attributes of CIP objects.
Note : This requirement is a general requirement on CIP objects, specific requirements on collections, guide entries, products, orders etc. are defined within Section 3.1.1.5.

UR Id : 22
Source : DPRS TN [R1, Section 4.1.5]
Priority : 2
Need : B
Qualifier : RP
The CIP shall support the access and retrieval of CIP data change history, this should include, as a minimum, the date of the last change to the attributes of a collection.

3.1.1.2 Attributes

A set of attributes provides the means by which an EO object can be described. Different classes of EO domain objects will be described by different sets of attributes.

In terms of interoperability between different catalogue systems with different inventories, the same 'name' may be used for different attributes. To aid the automated interpretation of different attributes, the CIP will need to support the notion of semantic attributes which should be defined for all attributes and used by the CIP to distinguish the different attributes.

Note that the actual (standard) attribute definitions (and also semantic attributes) will be defined in the CIP specification.

In general, these requirements are derived from CCSDS work in this area[R10] and the DPRS TN[R1, Section 4.1.6] (which is the Attribute Analysis section of the CINTEX Functional Model[R15], where the term 'attribute aspects' maps onto 'semantic attributes' in the CIP).

3.1.1.2.1 Attributes Definition

UR Id : 23
Source : DPRS TN [R1, Section 4.1.6]
Priority : 1
Need : A
Qualifier : RP
The attributes of the CIP data objects should be self describing.

UR Id : 24
Source : DPRS TN [R1, Section 4.1.6]
CCSDS [R10]
Priority : 1
Need : A
Qualifier : RP

The CIP shall support attributes that are described by semantic attributes.

Note : There will be a list of semantic attributes, defined in the CIP specification, which are supplied here as separate sub-requirements.

UR Id : 25
Source : DPRS TN [R1, Section 4.1.6]
URD 1.0 Review [DPRS Team]
Priority : 1
Need : A
Qualifier : RP

The CIP shall support the distinction between searchable and non-searchable attributes.

3.1.1.2.2 Semantic Attributes

UR Id : 26
Source : DPRS TN [R1, Section 4.1.6]
CCSDS [R10]
Priority : 1
Need : A
Qualifier : RP

The CIP shall support a 'NAME' semantic attribute, that can be used to identify the attribute.

UR Id : 27
Source : DPRS TN [R1, Section 4.1.6]
CCSDS [R10]
Priority : 1
Need : A
Qualifier : RP

The CIP shall support a 'MEANING' semantic attribute, that can be used to provide a full description and meaning of the attribute.

UR Id : 28
Source : DPRS TN [R1, Section 4.1.6]
CCSDS [R10]
Priority : 1
Need : A
Qualifier : RP

The CIP shall support a 'SHORT MEANING' semantic attribute, that can contain a short and concise description and of the attribute.

UR Id : 29
Source : DPRS TN [R1, Section 4.1.6]
CCSDS [R10]
Priority : 1
Need : A
Qualifier : RP

The CIP shall support a 'UNITS' semantic attribute, that can be used to describe the scientific unit associated with the value of the attribute (e.g. degrees, metres, metres per second, etc.).

UR Id : 30
Source : DPRS TN [R1, Section 4.1.6]
Priority : 1
Need : B
Qualifier : RP

The CIP shall support a 'DEFAULT' semantic attribute, that can be used to contain a default value for an attribute (e.g. for searching).

Note : It may be that providing default values for some attributes is inappropriate, in which case, the default semantic attribute is not set or even set to 'all possible values' (or similar).

UR Id : 31
Source : DPRS TN [R1, Section 4.1.6]
CCSDS [R10]
Priority : 1
Need : B
Qualifier : RP

The CIP shall support an 'ALIAS' semantic attribute, that can be used for an alternative attribute identifier (e.g. as used in another inventory).

Note : The value of this attribute can then be searched when an identifier used within the corresponding syntax description is not found within the 'NAME' values.

UR Id : 32
Source : DPRS TN [R1, Section 4.1.6]
Priority : 2
Need : B
Qualifier : RP

The CIP shall support a 'VERSION' semantic attribute, that can be used to indicate the version of the definition of the attribute.

UR Id : 33
Source : DPRS TN [R1, Section 4.1.6]
Priority : 2
Need : B
Qualifier : RP

The CIP shall support a 'DEFINER' semantic attribute, that can be used to reference the origin organisation of the definer of the attribute.

UR Id : 34
Source : DPRS TN [R1, Section 4.1.6]
Priority : 2
Need : A
Qualifier : RP

The CIP shall support a 'VALUE SYNTAX' semantic attribute, that defines the syntax of the value of an attribute. This may include base type (e.g. integer, real, string), ranges, permitted discrete values, etc.

Note : The value of this attribute is in fact an abstract syntax description language in itself. There are powerful languages designed for this purpose such as ASN.1[R11][R12], although for Release A the capability may be restricted to a simpler subset of abstract syntaxes, such as INTEGER, REAL and STRING, so as to prove the principle. Designing with the capability of a full abstract syntax language in mind provides for greater future expandability.

UR Id : 35
Source : DPRS TN [R1, Section 4.1.6]
CCSDS [R10]
Priority : 2
Need : B
Qualifier : RP

The CIP shall support a 'SPECIAL INSTANCE' semantic attribute, that can be used to indicate a particular case of the semantic attribute for a certain value, so as to convey greater meaning to the user.

Note : An example of a 'special instance' is [`0='The Equator'`] for a latitude attribute. If this was defined as a special instance, then there is the capability of providing an enhanced display facility to the user, i.e. display 'The Equator', rather than just '0 degrees'.

UR Id : 36
Source : DPRS TN [R1, Section 4.1.6]
CCSDS [R10]
Priority : 2
Need : B
Qualifier : RP

The CIP shall support a 'COMMENT' semantic attribute used to provide information to aid real world understanding to the user of the data. The comment contents would normally be intended for human readership.

Note : As explained in [R10], the 'COMMENT' semantic attribute is not for conveying any information about the meaning of the attribute (this should be all contained within the 'MEANING' semantic attribute), it is intended to convey supplementary data, such as the availability of standard software for processing this attribute, etc.

UR Id : 37
Source : DPRS TN [R1, Section 4.1.6]
CCSDS [R10]
Priority : 1
Need : B
Qualifier : RP

The CIP shall support an 'OCCURRENCE' semantic attribute used to indicate the number of times that a particular attribute may appear in an object descriptor.

Note : An attribute may be mandatory or optional, in turn it may be that it can appear at most only once or any number of times, e.g. for an particular image, CENTRE LATITUDE can appear only once and it is mandatory that it does.

3.1.1.2.3 Attribute Values

UR Id : 38
Source : DPRS Team
Priority : 2
Need : A
Qualifier : RP

The CIP shall support a 'date' format which is an internationally recognised standard format, such as the ISO/CCSDS Date/Time Standard[R16].

Note 1 : The 'date' format will be defined in the CIP retrieval specification and shall be the recognised date format within the CIP that all interfaces to the CIP should support. This is to avoid misunderstandings with the date format caused by differences in year/month/day order, use of other formats such as Julian date etc. The exact format will be defined and baselined in the CIP specification.

Note 2 : This does not mean that CIP client and servers are prevented from using an alternative date/time format that they wish for display or entry of dates and times. However, the format interchanged within the CIP objects shall be a single standard format to ensure interoperability between all clients and servers, and reduce the potential for misunderstanding.

UR Id : 39
Source : DPRS Team
Priority : 2
Need : A
Qualifier : RP

The CIP shall support 'longitude' and 'latitude' formats which are internationally recognised standard formats, such as the ISO Standard Representation of Latitude, Longitude and Altitude for Geographic Point Locations[R5].

Note 1 : The 'longitude' and 'latitude' formats will be defined in the CIP retrieval specification and shall be the recognised co-ordinate formats within the CIP that all interfaces to the CIP should support. This is to avoid misunderstandings with co-ordinate formats caused by, e.g. differences in measurement from the equator, meridian, units, etc. The exact formats are defined and baselined in the CIP specification

Note 2 : This does not mean that CIP client and servers can are prevented from using an alternative latitude/longitude format that they wish for display or entry. However, the format interchanged within the CIP objects shall be a single standard format to ensure interoperability between all clients and servers, and reduce the potential for misunderstanding.

UR Id : 40
Source : PTT Tokyo / CIP-BS Team
Priority : 1
Need : B
Qualifier : RP

The value of collection item descriptor identifier attributes shall be URLs.

Note : URNs will be considered for CIP-C.

UR Id : 41
Source : PTT Tokyo / CIP-BS Team
Priority : 1
Need : B
Qualifier : RP
The value of product or guide item descriptor identifier attributes should be URLs.
Note : URNs will be considered for CIP-C.

UR Id : 42
Source : PTT Tokyo / CIP-BS Team
Priority : 1
Need : C
Qualifier : RP
The value of item descriptor identifier attributes should be URNs.
Note : This is not a contradictory requirement from the previous one, as URNs will supersede (and effectively incorporate) URLs.

UR Id : 43
Source : URD 2.0 Review [NASA/JTH/02]
Priority : 1
Need : B
Qualifier : RP
A CIP item descriptor shall support the mandatory CIP attributes defined for it.
Note : This requirement helps to ensure that ICS data will be available through the CIP, eg via collections query using the CIP attributes.

3.1.1.2.4 Attribute Sets

The CIP will need to operate in an environment with inherited, new and future catalogue systems, with varying data definitions. These data definitions can also be extended. To enable the CIP to better handle variable/extensible catalogue systems, the notion of CIP 'standard' and 'local' sets of attributes have been introduced (derived from CINTEX engineering activity) and these need to be supported.

The terms 'standard' and 'local' attributes are assumed to apply for all the CIP object types, i.e. collection descriptors, product descriptors, guide descriptors, privileges, etc.

UR Id : 44
Source : DPRS TN [R1, Section 4.1.6]
Priority : 1
Need : A
Qualifier : RP
The CIP shall support a 'standard' set of attributes, which will be defined in the CIP specification.
Note : Any catalogue system wanting to take advantage of the CIP services will need to define provided objects in terms of at least the 'standard' set of attributes.

UR Id : 45
Source : CIP-BS Team
Priority : 1
Need : A
Qualifier : RP
The 'standard' set of attributes shall specify the set of core attributes that will ensure interoperability between data providers.

Note : *The 'standard' attribute set is not designed to contain a comprehensive list of all possible attributes from all data providers. On the contrary, it shall contain only a minimum set of core attributes which are commonly used in the ICS/CIP domain (i.e. the 'standard' attribute set is not the union of all existing attribute sets, but rather the intersection).*

UR Id : 46
Source : DPRS TN [R1, Section 4.1.6]
CIP-BS Team
Priority : 1
Need : A
Qualifier : RP

The 'standard' set of attributes shall contain the CIP mandatory and CIP optional attributes.

Note : *The CIP mandatory attributes must be supported for CIP compliance. On the other hand, the CIP optional attributes may or may not be supported by a particular site.*

The following list of requirements specify attributes that the CIP attribute set must contain. This list is not exhaustive, but includes attributes that are essential and whose existence is necessary/implied by other URs.

UR Id : 47
Source : CIP-BS Team
URD 2.0 Review [CCRS/DOB/12]
Priority : 1
Need : B
Qualifier : RP

The 'standard' set of attributes shall include a mandatory collection identifier attribute.

Note : *The value of a collection identifier attribute will allow the unique identification of a collection in the CIP domain.*

UR Id : 48
Source : CTN [R33] / CIP-BS Team,
CIP 2.1 Review [ESA/MF/9]
Priority : 2
Need : C
Qualifier : RP

The 'standard' set of attributes shall include a commonality attribute.

Note : *The value of this commonality attribute will be a list of all the attributes within a collection which can be assumed to be common to(i.e. inherited by) all the children in the collection hierarchy rooted by the collection. It will be possible to use this commonality attribute to performed tree pruning during a search (i.e. if a particular collection does not meet a search criterion relating to an attribute flagged as a common attribute, it can be assumed that all its children will not meet that criterion).*

UR Id : 49
Source : CIP-BS Team
Priority : 1
Need : B
Qualifier : RP

The 'standard' set of attributes shall include spatial coverage attributes.

Note : *Spatial coverage attributes are likely to be mandatory in the specification to reflect their importance for EO data retrieval.*

UR Id : 50
Source : DPRS TN [R1, Section 4.1.6]
CIP-BS Team
Priority : 1
Need : A
Qualifier : RP

The CIP shall support 'local' sets of additional attributes to the standard set. The CIP shall not reject such 'local' attributes but forward them with the recognised standard attributes.

Note : *These 'local' sets of attributes will not be defined in the CIP specification. However, the CIP will support the access and retrieval of those 'local' attributes by remote catalogue systems Local attributes are likely to be used by a particular data provider and not available throughout the CIP domain.*

UR Id : 51
Source : URD 2.0 Review [NASA/LR/01]
Priority : 1
Need : B
Qualifier : RP

The CIP shall support 'collection specific' sets of local attributes as extensions to the standard set. The CIP shall not reject such 'collection specific' attributes but forward them with the recognised standard attributes.

Note : *These collection specific sets of attributes will enable the user to request the particular attribute set which is specific for searching the required collection.*

3.1.1.3 Local Services

The notion of 'local services' was introduced during the CINTEX engineering activity. It reflects the possibility that some catalogue systems may provide services that are supplementary to the core catalogue services, i.e. additions to inventory, browse, guide, collections, order etc. Such services are likely to be more specialist, with examples such as:

- Remote execution of algorithm software on chosen products,
- Local printing of documents,
- Retrieval of ancillary data such as code, software, manuals etc.,
- Supplementary on line help services.

It is not appropriate however, for this URD to define requirements on the sorts of local services that can be supported, but the requirement to support the concept of local services is identified, at least as a first step in this direction.

UR Id : 52
Source : DPRS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support requests to initiate local services that supplement the CIP core services and that are provided by a catalogue site accessed within the CIP domain.

3.1.1.4 CIP Search Query Language

An important set of requirements on the CIP are those dealing with queries and searches issued to the internal catalogue systems and the handling of the results. The CIP search query language encompasses the syntactic rules for constructing a search query object. A CIP search query language statement is carried within a search query object and will be exchanged between client software and server software as part of the protocol mechanism. There will be other information that will have to be carried within the search query object, apart from the actual search query language statement, such as the search query source, result options, etc.

These requirements are derived from a combination of sources; the implications of certain preliminary requirements in the DPRS Statement of Work[R2], Section 4.1.7 of the DPRS TN[R1] (the Attribute Query section of the CINTEX functional model[R15]), references to search query in Z39.50[R17] , the Collections TN[R33] and DPRS/CIP-BS Team knowledge of the area. To avoid multiple references, the source for all the requirements is given as DPRS Team as the requirements themselves are not explicitly stated in any prior document.

Note that the requirements in this section are likely to be met by an 'off the shelf' retrieval package such as SQL 3, but they need to be stated explicitly and the method that they will be met is a constraint requirement. It is intended that there may be a number of search query languages that may be used within the search query object. The CIP specification shall specify a basic search query language that will satisfy the requirements stated below, and which all participating Retrieval Managers will support. Above this level of sophistication there may be more powerful languages that deal with, for example, natural language search queries, state oriented queries, i.e. IF-THEN-ELSE and local variables within the search query script, etc. As long as the CIP indicates in the search query object the language being used and that the client and server have negotiated beforehand the language(s) that are supported by both of them, then this provides for a powerful and flexible protocol.

An example of a CIP search query may be a search for all AVHRR image data acquired after a particular date, of which the core of the search query may look like:

```
( SENSOR = AVHRR ) & ( ACQUISITION_DATE > 24-JUL-1995 )
```

UR Id : 53
Source : DPRS Team
Priority : 1
Need : A
Qualifier : RP

The CIP specification shall contain the rules, syntax and semantics of a search query language which can be used to define catalogue retrieval queries.

UR Id : 54
Source : DPRS Team
Priority : 2
Need : A
Qualifier : RP

The CIP search query language should be derived from an existing search query language, which is either a standard or currently being defined as a standard.

UR Id : 55
Source : DPRS Team
Priority : 2
Need : A
Qualifier : RP

The CIP search query language should be modular and easily extensible.

Note : This requirement is not easy to verify, but analysis of the objects, rules, syntax etc. will illuminate whether the language is flexible and can be extended in terms of rules, objects. For modularity, the rules must be atomic and the objects must be atomic, i.e. little duplication or redundancy, both of which could reduce the efficiency of the language and increase possible ambiguity. This requirement can also be satisfied by identifying the search query language being used in the search query object, therefore permitting a number of search query languages (and hence extensibility) which the client and Retrieval Manager can handle.

UR Id : 56
Source : DPRS Team
URD 2.0 Review [NASA/LR/02]
Priority : 1
Need : A
Qualifier : RP

The CIP search query language shall support the use of logical constructors for building a search query where the search query targets are CIP attributes or semantic attributes or local attributes or combinations thereof.

*Note 1 : It is anticipated that the majority of searches will be on attribute values, but the capability of also searching on semantic attributes values is so that the user could, for example, find all attributes where the att*ribute's value is of type REAL.

Note 2 : The symbols used in the sub requirements of this UR are examples to aid understanding and are typical of those used in 'C'/UNIX parsing languages. They are not prescriptive, i.e. these do not need to be the exact format of the symbols specified in the search query language.

UR Id : 57
Source : DPRS Team
Priority : 1
Need : A
Qualifier : RP

The CIP search query language shall support the use of an 'equals' ('=') operator.

UR Id : 58
Source : DPRS Team
Priority : 1
Need : A
Qualifier : RP

The CIP search query language shall support the use of comparison operators, i.e. 'less than' ('<'), 'less than or equal to' ('<='), 'greater than' ('>') and 'greater than or equal to' ('>=').

UR Id : 59
Source : DPRS Team
Priority : 1
Need : A
Qualifier : RP

The CIP search query language shall support the use of a logical 'AND' ('&') operator.

UR Id : 60
Source : DPRS Team
Priority : 1
Need : A
Qualifier : RP

The CIP search query language shall support the use of a logical 'OR' ('||') operator.

UR Id : 61
Source : DPRS Team
Priority : 1
Need : A
Qualifier : RP

The CIP search query language shall support the use of a logical 'NOT' ('!') operator.

UR Id : 62
Source : DPRS Team
URD 1.0 Review [DPRS Team]
Priority : 1
Need : A
Qualifier : RP

The CIP search query language shall support the control of the precedence of the elements operated upon.

Note: *This can be achieved by the support of parentheses by the query language, or by the use of a query language which allows to directly control the order of evaluation of operands, i.e. by using the Reverse Polish Notation.*

UR Id : 63
Source : DPRS Team
Priority : 1
Need : B
Qualifier : RP

The CIP search query language shall support the use of the boolean 'TRUE' and 'FALSE' operators.

UR Id : 64
Source : DPRS Team
Priority : 1
Need : B
Qualifier : RP

The CIP search query language shall support the use of a wildcard ('*'), 'match all'/'match the rest' operator.

Note: : *Not all database system support wildcards and their use can make searches slow and inefficient. The support of wildcard searches should be negotiated between client and server and the user should be aware of the implications when using wildcard searches.*

UR Id : 65
Source : DPRS Team
Priority : 1
Need : B
Qualifier : RP

The CIP search query language shall support the use of a wildcard ('?'), 'match single character' operator.

Note: : See note against UR 64.

UR Id : 66
Source : URD 1.0 Review [NASA RID 8]
Priority : 1
Need : A
Qualifier : RP

The CIP search query language shall support spatial coverage attributes for queries.

UR Id : 67
Source : URD 1.0 Review [NASA RID 8]
CIP-A 1.1 review [NASA/LR/10]
Priority : 1
Need : A
Qualifier : RP

The CIP search query language shall support spatial coverage queries by the use of a bounding rectangle attribute.

UR Id : 68
Source : URD 1.0 Review [NASA RID 8]
CIP-A 1.1 review [NASA/LR/10]
Priority : 1
Need : B
Qualifier : RP

The CIP search query language shall support spatial coverage queries by the use of a point-and-radius attribute.

UR Id : 69
Source : CIP-BS Team
Priority : 1
Need : B
Qualifier : RP

The CIP search query language shall support spatial coverage queries by the use of a bounding polygon- attribute.

UR Id : 70
Source : CIP-BS Team
Priority : 1
Need : B
Qualifier : RP

The CIP search query language shall support spatial coverage queries by the use of a point-attribute.

UR Id : 71
Source : CIP-BS Team
Priority : 1
Need : B
Qualifier : RP

The CIP search query language shall support spatial coverage queries by the use of a swath attribute.

Note : Spatial query of swath attributes will not be a geographical or spatial structure.

UR Id : 72
Source : URD 2.0 Review [NASA/LR/04]
Priority : 1
Need : B
Qualifier : RP

The CIP search query language shall allow the use of spatial operators (eg Inside, Outside, Intersects and Within) in the formulation of search queries on spatial coverage attributes within a search query.

UR Id : 73
Source : URD 2.0 Review [NASA/LR/03]
URD 2.1 Comment
Priority : 1
Need : B
Qualifier : RP

The CIP search query language shall support the use of character strings in search queries and allow the use of exact string match, phrase match and wildcard constructs (prefix, embedded, and suffix) operators on character string attributes.

UR Id : 74
Source : URD 1.0 Review [NASA RID 31]
Priority : 2
Need : B
Qualifier : RP

The CIP search query language shall provide the capability to specify whether or not duplicates should be eliminated from the search results.

Note: : As results could be obtained from more than one collection, a search query could return a duplicate result entry several times from a single query. The Retrieval Manager should therefore be able to eliminate duplicates from search results.

UR Id : 75
Source : DPRS Team
Priority : 1
Need : N/A
Qualifier : RP

The CIP search query language should not be dependent on natural language interpretation for user understanding.

Note : Although some of the words/symbols defined in the search query language may be derived from English, this requirement is to encourage international access to the search query language, i.e. the symbols of the language should be easily explained in any natural language.

3.1.1.5 Catalogue Search Queries and Search Query Results

The requirements in this section are those relating to catalogue queries to be handled by the CIP. These requirements are defined in terms of 'The CIP shall/should....', this must be taken to mean both the CIP and the CIP search query language which will be used, in general, to define the required search query.

UR Id : 76
Source : SoW [R2, Section 4.3.3.1]
URD 1.0 Review [NASA RID 5]
Priority : 1
Need : A
Qualifier : RP

The CIP shall enable the directing of a search query to one or more ICS domain sites.

Note : Searches are targeted at collections, which can span EO catalogue sites.

3.1.1.5.1 Guide Search Queries

The interrogation of a guide catalogue service, although conceptually similar to that of a collection has subtle differences which are important enough to highlight in separate specific requirements.

An appropriate analogy for guide is that of a bibliographical database where guide descriptor = bibliographical reference (title, author, publisher: keywords) and the guide data is abstract text or a full document. Further, bibliographical databases can be searched either on the parameters in the reference or as full text and there is also the possibility of hyperlink navigation.

The requirements in this section are at a high level treating guide data as objects within the CIP domain. More specific requirements would effectively describe bibliographical information retrieval systems (and also perhaps Z39.50[R17]) which would not be appropriate in this URD. Currently the services of guide search and retrieval are often handled using the common HTTP/WWW protocols; this has been found very successful for this task and therefore interoperability between guide and the rest of the catalogue services may be achieved through mechanisms to link the CIP and HTTP/WWW protocols.

The first set of requirements in this section refers to the searching of the guide descriptors only, i.e. not the data itself, which is given by UR 85.

UR Id : 77
Source : DPRS TN [R1, Section 4.1.5.7]
Priority : 1
Need : B
Qualifier : RP

The CIP shall support a guide search query via the specification of guide descriptor attribute values.

Note : In general, the keywords used to specify the search query would be the value of an identified attribute such as 'GUIDE NAME'.

UR Id : 78
Source : DPRS TN [R1, Section 4.1.5.7]
Priority : 2
Need : B
Qualifier : RP

The CIP should support a guide search query via free text, where the text is assumed to be part of one or more specified guide descriptor attributes.

UR Id : 79
Source : DPRS TN [R1, Section 4.1.5.7]
Priority : 2
Need : B
Qualifier : RP

The CIP should support a guide search query via an attribute value/free text combination.

UR Id : 80
Source : DPRS TN [R1, Section 4.1.5.7]
Priority : 1
Need : B
Qualifier : RP

The CIP shall be able to process a list of zero or more returned guide descriptors as a result of a guide search query.

UR Id : 81
Source : DPRS TN [R1, Section 4.1.5.8]
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the retrieval of guide data from information obtained as a result of guide search queries.

UR Id : 82
Source : DPRS TN [R1, Section 4.1.5.8]
Priority : 2
Need : B
Qualifier : RP

The CIP shall support the specification of the format and delivery method of the guide data to be retrieved, if these options are available.

Note : Examples of guide data format include the document format (text, word processor format, PDF, etc.) or media format, the delivery may include physical transfer (e.g. by FTP), direct synchronous display, transfer by e-mail, HTML, printing etc.

UR Id : 83
Source : DPRS TN [R1, Section 4.1.5.7]
Priority : 2
Need : B
Qualifier : RP

The CIP shall support those guide descriptors that have no external reference to guide data (i.e. the guide text may be an attribute value of the guide descriptor). In this case, any further request for the guide data should be ignored.

UR Id : 84
Source : OTN [R31] / CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support the retrieval of general price information.

Note 1 : The scope of the general price information provided (e.g. general pricing policy) depends on the item descriptor to which this guide data is related, i.e. it could be a product, a collection, or could even be related to the whole data provider (e.g. if the information is related to the global collection containing all the data of a data provider).

Note 2 : The general price information defined in this requirement should not be confused with the privileges associated with a group and an item descriptor: the information described here is general and purely informative (i.e. guide data), whereas privileges describe actual prices that are used in an order request and may be used in accounting/invoicing.

UR Id : 85
Source : DPRS Team
URD 2.1 Comment
Priority : 2
Need : C
Qualifier : RP

The CIP should support an optional keyword/free text search of the guide data itself.

Note : In this case, the CIP must handle a keyword or free text search directly of the guide data. This can either be managed by the Retrieval Manager software or passed on to the catalogue server software which may support the searching.

The sub requirements of UR 86 map onto those of the 'Describe Guide' section of the DPRS TN[R1] used to return the data definitions of guide entries.

UR Id : 86
Source : DPRS TN [R1, Section 4.1.5.6]
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the access and retrieval of the attributes of guide descriptors.

UR Id : 87
Source : DPRS TN [R1, Section 4.1.5.6]
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the retrieval of a guide descriptor by specifying a guide identifier.

UR Id : 88
Source : DPRS TN [R1, Section 4.1.5.6]
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the specification of a subset of guide descriptor attributes to be returned in the guide search query results.

UR Id : 89
Source : DPRS TN [R1, Section 4.1.5.6]
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the specification of those semantic attributes of the guide descriptor attributes to be returned in the search query results.

UR Id : 90
Source : DPRS TN [R1, Section 4.1.5.6]
CIP-BS Team
URD 2.1 Comment
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the default of returning a minimum subset of guide descriptor attributes if no preference is specified in the specified search query.

UR Id : 91
Source : DPRS TN [R1, Section 4.1.5.6]
URD 2.1 Comment
Priority : 1
Need : C
Qualifier : RP

The CIP shall support the navigation of guide hyperlinks via http.

3.1.1.5.2 Collection Queries

This sub-section contains those requirements specifically dealing with collection based queries, primarily concerning the information to be managed (i.e. supplied and returned) by the CIP when processing collection queries.

In the following requirements, references are made to identifiers, in particular collection and product identifiers (in terms of actual values). The latter may vary between catalogue implementations and between data providers. In particular, it may not be a single unique identifier or name, but a combination of, for example, domain, date, satellite etc. These requirements therefore assume, for those non CIP generated identifiers, that a product identifier will be whatever information is needed to uniquely and unambiguously identify an EO product, whether this is a single numeric identifier or a character string or a combination of data such as agency, range, time and satellite.

UR Id : 92
Source : DPRS TN [R1, Section 4.1.5.1]
DPRS TN [R1, Section 4.1.5.3]
Priority : 1
Need : A
Qualifier : RP

The CIP shall support a collection search via a general search query constructed using the CIP search query language.

Note : The components of the search query will be conditions on the actual attribute's values of the required collection e.g. on date, geographical area, sensor identifier etc.

UR Id : 93
Source : DPRS TN [R1, Section 4.1.5.3]
Priority : 1
Need : A
Qualifier : RP

The CIP shall support a collection search query via attributes.

Note : This search is to enable location of collections that are defined by certain attributes, the specification is not by the actual attribute value but by the data dictionary attribute name.

UR Id : 94
Source : DPRS TN [R1, Section 4.1.5.3]
Priority : 1
Need : A
Qualifier : RP

The CIP shall support a collection search query via collection identifier(s) to enable location of a particular collection descriptor.

UR Id : 95
Source : DPRS TN [R1, Section 4.1.5.7]
Priority : 1
Need : A
Qualifier : RP

The CIP shall be able to process a list of zero or more returned collection descriptors as a result of a collection search query and also appropriate collection hierarchy information to enable full interpretation of the results.

Note : It may be necessary for the CIP to return not only the located collection descriptors but also hierarchical tree information and tree positioning to allow, for instance, the client to fully display the collection tree associated with the located collections.

UR Id : 96
Source : DPRS TN [R1, Section 4.1.5.3]
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the specification of a subset of collection attributes for which the attribute values must be returned in the search results. If none are specified, then all attribute values shall be returned.

Note : If a guide descriptor is one of the collection attributes and this is a reference to an external document, it is not necessary for the CIP to follow the reference and retrieve the actual guide data.

UR Id : 97
Source : DPRS TN [R1, Section 4.1.5.2]
Priority : 1
Need : A
Qualifier : RP

The CIP shall support the access and retrieval of the attributes and associated semantic attributes of collection descriptors.

UR Id : 98
Source : DPRS TN [R1, Section 4.1.5.2]
Priority : 1
Need : A
Qualifier : RP

The CIP shall support the retrieval of a collection descriptor by specifying a collection identifier.

UR Id : 99
Source : DPRS TN [R1, Section 4.1.5.2]
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the specification of a subset of collection descriptor attributes to be returned in the search query results.

Note : This is not the same requirement as UR 96 as this requirement refers to the data definitions, i.e. the attributes of the collection descriptors, not the actual values of the attributes.

UR Id : 100
Source : DPRS TN [R1, Section 4.1.5.6]
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the specification of those semantic attributes of the collection descriptor attributes to be returned in the collection search query results.

UR Id : 101
Source : DPRS TN [R1, Section 4.1.5.6]
CIP-BS Team
Priority : 1
Need : A
Qualifier : RP

The CIP shall support the default of returning all collection descriptor attributes if no preference is specified.

Note : This requirement is worded slightly differently than that implied in [R1, Section 4.1.5.6] as it was thought better to return all data as a default rather than an arbitrary undefined subset, so as not to mislead the end user.

UR Id : 102
Source : DPRS TN [R1, Section 4.1.5.4]
Priority : 2
Need : B
Qualifier : RP

The CIP shall support a search query by collection identifier and date of all collections on or below the hierarchical level of the specified collection to return those collections that have had a modification to their attributes or semantic attributes since the specified date.

Note : Modification here means a modification to the attributes or semantic attributes of a collection descriptor, not a modification of the attribute values. In addition, a deleted collection will register as a modification to its Parent.

UR Id : 103
Source : DPRS Team
URD 1.0 Review [DPRS Team]
Priority : 2
Need : B
Qualifier : RP

The CIP shall support an optional flag on the search query to indicate in the search query results, or otherwise ignore, any collections that have no 'modification date' attribute.

3.1.1.5.3 Product Descriptor Search Queries

This section explicitly highlights the differences between collection descriptors and product descriptors in terms of search queries (Note that a product descriptor, maps on to the CEOS term inventory entry).

Although a collection can comprise of either other collections or product descriptors (not including separate collection of guide descriptors), the lowest hierarchical element within a collection tree is a product descriptor and these provide the descriptions and links to the EO products themselves. Note that a collection of all the product descriptors of a particular inventory maps onto a CEOS directory.

UR Id : 104
Source : DPRS TN [R1, Section 4.1.5.9]
Priority : 1
Need : A
Qualifier : RP

The CIP shall support a collection directed search query to enable location of a product descriptor where the search start point is specified by collection identifier(s).

UR Id : 105
Source : DPRS TN [R1, Section 4.1.5.9]
Priority : 1
Need : A
Qualifier : RP

The CIP shall support a product descriptor search query constructed using the CIP search query language.

Note : The components of the search query will be conditions on the actual attribute values of the required product and collection descriptors to be searched, e.g. date, geographical area, sensor identifier etc.

UR Id : 106
Source : DPRS TN [R1, Section 4.1.5.9]
Priority : 1
Need : A
Qualifier : RP

The CIP shall be able to process a list of zero or more returned product descriptors as a result of a product descriptor search query.

UR Id : 107
Source : DPRS TN [R1, Section 4.1.5.3]
Priority : 1
Need : B
Qualifier : RP

The CIP shall support specification of a subset of product descriptor attributes for which the attribute values must be returned in the search results. If none are specified, then all attributes shall be returned.

The following set of requirements on search querying of attributes of product descriptors has no direct source in the DPRS TN[R1] or in the CINTEX functional model[R15] as the requirements are implicitly given by those on collections (e.g. in DPRS TN [R1, Section 4.1.5.3]).

However, it is worth highlighting them explicitly as separate requirements to ensure that the management of product descriptor attributes is supported by the CIP and the Retrieval Manager.

UR Id : 108
Source : DPRS Team
Priority : 1
Need : A
Qualifier : RP

The CIP shall support the access and retrieval of the attributes of product descriptors.

UR Id : 109
Source : DPRS Team
Priority : 1
Need : A
Qualifier : RP

The CIP shall support the retrieval of a product descriptor in terms of attributes by specification of a keyword identifier such as a product identifier.

Note : The definition of a product identifier (in terms of actual values) may vary between catalogue implementations and between agencies. In particular, it may not be a single unique identifier or name, but a combination of, for example, range, date, satellite etc. This requirement therefore assumes that a product identifier as given here will be whatever information is needed to uniquely and unambiguously identify an EO product.

UR Id : 110
Source : DPRS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the specification of a subset of product descriptor attributes to be returned in the search query results.

UR Id : 111
Source : DPRS Team
URD 1.0 Review [DPRS Team]
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the specification of the semantic attributes of the product descriptor attributes required to be returned in the product descriptor search query results.

UR Id : 112
Source : DPRS Team
URD 2.0 Review [CCRS/DOB/13]
Priority : 1
Need : A
Qualifier : RP

The CIP shall support the default of returning a minimum subset of product descriptor attributes if no preference is specified in the specified search query.

Note : The CIP will provide at least a 'brief', 'full' and 'browse' sets of product descriptors. The minimum subset corresponds to the brief set. The brief set is likely to exclude Browse data..

3.1.1.5.4 Collection Hierarchy Search Queries

The following requirements associated with collection hierarchy are implied in the DPRS TN[R1] (i.e. the CINTEX functional model[R15]) but are made more explicit here to clarify the search query scenarios and information that the CIP must be able to handle.

The queries in the subsection title refers to a search query for collection or product descriptors that will involve collection hierarchy traversal to fulfil the search. In the requirements in this subsection, the word search reflects that the search query needs to be performed over the hierarchy.

Note that requirements on distributed collections over sites are covered by requirements on the Retrieval Manager.

The following requirements are applicable to both collection and product descriptor search queries.

UR Id : 113
Source : DPRS Team/UR 0.1 Review [RID 15]
Priority : 1
Need : A
Qualifier : RP

The CIP shall support searches of the attributes and semantic attributes of the members of a collection.

UR Id : 114
Source : DPRS Team/UR 0.1 Review [RID 15]
Priority : 1
Need : A
Qualifier : RP

The CIP shall support hierarchical collection searches to be continued from the specified collection until all terminal collections have been searched.

UR Id : 115
Source : DPRS Team
Priority : 1
Need : A
Qualifier : RP

The CIP shall assume a hierarchical collection search, as far down as terminal collections, if no alternative has been specified.

UR Id : 116
Source : CTN [R33] / CIP-BS Team
CIP 2.1 Review [ESA/MF/9]
Priority : 2
Need : C
Qualifier : RP

The CIP should support a full collection tree search and a refined collection tree search, where the refined search is via pruning of the collection hierarchy using commonality attributes.

Note: Commonality attributes are likely to be a list of keywords, for which collections and child collections are assumed to have a common theme.

UR Id : 117
Source : DPRS Team
Priority : 1
Need : B
Qualifier : RP

The CIP should ensure that unique collection identifiers are returned from hierarchical searches, i.e. to avoid duplications of a collection identifier that may have been incorporated in more than one higher level collection.

UR Id : 118
Source : DPRS Team
Priority : 1
Need : B
Qualifier : RP

The CIP should support an option to flag or ignore duplicated product descriptor identifiers that may result if a product descriptor is in more than one collections.

Note : This could occur, for instance, if a search is conducted across collections and one of the specified collections is a 'hot collection' which contains product descriptors from an earlier search query result.

3.1.1.5.5 CIP Search Query Management

According to the CIP object model and as given by previous requirements in this section, queries generated within the CIP domain are treated as a type of CIP object, although these are in general, dynamic and not part of any catalogue site.

This section contains requirements on the CIP search query as an object for which, in particular, status information should be made available. These requests for status information are called status queries (as opposed to search queries).

There is a correspondence between the requirements in this subsection and those on Command Control in Section 3.1.1.8.2.

UR Id : 119
Source : DPRS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the generation of a unique identifier for all CIP search queries which provides a handle for subsequent status query interaction.

UR Id : 120
Source : DPRS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall make the unique identifier available to the source of the search query.

Note : Here the search query source could be a CIP client, server, another Retrieval Manager, etc.

UR Id : 121
Source : DPRS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall ensure that an identifier for a completed search query is no longer applicable within the CIP domain.

Note : Here a completed search query is taken to mean that the results have been obtained and returned to the source of the search query and no further results are expected. This requirement also holds for unsuccessful search queries.

UR Id : 122
Source : DPRS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the status query of a search query via the specification of the required search query identifier.

Note : The status query of a search query, although sounding somewhat confusing, logically means that once submitted, the status or stage reached of the search query can be obtained via the search query identifier. This requirement has implications on the Retrieval Manager to maintain, for instance, the stages of a search query for subsequent access.

The following requirement and sub requirements relate to the management of the numbers of search query results or 'hits' that may be returned or have been returned as the result of a search query.

These requirements could help to reduce the resource and performance load on systems and servers that could be impacted by search queries that are undirected and would result in the return of large amounts of matching data. For instance a search query to find all the product descriptors in a number of distributed collections that relate in some way to temperature may result in thousands of matches and could swamp the client if returned. A requirement is also included to define a time limit for the search query processing to avoid systems hanging if search queries are not responded to by the destination server.

UR Id : 123
Source : URD 0.1 Review [RID 55]
Priority : 2
Need : B
Qualifier : RP

The CIP shall support the management of the number of matches that result or may result from a search query.

UR Id : 124
Source : URD 0.1 Review [RID 55]
Priority : 2
Need : B
Qualifier : RP

The CIP shall support the specification of the maximum number of matches that are required to be returned as the result of a search query.

Note : A simple illustrative example. If the user knows that over a thousand product descriptors may result from a collection search query, they may want to see only a small subset as a first pass, e.g. preceding a more specific query, so they would specify that a maximum of only one hundred matches are returned.

UR Id : 125
Source : URD 0.1 Review [RID 55]
Priority : 2
Need : B
Qualifier : RP

The CIP shall support the limiting of the numbers of matches resulting from a search query.

Note : The limiting may take the form of information messages, termination of a search query on reaching a defined limit or ensuring that appropriate information is available to the catalogue server or Retrieval Manager to ensure that the effects of unintelligent search queries are restricted.

UR Id : 126
Source : URD 0.1 Review [RID 55]
Priority : 2
Need : B
Qualifier : RP

The CIP shall support a request to obtain the number of potential matches for a search query without actually placing the search query.

Note : This full support of this service is likely to be catalogue dependent, i.e. for effective implementation, the request for 'number of likely hits' to be passed via the Retrieval Manager to the catalogue server, which returns the number of potential successful matches, without returning the actual results. Of course, the Retrieval Manager could also support this by counting the number of results then just returning that number, but this is considerably less efficient.

UR Id : 127
Source : URD 0.1 Review [RID 82]
Priority : 2
Need : B
Qualifier : RP

The CIP shall support the specification of a user required time-out on search queries and also support the return of a result set, or partial result set, together with a flag indicating a full or partial completion of the search query results.

Note : A partial result may occur when more than one site is specified but some do not respond. The Retrieval Manager will probably have to set timers following the routing of the search query, if no time limit is specified, the time out should be a system configurable limit, e.g. ten minutes. Of course, the flag could also be used to indicate a partial match, where the user has specified a maximum number of returned matches which is less than the number of actual matches.

Note that the preceding requirements on match numbers and search query time-outs are identified as high level requirements at this stage and are likely to be refined during the protocol definition.

Note also that these preceding requirements may have implications on requirements for 'incremental delivery' of results and 'sorting' of the incremental results, but further analysis is needed in this area to assess the need for more specific and detailed requirements. It is feasible that incremental delivery and sorting are local services which may be supported by a minority of catalogue sites.

UR Id : 128
Source : CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support the segmentation of retrieved data during the retrieval of search results.

Note 1 : Segmentation enables large data items to be segmented during the retrieval process so that results can begin to be processed, without needing to wait for the full data item to be transferred. For the CIP, this may be particularly useful in the transfer of browse or sub-sampled image data. Segmentation is a Z39,50 service and the level of segmentation is established at initialisation.

Note 2 : An associated service known as fragmentation may also be useful for the CIP. However, further analysis and results from practical investigations are needed, prior to establishing the requirement. This is then likely to be a CIP-C requirement.

UR Id : 129
Source : CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support the sorting of the results obtained from the execution of search queries so that retrieval can be performed in an order defined by the user.

3.1.1.6 Browse Data

This section contains requirements associated with providing versions of EO products that are intended to serve as EO product evaluation aids for a user. These evaluation aids are typically reduced or summary data versions derived from the EO product data itself. Browse, Quicklook and subsetted data are the most common examples of derived data used for evaluation. These types of evaluation data are delivered to the user via two different mechanisms, dynamically over the network during a user query session, and as an EO product order. The second case accounts for users who wish to evaluate large numbers of EO data products and allows them to order the EO product evaluation data from an archive system and then store and access it locally rather than dynamically over a network. The CIP will support both delivery methods for EO product evaluation data.

It is important to note that although most catalogue systems will provide some form of reduced data retrieval, it is not a prerequisite.

Browse Data

Browse data is a derived representation or summary of data provided by a catalogue system to aid user selection of EO products. The form and content of browse data is dependent on the nature of the associated EO data and the data selection criteria necessary for a science discipline to evaluate the EO data. A given EO product may be represented by several different browse data. For example with multi-channel data, browse data from one of several different channels or combinations of different channels may be required in order to represent different geophysical parameters and/or selection criteria. In addition a single large EO product may be represented by multiple browse data which depict specific regions or subsections of the EO product. (Ordering of browse data is a specific requirement in the Order requirements subsection).

Browse data is produced from the application of a browse service on an EO product, either dynamically at the time the browse data is requested by a user or as output which is stored as a system resource for retrieval at a later time. Examples of browse data include; 1 bit attribute maps (i.e. cloud mask), JPEG compressed images, subsampled reduced resolution images, data statistics and histograms).

Quicklook Data

The term 'Quicklook' is used within some catalogue systems to refer to specific types of browse data, however the term is not consistently defined from one system to another. Within this document Quicklook is considered a closed subset of browse data and is not considered independently in terms of requirement specifications.

The following requirements are associated with retrieval of Browse data.

UR Id : 130
Source : DPRS TN [R1, Section 4.1.5.10]
Priority : 1
Need : A
Qualifier : RP

The CIP shall support the request for the retrieval of browse data via the specification of a product identifier.

UR Id : 131
Source : DPRS TN [R1, Section 4.1.5.10]
Priority : 2
Need : B
Qualifier : RP

The CIP shall support requests for the retrieval of multiple browse data objects from a single full product source.

Note : For large products, e.g. SAR images, various browse data objects could be presented, providing views of various sections of the image. One way this requirement could be supported is via the specification of an optional parameter e.g. to specify browse data object identifier (for a particular browse) or to specify an 'All' option or a 'default' option, etc.

UR Id : 132
Source : URD 1.0 Review [NASA RID 14]
Priority : 2
Need : B
Qualifier : RP

The CIP should support the distinction between and selection of multiple browse attributes from a single product source.

Note : This can be achieved by the use of a 'Browse descriptor' compound attribute object, where a browse attribute is described by additional attributes.

UR Id : 133
Source : DPRS TN [R1, Section 4.1.5.10]
Priority : 2
Need : B
Qualifier : RP

The CIP shall support the request for retrieval of browse data with an optional specification of the required format.

Note : Examples of candidate browse data formats that may be supported by catalogue systems include GIF, JPEG and hdf-eos.

UR Id : 134
Source : URD 2.0 Review [BTT/NASDA/SS/1]
Priority : 2
Need : B
Qualifier : RP

The CIP shall support the request for retrieval of browse data with an optional specification of the required compression format.

Note : Examples of compression format include GIF and JPEG (which include compression options) and lzh (Lempel-Ziv encoding).

3.1.1.7 Order

The following requirements are those relating to CIP support of ordering of Earth observation products.

It is probably worth reiterating, for extra clarification, the general conceptual relationship between the major elements of a catalogue system: CEOS inventories, CEOS inventory entries, EO products, product descriptors, package descriptors, packages and archives.

Archive

An archive of Earth observation data can hold various types of EO data ranging from satellite images and climatological products processed from the images, to observation data and climatological statistics. An archive may also contain information describing the EO data and also supplementary data such as design documentation, algorithm object and source code, technical reports user manuals etc.

There is likely to be a database management system for maintenance and low level access to the data. It is important to note that the CIP makes no assumptions about the format or structure of the archived data.

Inventory

An EO inventory holds information about the data held in an EO archive. An inventory and archive should not be assumed to be the same thing, although they may in some cases be synonymous.

An inventory is effectively a register of the EO data that is available for retrieval, it holds inventory entries which describe the EO products themselves. These inventory entries should not be assumed to have a one-to-one relationship with the individual data items held in an archive as an EO product may be formed by combinations of archive data items and in different formats. Further, an inventory entry may describe a logical piece of data from which various products can be derived where the particular product required is generated according to appropriate order criteria.

Further, the relationship between inventory entries and archive data items may be, in some cases, less concrete as inventory entries may also exist for data that is not yet in the archive as, for instance, the data has not yet been acquired by the archive system. For instance, the ESA ERS-1/2 system does not distinguish between archived data and to be acquired data. In the ERS-1/2 system, the products ordered by a user is labelled an ‘Observation Set’ such that the Observation could have occurred or is yet to occur.

Note that in this URD, the term inventory entry is mapped onto product descriptor.

EO Product

An EO product is generated as a result of an EO product order. The generated product should not be assumed to exist in the required format prior to the placing of the order, although in general the EO data that comprises the EO product will exist (at some stage) in an appropriate archive. Subselected products can also be ordered.

Browse Product

Browse data is normally derived from a particular product (or products). A browse service provider could also choose to provide browse data independently from data products, in the form of a separately ordered product. In this case, as far as the ICS domain is concerned, the Browse product is viewed as another form of EO product although an explicit order requirement is included for completeness.

Package

A predefined package is a set of one or more EO formatted products that may already be assembled on a media item. Conceptually, it is pre-packaged sales item. Logically, a package can be regarded as a

special instance of a collection. A user can order a predefined package or specify one or more products to be delivered on a particular medium, which is an ad-hoc package.

A predefined or ad-hoc package is described by a package descriptor and predefined packages can be listed or ordered via package descriptors.

These brief explanations of key terms and assumptions should help to clarify the following order requirements.

3.1.1.7.1 Product Order

UR Id : 135
Source : DPRS TN [R1, Section 4.1.5.11]
CIP-BS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall support order requests of EO products via a product identifier which should be an attribute of a product descriptor.

Note : As a browse product is a specialisation of a product, this requirement therefore also logically covers the ordering of browse products, but see later browse order requirement.

UR Id : 136
Source : DPRS Team
CIP-BS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall support EO product order requests using information from product descriptors obtained as a result of a collection or product descriptor search query.

UR Id : 137
Source : DPRS Team
CIP-BS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall support EO product order requests via a product identifier which has not been located via a collection or product descriptor search query.

Note : This is for an order of a product where the product identifier is already known to the end user.

UR Id : 138
Source : Browse TT RID: NASDA/SS/07,13
Priority : 1
Need : B
Qualifier : RP

The CIP shall support order requests of EO browse data via a browse product identifier.

Note : Although a browse product is a formally a specialisation of a product, this requirement is included to explicitly support the ordering of browse data.

3.1.1.7.2 Product Subset

A subset of a product is a smaller region of a full product, but usually at the same resolution as the full product. For example, band selection of a multi-band image (eg infra-red/water vapour/visible 3-band image). Another example would be the subsetting of a SAR image via given co-ordinates specifying a rectangle, could allow viewing at full resolution the smaller region of the image, prior to full product ordering. (Note that subsetting could also be performed by specifying processing options in a normal order request).

UR Id : 139
Source : CINTEX Functional Model V0.4 [R15]
URD 2.0 Review [NASA/LR/07]
Priority : 2
Need : B
Qualifier : RP

The CIP shall support the request for retrieval of a product data subset via the specification of a product identifier and the region of the subset.

UR Id : 140
Source DPRS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support the subset retrieval where a product descriptor has not previously been retrieved.

Note : This requirement is so that an already known product identifier can be used to obtain a subset selection without having to locate the product descriptor. It also implies that the CIP does not have to validate the potential support of product subsets prior to processing the request.

UR Id : 141
Source : DPRS TN [R1, Section 4.1.5.10]
Priority : 2
Need : B
Qualifier : RP

The CIP shall support the request for retrieval of a product subset with an optional specification of the required format.

3.1.1.7.3 Collection Order

UR Id : 142
Source : DPRS Team
PTT [Tokyo] / CIP-BS Team
Priority : 2
Need : C
Qualifier : RP

The CIP shall support the placing of a collection order request which corresponds to the ordering of all products described in the collection.

Note : This requirement does not need to be taken to mean a hierarchical order, the assumption is that the collection is a terminal collection containing product descriptors and only order requests are placed for these. Note that this requirement also covers ordering of collections of browse products.

UR Id : 143
Source : DPRS Team
PTT [Tokyo] / CIP-BS Team
Priority : 2
Need : C
Qualifier : RP

The CIP shall support the generation of a confirmation request to ensure that the full collection order request is actually needed.

UR Id : 144
Source : DPRS Team
CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support the placing of an order request for a predefined package, where a predefined package may be comprised of one or more EO products on a particular medium.

Note : It is assumed that a predefined package will be comprised of at least one product. Conceptually a package of browse products is the same as a package of full products, just that the resolution or definition is usually of a lower quality.

3.1.1.7.4 Standing Orders

UR Id : 145
Source : DPRS Team
Priority : 1
Need : C
Qualifier : RP

The CIP shall support standing order facilities.

UR Id : 146
Source : DPRS Team
PTT [Tokyo] / CIP-BS Team
Priority : 2
Need : C
Qualifier : RP

The CIP shall support the ordering of a data product in the form of a standing order request.

Note : A standing order means that the data product(s), on generation, could be automatically ordered and delivered to the requester.

UR Id : 147
Source : DPRS Team
CIP-BS Team
URD 2.0 Review [ESA/SM/04]
Priority : 1
Need : C
Qualifier : RP

The CIP shall support the execution of standing order requests.

UR Id : 148
Source : DPRS Team
CIP-BS Team
Priority : 1
Need : C
Qualifier : RP

The CIP shall support standing order interaction requests including cancellation and standing order modification.

UR Id : 149
Source : DPRS Team
CIP-BS Team
Priority : 1
Need : C
Qualifier : RP

The CIP shall support standing order request schedule management

Note : This is to enable monitoring of scheduled standing order requests, adjustment of order requests etc. and is primarily meant from a system administrator's view rather than an operator's.

3.1.1.7.5 Order Process and Management

This section contains detailed Order requirements. Much of this section has been significantly reworked since version 1 of the URD, in particular to derive requirements from and to reflect analysis carried out by CEOS PTT members in the Order Technical Note.

There are two types of CIP Order message and two types of conceptual ICS Order:

Primary Order (CIP message)

A Primary Order is an Order message (eg order request, quote or validate) being passed from a client and a local Retrieval Manager.

Secondary Order (CIP message)

A Secondary Order is an Order message (eg order request, quote or validate) being passed from a Retrieval Manager to another Retrieval Manager.

Local Order (ICS concept)

A Local Order is an Order request (eg order request, quote or validate) which is entirely local, so that the order process is entirely within an ICS node. A Local Order is comprised of a Primary CIP Order message and interaction with the local Order handling system.

Remote Order (ICS concept)

A Remote Order occurs between two ICS nodes (ie catalogue sites that communicate via Retrieval Managers). A Remote Order will necessarily follow a Primary Order CIP message and involve RM to RM interaction. A Remote Order will require authentication between the Retrieval Managers.

Security Approach

Although the approach to passing of authentication information is to a certain extent implementation dependent, the likely approach for any Remote Order is that at least the following information will always be transferred:

- User Profile (as per the logged in user, including group information)
- User Authenticated Flag (flag to confirm that authentication has occurred)
- Origin domain information (eg about the origin ICS node)
- (Order request specification)

It will then be up to the target Retrieval Manager/Order handling system which data to accept. For instance, remote authentication could be performed with the user profile information, this corresponds to Remote Order with passthrough. User authenticated flag and origin domain information could alternatively be sufficient for a proxy Remote Order.

Note that local and remote order requirements related to proxy and passthrough are provided in the Retrieval Manager requirements.

UR Id : 150
Source : URD 2.0 Review [NASA/GP/01]
Priority : 1
Need : B
Qualifier : RP
The CIP shall support the exchange of Primary and Secondary Order messages.

UR Id : 151
Source : URD 2.0 Review [NASA/GP/01]
Priority : 1
Need : B
Qualifier : RP
The CIP shall support local and remote orders.

UR Id : 152
Source : URD 2.0 Review [NASA/GP/27]
Priority : 1
Need : B
Qualifier : RP
The CIP shall support the establishment of a link from Secondary to Primary order sessions.
Note : This may be implemented in the Retrieval Manager.

UR Id : 153
Source : URD 2.0 Review [NASA/GP/01]
Priority : 2
Need : C
Qualifier : RP
The CIP shall support the prompting for authentication information where this is required to aid the order process.

The following requirements include the following categories of Order functionality:

- Order specification
- Order validation
- Order quotes
- Order management/control (including submission)
- Order item retrieval.

An overview of each of these order functions precedes each requirement subset.

Order Specification

The order specification process is the initial step in the order process and primarily involves the user definition of the required order. The options for the order are defined by the CIP with a core of CIP description attributes for the data that can be ordered. In system terms, the majority of the specification process is performed at the client side.

UR Id : 154
Source : OTN [R31] / CIP-BS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the specification of orders by the definition of order requests.

UR Id : 155
Source : OTN [R31] / CIP-BS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the specification of order requests consisting of one or more delivery units.

UR Id : 156
Source : OTN [R31] / CIP-BS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the specification of delivery units.

Note : This requirement is a general requirement that explicitly states the support of the definition of delivery units by the CIP. It is refined in the following requirements.

UR Id : 157
Source : DPRS TN [R1, Section 4.1.5.11]
OTN [R31] / CIP-BS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the specification of the required delivery method in which the delivered packages are to be provided for each delivery unit.

Note : It is not expected that the chosen delivery method should be validated by the CIP as this is a product or catalogue system dependency. Examples of typical delivery methods may include electronic on-line delivery, located on a known location (e.g. file server) for subsequent retrieval or even delivery deferred.

UR Id : 158
Source : DPRS TN [R1, Section 4.1.5.11]
OTN [R31] / CIP-BS Team
URD 2.0 Review [CCRS/DOB/14]
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the specification of postal address (delivery or electronic) information for each delivery unit when specifying the order request.

UR Id : 159
Source : DPRS TN [R1, Section 4.1.5.11]
OTN [R31] / CIP-BS Team
URD 2.0 Review [CCRS/DOB/14]
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the specification of billing address (delivery or electronic) information for each delivery unit when specifying the order request.

Note : This may be different to the delivery address.

UR Id : 160
Source : OTN [R31] / CIP-BS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the specification of delivery units consisting of one or more packages.

UR Id : 161
Source : OTN [R31] / CIP-BS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the specification of ad-hoc packages.

Note : This requirement is a general requirement that explicitly states the support of ad-hoc packages by the CIP. It is refined in the following requirements.

UR Id : 162
Source : OTN [R31] / CIP-BS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the specification of ad-hoc packages consisting of one or more products, each identified by its product descriptor.

UR Id : 163
Source : OTN [R31] / CIP-BS Team
Priority : 2
Need : C
Qualifier : RP

The CIP shall support the specification of ad-hoc packages consisting of a collection of products identified by a collection descriptor.

UR Id : 164
Source : DPRS TN [R1, Section 4.1.5.11]
OTN [R31] / CIP-BS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the specification of the required format in which a product is to be provided in an ad-hoc package.

Note 1 : It is not expected that the chosen format should be validated by the CIP as this is a product generation or catalogue system dependency. Examples of product formats may include MPH/SPH/DSR[R18], HDF[R19], or IPI-IIF (ISO 12087[R20]).

Note 2 : This requirement also effectively covers the generation of multiple products from one product description, e.g. the 'format' could effectively define the processing that needs to be initiated at the catalogue site to generate the product required.

UR Id : 165
Source : DPRS TN [R1, Section 4.1.5.11]
OTN [R31] / CIP-BS
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the specification of the required medium upon which a product is to be provided in an ad-hoc package.

Note : It is not expected that the chosen media should be validated by the CIP as this is a product or catalogue system dependency. Examples of typical media may include DAT, HDDT, DLT, CCT, Exabyte, CD-ROM or electronic link.

UR Id : 166
Source : URD 2.0 Review [NASA/LR/07]
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the specification of the processing options that are required to be performed during the data generation and packaging process.

Note : To some extent, there may be some overlap with preceding specification requirements with this requirement (eg format), but this requirement also covers areas such as generation algorithm, specific compression functions, subsetting options etc.

UR Id : 167
Source : URD 2.0 Review [NASA/GP/04]
URD 2.1 Comment
Priority : 1
Need : C
Qualifier : RP

The CIP shall support the encryption of financial information specified in the order.

Note : Such financial information could include bank information, credit card details, account details etc.

Order Validation

The validation of the order is that process which confirms or denies that the order specification is valid. There are three potential phases to the validation. These are:

- Client validation - eg where straightforward form and range checking can be made
- Retrieval Manager validation - eg where the Retrieval Manager checks the collection ids
- Target validation - where the target order handling system validates the order against the data available.

The degree and combination of validation is dependent on the functions of the origin client and target catalogue server.

UR Id : 168
Source : OTN [R31] / CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support the validation of order requests.

Note : This requirement is a general requirement that explicitly states the support of the validation of order requests by the CIP. It is refined in the following requirements.

UR Id : 169
Source : URD 0.1 Review [RID 54]
CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support the validation of order requests, without order request submission and where the scope of the validation could also be specified.

Note : This is to enable the user to check the validity of their specified order request criteria, without having to place the order request and wait for it to be accepted/rejected to confirm that it is valid.
In terms of scope, it is envisaged that the order request could be validated at various domain locations. For instance a local MMI client may support simple range/field checking of the order request criteria, the Retrieval Manager could support consistency checks (e.g. of collections) and the catalogue server could process the order request and validate it, but not submit it. The scope supported will also therefore depend upon the client and the catalogue server.

UR Id : 170
Source : OTN [R31] / CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support the provision of a textual explanation of the reason of the rejection when an order request could not be validated.

Note : This is to provide the user of an invalid order request with information that will assist him/her in order to change the request so that it will pass the validation process. This explanation will, for example, indicate ordering options which have not been set properly, or the privileges that have been flawed.

Order Quotation

The quoting of an order is the submission of an order specification solely for the purposes of checking availability and confirming the provisional price if that order were submitted. A quote does not have to be performed prior to placing an order.

UR Id : 171
Source : OTN [R31] / CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support the quotation of order requests.

Note : This requirement is a general requirement that explicitly states the support of quotation requests by the CIP. It is refined in the following requirements. Note further that a quote could be a long process and may span sessions, ie be completed when user no longer has the original quote session established. This means the information would need to be sent back to the origin by a mechanism such as e-mail.

UR Id : 172
Source : OTN [R31] / CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support the quotation of every package that is part of an order request.

UR Id : 173
Source : OTN [R31] / CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support the quotation of every delivery unit being part of an order request.

UR Id : 174
Source : OTN [R31] / CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support the definition of a textual explanation when the quotation of a delivery unit differs from the sum of the quotations of the packages it is composed of.

Note : Because of special offers, bulk discounts, etc., it is possible that the price of a delivery unit differs from the sum of the price of all the packages it is composed of. The CIP should therefore be able to provide enough information to explain this difference.

UR Id : 175
Source : OTN [R31] / CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support the quotation of the order as a whole as defined by an order request. The quotation for the order shall include a validity date and a delivery date.

Note : *The validity date of a quotation indicates the latest point until which the quotation is valid.*
The delivery date indicate when the order would be delivered if the user was to submit the order request.

UR Id : 176
Source : OTN [R31] / CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support the definition of a textual explanation when the quotation of a complete order differs from the sum of the quotations of the delivery units it is composed of.

Note : *Because of special offers, bulk discounts, etc., it is possible that the price of a complete order differs from the sum of the price of all the delivery units it is composed of. The CIP should therefore be able to provide enough information to explain this difference.*

Order Management

The order management functions include the submission of the actual order, which, assuming the specification is verified and the required data is available, should result in a valid order request being placed with the target order handling system.

In the following URs the term order request is a general term encompassing quote, validate and order submission requests. The order submission is the request that should result in the generation of data pertinent to the order items.

Order management also includes the cancellation of orders and monitoring of orders. (Note that an order submission is likely to include some or all of the validation (and possibly quote) steps, but is not dependent on those occurring prior to the placing of the order).

UR Id : 177
Source : OTN [R31] / CIP-BS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the order submission requests.

UR Id : 178
Source : DPRS Team
CIP-BS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the order submissions where the ordered product(s) may not exist at the time of placing the submission request.

Note : *This is to support ordering of future products, which are likely to be created and archived at some future time, not for the support of ordering of non existing 'historical' products. Note that the product descriptor describing the product will however need to exist for the order to be made. This may be facilitated by a special query that can be recognised by the catalogue.*

UR Id : 179
Source : DPRS Team
CIP-BS Team
URD 2.0 Review [NASA/GP/04]
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the generation of a unique order request identifier following a quote request, validate request or order submission request , which enables subsequent request tracking.

Note : The order request identifier is similar to the earlier mentioned status query identifier, except that its life will be a great deal longer, i.e. it is feasible that order request identifiers would be needed even after the order request is completed and the ordered data is delivered.

UR Id : 180
Source : OTN [R31] / CIP-BS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the generation of the delivery date for every delivery unit following the submission of an order submission request.

Note : This information allows a user to know the latest point at which an order can be expected to be delivered. Note this functionality may be extended to a quote or a validate, dependent on the target catalogue site.

UR Id : 181
Source : OTN [R31] / CIP-BS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the generation of the cancellation date following an order submission request.

Note : This information allows a user to know the latest point at which an order can be cancelled. Past this cancellation date, the order request cannot be cancelled anymore and the order will be delivered (and invoiced).

UR Id : 182
Source : OTN [R31] / CIP-BS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the monitoring of order (quote, validate and submission) requests.

UR Id : 183
Source : OTN [R31] / CIP-BS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the cancellation of order (quote, validate and submission) requests.

Note : A cancellation request can be performed up to the cancellation date defined when the order was submitted.

UR Id : 184
Source : DPRS Team
CIP-BS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the deletion of an order request identifier, following the completion and delivery of the product or following cancellation of the order request.

Note : The order request identifier is similar to the earlier mentioned status query identifier, except that its life will be a great deal longer, i.e. it is feasible that order request identifiers would be needed even after the order request is completed and the ordered data is delivered.

UR Id : 185
Source : URD 2.0 Review [NASA/GP/07]
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the generation of status information following an order (quote, validate or submission) request.

Note : Such status information may include an acknowledgement that the order is received, time that the order request may take etc.

Order Item Retrieval

The next requirements, regarding the user initiated retrieval of ordered data stems from the concept that EO products can be ordered in two ways:

1. The EO products are available from data generation from an archive and can be immediately delivered following an order request, via the specified delivery method;
2. The EO product needs to be acquired and/or produced off line (e.g. generated by the execution of an algorithm at the catalogue site), so that the order request triggers a scheduled generation or acquisition at the catalogue site and the EO product will be available when this process is completed.

Order item retrieval concerns the retrieval of the ordered item(s) following a valid order and after the target order handling system has made the required data available.

UR Id : 186
Source : DPRS Team
CIP-BS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the retrieval of EO product(s) with the specification of an order request identifier.

Note : The use of the order request identifier indicates that the product has already been ordered, but that an attempt is now being made to retrieve it. The CIP is not expected to validate this order request identifier.

UR Id : 187
Source : DPRS Team
CIP-BS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the retrieval of EO product(s) via an order request identifier such that the options which were provided at original order time can be recovered and delivery information amended if required..

Note : The storage of the previously supplied order request information is not currently a requirement but could be considered as a requirement on the Retrieval Manager.

UR Id : 188
Source : DPRS TN [R1, Section 4.1.5.12]
CIP-BS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the search and retrieval of order request status information with the specification of an order request identifier.

Note : This order request status information can be used to monitor the stage reached in the processing of a particular order request. Information pertaining to the order request that may be relevant could include the ordered packages, the parent collection(s), order request status and date of the order request.

In terms of order request status, the stage reached could include, for example

- *order request received/acknowledged,*
- *data being retrieved from archive,*
- *data being formatted,*
- *data being packaged,*
- *data being delivered,*
- *data delivered,*
- *invoice issued,*
- *order completed.*

Of course, the information provided will depend on order request status information managed by the catalogue system that is processing the order request.

3.1.1.8 Options

This section contains requirements associated with the options that provide the framework for the access of resources, both in terms of data and Retrieval Managers, by the users through the use of requests.

Two kinds of options must be distinguished:

- session options: session options provide the framework for the management of user sessions.
- service options: service options provide the framework for the access of CIP data by the users via services.

Moreover, the following two aspects of options must be considered:

- the management of the options, i.e. the assignment of options to users (or groups of users) to resources;
- the use and checking of options during the access of the resources by the users.

3.1.1.8.1 User Registration

The following requirements are associated with the registration of users into the ICS domain. Registration is the establishment of a user profile within an ICS site eg at a user database local to the Retrieval Manager. A registered user will have a profile which may include information such as log on name and password, privileges and group. A registered user will then be able to log on to the ICS domain to obtain an authenticated session and be assigned their privileges for that session. Unregistered users can have access to the ICS domain, e.g. as a 'guest' and in general granted only basic, default options (e.g. a guest user should be able to perform search and retrieval requests, however, they are unlikely to be able to order products). Registration provides the means for a user to gain additional options. It also provide the means to customise a user's environment, e.g. by the definition of a profile.

The registration of a user essentially results in the definition of the session options for a user: registration of a user at a Retrieval Manager specifies that this user is granted access to the Retrieval Manager with the options assigned to the user in the registration process.

Session options contain all the information related to both a user and a Retrieval Manager, thus defining the framework in which the interactions between the user and the Retrieval Manager will take place. User customisation of service options can be performed to a large extent (e.g. a specification could include definitions such as a user's default collection for searches, quotas for various types of requests, specific local services included, etc. However, the session options must include the assignment of a user to at least one group. This is essential as the service options of a user are not defined on an individual basis, but rather are determined by the group(s) in which the user belongs.

UR Id : 189
Source : CIP-BS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the search and retrieval of group information via the specification of a group identifier.

UR Id : 190
Source : CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support session options.

Note : This general requirement is refined in the following sub-requirements.

UR Id : 191
Source : CIP-BS Team
URD 2.0 Review [NASDA/SS/6]
Priority : 2
Need : B
Qualifier : RP

The CIP shall support personal user information session options.

Note : *This session option enables to indicate information relevant to the particular user such as user name, agency, address, telephone, e-mail, fax, etc. Such information may then be used by a request during a session, for instance to specify default information (e.g. default delivery address for an order request if none is provided in the order specification).*

UR Id : 192
Source : CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support session profile information session options.

Note : *This session option enables to indicate profile information regarding a user, such as default target collection, etc. Such information may then be used by a request during a session, for instance to specify default information (e.g. default target collection, default maximal number of item descriptors to be retrieved by a search query, etc.).*

UR Id : 193
Source : CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support ordering information session options.

Note : *This session option enables to indicate ordering information regarding a user, such as maximum authorised credit, etc. Such information may then be used by an order request during a session, for instance to validate the order request (e.g. check if the price of the requested order does not exceed the maximal allowance for the user).*

UR Id : 194
Source : CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support complementary user information session options.

Note : *This session option enables to indicate complementary information regarding a user, such as areas of interest, type of user, etc. This information might be used for statistics purposes, or for system tuning.*

UR Id : 195
Source : CIP-BS Team
Priority : 2
Need : C
Qualifier : RP

The CIP shall support the management of session options.

Note 1 : *This includes the creation, modification and deletion of the session options of a user at a particular Retrieval Manager. Session options for a user will effectively provide a user profile, including user specific information and privileges for services that can be accessed during a session.*

Note 2 : The management of session options is supported by the Retrieval Manager for Release B (as the existence of such information is necessary for the handling of session options by the protocol). However, the direct support of this functionality by the protocol is provisionally left for Release C.

UR Id : 196
Source : CIP-BS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the search and retrieval of session options.

Note : This will allow to use the session options data when appropriate. In particular, it will allow to retrieve user profile data to customise requests during a session. It will also allow to check the service options for a request since the information about the group related to a session is included in the session options.

3.1.1.8.2 User Authentication

The following requirements are associated with support of and access to options, which will be used by the CIP or Retrieval Manager or (indirectly by catalogue servers) during processing of CIP search queries and orders.

In this context, the user of the catalogue system, should be taken as the human user initiating the interaction with the CIP. They will, in general, be interacting with the CIP via a terminal e.g. via a WWW or specific CIP client MMI.

The authentication of the user relates in particular to the order processing services which may vary according to the user and their options. In general, the locating of product descriptors shall be open to all users, but the ordering functions and pricing policies may vary according to the user or the body that the user represents.

The following requirements are associated with establishing user interaction sessions, i.e. establishing the session between the user's client MMI and the Retrieval Manager, or between Retrieval Managers.

UR Id : 197
Source : STN [R32] / CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support the authentication of users to the CIP domain.

Note : This is a general requirement. This requirement is refined in the following requirements.

UR Id : 198
Source : STN [R32] / CIP-BS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall support peer to peer authentication of Retrieval Managers.

Note : This allows a Retrieval Manager to act by proxy for a user. It is envisaged that a special username/password could specified for a Retrieval Manager to enable identification by another Retrieval Manager (together with unique information such as host address etc.). This role of proxy by the Retrieval Manager will also help to reduce the possibility of malicious entry by a user impersonating an RM.

UR Id : 199
Source : STN [R32] / CIP-BS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the negotiation of the authentication mechanism used between Retrieval Managers.

Note : Depending whether or not there is an agreement between agencies, the authentication mechanism used between two Retrieval Managers may vary.

UR Id : 200
Source : STN [R32] / CIP-BS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the passing of user authentication information from one Retrieval Manager to another in a secure manner.

Note : This is to allow a remote Retrieval Manager to authenticate a user without the user needing to explicitly log into that remote Retrieval Manager. This necessitates that the remote Retrieval Manager stores the session options for the user to be authenticated.

UR Id : 201
Source : URD 2.0 Review [CCRS/DOB/15]
Priority : 1
Need : B
Qualifier : RP

The CIP shall support CIP Client to Retrieval Manager authentication.

Note : This requirement is added to make it explicit that authentication is not only between Retrieval Managers, but also between clients and Retrieval Managers.

UR Id : 202
Source : DPRS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the establishment of catalogue user interaction sessions, for which the user has been authenticated and during which the user remains authenticated.

Note : This is analogous to a user successfully 'logging on' to a system, e.g. onto a UNIX computer or within a LAN. For ease, the term 'log on' will be used to mean the establishing of a user interaction session with the CIP domain.

UR Id : 203
Source : DPRS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the termination of an established user interaction session, following which the user will need to establish an authenticated user interaction session for further catalogue interaction.

Note : This is analogous to a user 'logging off' a system. For ease the term 'log off' will be used to mean the termination of an established user interaction session.

UR Id : 204
Source : DPRS Team
Priority : 1
Need : B
Qualifier : RP

The CIP should support the initial establishment of an authenticated catalogue user interaction session via a technique such as username and password.

Note : It may not be mandatory for a user to have to log on with a username and password, it will depend upon the point of entry, the local catalogue host, whether the user wants to obtain data from a distributed system, etc. Username and password reflects current authentication technology and may be revisited during subsequent CIP definitions.

UR Id : 205
Source : URD 2.0 Review [NASA/LR/15]
Priority : 1
Need : B
Qualifier : T

The CIP should support the change of user identity within a session.

Note : This is to enable different privileges to be assumed, eg when a user wants to order data to which they are restricted with their current user profile. Parallel requirements are also present for the CIP Client and the Retrieval Manager.

3.1.1.8.3 Service options

This section contains requirements related to the service options granted to groups of users by data providers. These service options define the framework within which the item descriptors, which are provided at a Retrieval Manager (by a data provider), can be accessed by groups of users via data requests performed during a user session.

The concept of service options can be applied to any type of service request. For search requests, service options could limit the number of maximal hits, for retrieval requests, the maximal number of retrieval records could be defined, for collection requests, the right to maintain hot collections could be defined. However, it is for order requests that service options are the most important. Service options will allow to define supplementary information associated with product ordering. Such information may include: special offers, bulk discounts, special deals for particular groups of users etc.

Service options are related to groups of users, the data provider and the item descriptors provided. They define the options granted by a data provider to a group of users concerning the access to particular item descriptors.

Concerning order information, it is recognised that there is currently no existing system that fully handles integrated order information and this section does not attempt to provide guidelines for implementation but attempts to list the information the CIP shall or should be able to handle to support this functionality.

The following requirements describe the type of service options supported by the CIP. Those requirements define what service option are defined for a particular group of user, by a particular data provider concerning a particular item descriptor. They can be read in the following way:

“data provider W grants service options X to group of users Y for the access of item descriptor Z”.

UR Id : 206
Source : CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support service options.

Note : This general requirement is refined in the following sub-requirements.

UR Id : 207
Source : CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support access type service options.

Note : This could be "search", "retrieval", "order"...

UR Id : 208
Source : CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support quota service options.

Note : The interpretation of the quota will depend on the type of the service options. This could be, for instance, the maximal number of copies of the same product that can be ordered in a single order request.

UR Id : 209
Source : CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support pricing service options.

Note : This service option is meant only for the ordering of item descriptors (as the other services are free). It indicates the unit price of the item descriptor.

UR Id : 210
Source : CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support media service options.

Note : This service option is meant only for ordering of item descriptors. It indicates the media on which an item descriptor can be ordered.

UR Id : 211
Source : CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support formatting service options.

Note : This service option is meant only for ordering of item descriptors. It indicates the format which can be applied to an item descriptor when ordered.

UR Id : 212
Source : CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support delivery method service options.

Note : This service option is meant only for ordering of item descriptors. It indicates the delivery methods that can be used for an item descriptor.

UR Id : 213
Source : DPRS TN [R1, Section 4.1.5.13]
CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support the search and retrieval of service options.

Note : This is a general requirement that ensures that service options information can be accessed via the CIP. This will allow to support users in the ordering process (by providing them with their service options) and to support the Retrieval Manager for the checking of service options.
This requirement is refined in the following sub-requirements.

UR Id : 214
Source : DPRS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support the search and retrieval of service options via the specification of a group identifier.

Note : Service options are assigned to groups, not individual users. Therefore, the service options of a user are determined via the service options of the group(s) to which the user belongs..

UR Id : 215
Source : CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support the search and retrieval of service options via the specification of an item descriptor identifier.

Note : As stated before, service options can be defined for any type of item descriptor. However, the following requirement are define to explicitly show how service options can be applied in particular to the item descriptors involved in the ordering process. Note that guide items are not included in the following list, as guide data is not expected to be ordered.

UR Id : 216
Source : DPRS TN [R1, Section 4.1.5.13]
CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support the search and retrieval of service options via the specification of a product identifier.

Note : As before, the product identifier should be an attribute of a product descriptor.

UR Id : 217
Source : DPRS Team
CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The CIP should support the search and retrieval of service options via the specification of a collection identifier.

Note : The amount of information returned here will depend upon the serving catalogue system. It may be that the information returned is pertinent only to the collection or, if it is a terminal collection, that it may be related to all the product descriptors (inventory entries) of the collection.

UR Id : 218
Source : DPRS TN [R1, Section 4.1.5.13]
CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support the search and retrieval of service options via the specification of a package descriptor identifier.

Note : Here, a valid package descriptor identifier is likely to be available as the result of a previous order request.

UR Id : 219
Source : CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support the search and retrieval of the service options granted to a group of users for the definition of an order request.

Note : This has two distinct uses: firstly, it can assist a user in the order request process by providing the options available to this user (i.e. a user can determine what are the medium available to him/her for a particular product - which may depend on the group in which the user belong). Secondly, it can be used in the order to control if a specified order respects the options that can be assigned to it.
This requirement is refined in the following requirements.

UR Id : 220
Source : CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support the search and retrieval of the service options granted to a group of users for the definition of an ad-hoc package.

Note : This could be used to determine the valid order options regarding the definition of ad-hoc packages by a user, e.g. the possible media on which a product could be delivered to that user.

UR Id : 221
Source : CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support the search and retrieval of the service options granted to a group of users for the definition of a delivery unit.

Note : This could be used to determine the valid order options regarding the definition of delivery units by a user, e.g. the possible delivery methods with which a product could be delivered to that user.

UR Id : 222
Source : CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support the search and retrieval of the service options granted to a group of users for the definition of a complete order.

Note : This could be used to determine the valid order options regarding the definition of a complete order by a user, e.g. the maximum price allocated to a user for a single order.

3.1.1.9 Command Control

This section contains requirements associated with control and management of a command such as a CIP query or product order, usually initiated by a user. The term 'request' is used here to cover any CIP supported function such as a search query, a status query, a product order, browse retrieval request etc.

The word 'session' (as in 'session management') has not been used in isolation, to avoid confusion with user interaction sessions (which are those established by a user when logging on), although command control will generally take place within a user interaction session.

These requirements have been derived from the DPRS Statement of Work[R1] and from the first release of the CINTEX functional model (V 0.1 dated 17/11/94) and are Release B requirements.

Note that the commands Initialise and Terminate (as in CINTEX functional model V0.1) are not represented in this section, but are mapped to the establishment of user interaction sessions given in Section 3.1.1.8.1.

3.1.1.9.1 Cancellation of Requests

UR Id : 223
Source : DPRS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the transmission of a 'cancel' command following the issue of a CIP supported request.

Note : The issue of a cancel command should enable the termination of the CIP request, although the success of the cancel will depend on the point of issue within the processing of the request and the functionality of the catalogue system that the original requests was issued to. The 'confirmation' of a cancel command, i.e. asking the user if they are sure that the cancel command should be sent, will not be supported by the CIP as this feature would be supported by the client.

UR Id : 224
Source : DPRS Team
Priority : 1
Need : B
Qualifier : RP

The CIP shall support the transmission of a 'cancel' command using a request identifier.

Note : The request identifier may be, for example, as returned from a successful suspension of a request.

UR Id : 225
Source : DPRS Team
Priority : 2
Need : B
Qualifier : RP

The CIP should support the return of a cancel status, indicating the success or otherwise of the command.

3.1.1.9.2 Suspending and Resuming Requests

The previous requirements refer to cancellation of a request, which in most cases will mean termination of the request and no resumption. The next requirements refer to the suspending and resuming of requests. The suspending of a request may be necessary, for instance, if the user knows that the results of a search will take some time to be processed and they wish to delay the delivery.

Note that the suspend/resume requirements are derived from services supported by Z39.50[R17] and should be regarded as potentially useful rather than essential services.

UR Id : 226
Source : DPRS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support the transmission of a 'suspend' command following the issue of a CIP supported request.

Note : *The issue of a suspend command should enable the suspension of the CIP request, although the success of the suspend will depend on the point of issue within the processing of the request. The 'confirmation' of a suspend command will not be supported by the CIP as this is a potential client feature. Suspension may not be appropriate for all CIP requests, for instance, it may not be appropriate to suspend a query status request, but none have been specifically excluded in this requirement.*

UR Id : 227
Source : DPRS Team
Priority : 2
Need : B
Qualifier : RP

The CIP should support the return of a suspend status indicator, indicating the success or otherwise of the command and a suspended request identifier in the case of a successfully suspended request.

Note : *The identifier of the suspended request should be unique within the CIP domain and provide a handle for resumption or cancellation of the request.*

UR Id : 228
Source : DPRS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support the transmission of a 'resume' command following the suspension of a CIP request.

3.1.1.9.3 Batch Requests

The following requirements are associated with controlling batch requests.

A batch request is seen as one that differs from on-line requests (which the majority of requirements assume and the majority of requests will default to), for which, in general, a synchronous communications link is established within a user interaction session.

For batch requests, the user specifically requests that the request is scheduled in the CIP domain for later processing, e.g. for low priority requests that could be processed outside peak periods.

Note that a standing order should not be viewed as a batch request as defined here.

UR Id : 229
Source : DPRS Team
CIP-BS Team
Priority : 2
Need : C
Qualifier : RP

The CIP shall support the batching of CIP requests.

Note : *It may be that some queries or orders are not appropriate for batch processing, e.g. a request for a status query, but this requirement does not specifically exclude any.*

UR Id : 230
Source : DPRS Team
CIP-BS Team
Priority : 2
Need : C
Qualifier : RP

The CIP should support the return of a batch status, indicating the success or otherwise of the batch command and a batch request identifier in the case of a successful batch request.

Note : The identifier of the batch request should be unique within the CIP domain and provide a handle for resumption or cancellation of the request.

Note that there are no explicit requirements for control of batch requests or querying the status of batch requests as these are covered by earlier requirements which refer to all requests, whether batch or not.

3.1.1.9.4 Error and Failure Management

For the CIP an error is defined as an anomalous condition or event within the protocol which should not occur in normal protocol processing conditions. It may be related to data corruption or logic errors in the protocol or software (client/server or retrieval management software).

For the CIP, a failure is defined as the abnormal termination or incorrect execution, within the CIP domain of a dependent component, such as a software function or hardware item.

Such error and failure conditions should be recognised by the CIP and attempts made to handle the situation gracefully with appropriate status/error condition feedback. In some cases, the results of such failures may become interpreted by the CIP as an error condition, in which case the error handling states are appropriate.

It is important to note that CIP requests that do not produce the expected results (e.g. absence of data matching the search query) are not errors as they are conditions of the request processing that can legitimately and regularly arise within the CIP domain.

The following requirements are not specific to any CIP request or transaction and should be assumed to generally apply throughout the CIP domain.

UR Id : 231
Source : DPRS Team
Priority : 2
Need : A
Qualifier : RP

The CIP shall support the generation and production of CIP error or failure indicators on recognition of error and failure conditions.

UR Id : 232
Source : DPRS Team
Priority : 2
Need : B
Qualifier : RP

The CIP should indicate the level of priority of the error or failure.

Note : *The levels are not specified in this requirement, but examples may be High, Medium or Low. High could mean that a serious error condition has occurred which would prevent any further processing of the request (abnormal termination), Medium could mean that a recognised problem has occurred and the results (if produced) may not be reliable, Low could be a warning condition and results will probably be produced but may need cross checking.*

UR Id : 233
Source : DPRS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall attempt to continue the request processing on an error or failure condition , where the results of continuation are unclear, operator confirmation should be obtained if appropriate.

UR Id : 234
Source : DPRS Team
Priority : 2
Need : A
Qualifier : RP

The CIP shall report the error or failure condition to the origin user.

Note : *For some requests, the origin user is not known, in which case, the error is logged and an appropriate status is returned which would be handled by, for example, the client. The method of remote reporting of error conditions in a distributed system is known and recognised, but it is not appropriate for this URD to recommend any particular implementation approach.*

UR Id : 235
Source : DPRS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall provide appropriate diagnostic information to aid analysis of the error or failure, which should include at least a request identifier, error/failure code, short message, time of occurrence and error location identifier (which may be an attribute, software component, hardware component etc.).

Note : *This list of diagnostic information is not comprehensive, in general the more information related to the error/failure condition, the easier is the subsequent analysis.*

UR Id : 236
Source : URD 2.0 Review [PTT minutes, action item: 960926/2]
URD 2.1 Comment [12/12/96 - 07/01/97]
Priority : 2
Need : C
Qualifier : RP

The ICS shall provide facilities to support performance monitoring. These facilities shall enable the analysis of the performance of the system to the level of individual messages between Client applications and Retrieval Manager, Retrieval Manager to Retrieval Manager and between Retrieval Manager and backend server.

Note : One mechanism to support the process of performance monitoring is timestamping of messages and transactions. This requires the client and server to have synchronised clocks in order to compare the timestamps. Timestamps shall have a resolution of 1 second or better, 100ms is highly perferred.

3.1.1.9.5 Security

This section contains requirements defined to ensure that CIP requests are secure.

UR Id : 237
Source : STN [R32] / CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The CIP shall support non-repudiation of user requests when required.

Note : Non-repudiation may be required, for instance, for an order request. Note that non-repudiation for the order submission is effectively covered by authentication and logging. If this is not achieved in Release B, then it will be included as an explicit Release C requirement.

3.1.1.10 Accounting

As a fundamental aspect of the CIP is the ordering of EO products, the accounting associated with the orders, although not currently a priority, may be more significant in the future.

It is likely that the CIP and Retrieval Manager will not need to support accounting functions associated with the order, but more probable is the need to interface to appropriate external components such as purchase order, invoicing and accounting packages.

This section contains therefore some high level requirements to reflect this. These requirements are of a lower priority than the majority, so are designated for CIP Release C.

UR Id : 238
Source : DPRS Team
Priority : 2
Need : C
Qualifier : RP

The CIP shall support transfer of information including order details, user details and product details to an appropriate accounting package. The accounting package is [TBD].

Note : This requirement may be difficult to satisfy as not only accounting packages, but accounting practices will vary greatly between service providers. Analysis for CIP-C will be needed to produce more detailed requirements in this area.

UR Id : 239
Source : DPRS Team
Priority : 2
Need : C
Qualifier : RP

The CIP shall support the generation of purchase orders by transfer of order information to an appropriate purchase order system. The purchase order system is [TBD].

Note : This requirement may be difficult to satisfy as not only purchase orders, but purchase order practices will vary greatly between service providers. Analysis for CIP-C will be needed to produce more detailed requirements in this area.

UR Id : 240
Source : DPRS Team
Priority : 2
Need : C
Qualifier : RP

The CIP shall support the generation of invoices by transfer of order/user/product information to an appropriate invoicing system. The invoicing system is [TBD].

Note : This requirement may be difficult to satisfy as not only purchase orders, but purchase order practices will vary greatly between service providers. Analysis for CIP-C will be needed to produce more detailed requirements in this area.

Note that the invoicing, accounting and purchase order systems may all provide the same interface to the CIP.

3.1.2 CIP retrieval manager

This section contains the specific capability requirements for the Retrieval Manager, i.e. for the software components that provide the interfaces between the client and server processes within the CIP domain.

During the definition of the CIP-A URD, the 'Need' entries of the Retrieval Manager were set at N/A (Not Applicable) as the need referred to the version of the CIP specification. However, in this ICS URD, the Retrieval Manager requirements are now associated with a 'Need' to indicate with which CIP release they will be required to be implemented.

Note that the key aspect to the capability requirements on the Retrieval Manager is that the Retrieval Manager must be designed and implemented so that operationally it supports the CIP capability requirements.

UR Id : 241
Source : DPRS Team
Priority : 1
Need : A
Qualifier : RP

The Retrieval Manager must support the CIP capability requirements.

Note : The CIP capability requirements are those agreed requirements defined in Section 3.1.1 of this document.

The other requirements in this section are high level functional requirements on the Retrieval Manager, that are either additional to the CIP support functions or are required to support the CIP.

These requirements have only been identified at the high level so as not to make any assumptions on the Retrieval Manager internal components which may result in unduly early implications for the Retrieval Manager architectural and detailed design.

There are also a number of constraint requirements (within Section 3.2) directly on the Retrieval Manager, so this section is proportionally smaller than the other requirements sections as the majority of capability requirements on the Retrieval Manager are effectively included elsewhere in this URD.

3.1.2.1 Query Management

UR Id : 242
Source : DPRS Team
URD 1.0 Review [NASA RID 16]
Priority : 1
Need : A
Qualifier : T

The Retrieval Manager shall manage the replication of search queries that need to be forwarded to distributed collections across distributed sites.

UR Id : 243
Source : DPRS Team
Priority : 1
Need : A
Qualifier : T

The Retrieval Manager shall manage the routing of decomposed search queries onto the relevant collections and catalogue sites.

UR Id : 244
Source : DPRS Team
CIP-BS Team
Priority : 1
Need : B
Qualifier : RP

The Retrieval Manager shall prevent recursive searching of collection hierarchies and searching of the same collection more than once within the same search query.

Note : These could occur, for instance, if a search is conducted across collections and one of the specified collections is a 'child' of another specified collection or if the same collection is expressed more than once as an element of the search query.

UR Id : 245
Source : DPRS Team
Priority : 1
Need : A
Qualifier : T

The Retrieval Manager shall collate the results of distributed search queries and return them to the originator of the search query.

UR Id : 246
Source : URD 0.1 Review [RID 55]
Priority : 2
Need : B
Qualifier : T

The Retrieval Manager shall support the management of matches that may result from a search query by limiting the number of successful matches to a user specified or system defined limit.

Note : This requirement is provided to emphasise the support the Retrieval Manager may need to provide to support the protocol in 'hit' result management

UR Id : 247
Source : URD 0.1 Review [RID 82]
Priority : 2
Need : B
Qualifier : T

The Retrieval Manager shall support the management of time-outs on search queries (either as specified by the user or defaulting as a system limit) and also enable the return of a flag indicating a full or partial completion of the search query results.

Note: *This requirement supports the requirement on the protocol for the time limit specification for distributed queries. A partial result may occur when more than one site is specified and some do not respond or where the user has limited the number of matches required. The Retrieval Manager will probably have to set timers following the routing of the query and if no time limit is specified, the time out should be a system configurable limit, e.g. ten minutes.*

UR Id : 248
Source : DPRS Team
Priority : 1
Need : A
Qualifier : T

The Retrieval Manager shall manage and monitor queries in progress.

UR Id : 249
Source : DPRS Team
Priority : 1
Need : B
Qualifier : T

The Retrieval Manager shall provide, on request, information it holds on the status of queries in progress.

3.1.2.2 Collections Management

UR Id : 250
Source : DPRS Team / URD 0.1 Review [RID 97]
CTN [R33] / CIP-BS
Priority : 1
Need : B
Qualifier : T

The Retrieval Manager shall support the management of the collection hierarchy it owns.

Note 1 : *The management of a collection hierarchy includes creation, modification and deletion of collections within the hierarchy.*

Note 2 : *This requirement does not imply that the CIP needs to support functions such as creation and deletion of collections by a user, which would imply appropriate user client functions. Such functions as specified in this requirement are envisaged to be administrative and directly supported by the Retrieval Manager and are analogous to database administration functions not normally available to the end user.*

UR Id : 251
Source : CTN [R33] / CIP-BS
Priority : 1
Need : B
Qualifier : T

The Retrieval Manager shall support the maintenance of the collection hierarchy it owns.

Note : The maintenance of a collection hierarchy includes operation that are not part of the normal management of collection, e.g. checking of stale collection links, etc.

UR Id : 252
Source : CTN[R33] / SERC
Priority : 1
Need : B
Qualifier : T

The Retrieval Manager shall persistently store a local collection structure including links to remote collections.

Note : It is required that the Retrieval Manager stores collections and the relation between collections. If remote collections are referenced, the references must be held in the Retrieval Manager.

UR Id : 253
Source : CTN[R33] / SERC
Priority : 1
Need : B
Qualifier : T

The Retrieval manager shall provide the ability to create new collections

Note : This is a general requirement which is detailed in the following requirements.

UR Id : 254
Source : CTN[R33] / SERC
Priority : 1
Need : B
Qualifier : T

The Retrieval Manager shall provide the ability to convert a result set into a persistently stored collection, i.e. hot collection.

Note : A hot collection is, essentially, a result set whose existence spans sessions. Therefore, this promotion consists mainly in storing the result set so that it can be reused in further session. A hot collection could be accessed by more than one user, if the location is publicised, but not via a collection hierarchy.

UR Id : 255
Source : CTN[R33] / SERC
Priority : 1
Need : B
Qualifier : T

The Retrieval Manager shall support the promotion of a hot collection into a provider theme collection.

Note : A hot collection is, essentially, a result set whose existence spans sessions and so does not contain any metadata defining the collection. This promotion, therefore consists mainly in defining all the required attributes for a collection

UR Id : 256
Source : URD 2.0 Review [CCRS/DOB/3]
Priority : 1
Need : B
Qualifier : T

The Retrieval Manager shall support the deletion of hot collections.

UR Id : 257
Source : CTN[R33] / SERC
Priority : 1
Need : B
Qualifier : T

The Retrieval Manager shall provide the ability to add or delete a single item descriptor to a collection's contents.

UR Id : 258
Source : CTN[R33] / SERC
Priority : 1
Need : B
Qualifier : T

The Retrieval Manager shall provide the ability to add or delete a group of item descriptors to a collection's contents, i.e., bulk load and bulk delete.

UR Id : 259
Source : CTN[R33] / SERC
Priority : 1
Need : B
Qualifier : T

The Retrieval Manager shall provide the ability to modify any attribute of any item descriptor.

UR Id : 260
Source : CTN[R33] / SERC
Priority : 1
Need : B
Qualifier : T

The Retrieval Manager shall provide at a minimum, data base administration utilities for modifying a collection schema.

3.1.2.3 Collection Import/Export

UR Id : 261
Source : CTN[R33] / SERC
Priority : 1
Need : B
Qualifier : T

The Retrieval Manager shall provide the ability to import collections.

Note : Preparation of collections to be imported may be done using the ICS Collection Management Tools (CMT). The CMT will support conversion from other formats (DIF, HTML, SGML, flat ASCII file) and checking of data to be imported against the CIP attribute and schema definitions.

3.1.2.4 Collection Consistency Checking

UR Id : 262
Source : CTN[R33] / SERC
Priority : 2
Need : B
Qualifier : T

The Retrieval Manager shall provide the ability to manually check and report on remote links.

Note : Manually in this requirement means that the Retrieval Manager Administrator will be actively involved in checking the links.

UR Id : 263
Source : CTN[R33] / SERC
Priority : 2
Need : C
Qualifier : T

The Retrieval Manager shall provide the ability to automatically check and report on remote links.

Note : Automatically in this requirement means that the no intervention by the Retrieval Manager Administrator will be needed to generate a remote links report.

UR Id : 264
Source : CTN[R33] / SERC
Priority : 2
Need : C
Qualifier : T

The Retrieval Manager shall provide the ability to check and report on collection correspondence of a collection's commonality attribute and its contents.

UR Id : 265
Source : CTN[R33] / SERC
Priority : 1
Need : B
Qualifier : T

The Retrieval Manager shall provide the ability to check and report on the conformance of the item descriptor contents against the CIP attribute syntax.

UR Id : 266
Source : CTN[R33]/SERC
URD 2.1 Comment [NASA/RWH/13]
Priority : 1
Need : C
Qualifier : T

The Retrieval Manager shall provide the ability to check for loops in the ICS collection structure in which the Retrieval Manager's collections are connected. Loop checking shall be limited to following every path from a given collection to a depth of 64 links from the orignal collection before concluding that a loop does not exist.

3.1.2.5 User Management

The requirements in this section are related to those in Section 3.1.1.8.1, and are high level capability requirements on the Retrieval Manager to support the management of users that 'log in' and 'log out' of the ICS domain.

In this context, the user of the catalogue system, should be taken as the human user initiating the interaction with the CIP. They will, in general, be interacting with the CIP via a terminal, e.g. via a WWW or specific CIP client MMI and here, the term 'ICS log on' is used to mean the establishing of a user interaction session with a catalogue system supported within the ICS domain.

The following requirements are associated with the management of catalogue interaction sessions, i.e. the management of the session between the user's client MMI and the Retrieval Manager.

UR Id : 267
Source : CIP-BS Team
Priority : 1
Need : B
Qualifier : T

The Retrieval Manager shall support the management of user groups.

Note : This includes the creation, modification and deletion of the user groups.

UR Id : 268
Source : STN [R32] / CIP-BS Team
URD 2.0 Review [NASA/GP/33]
Priority : 2
Need : B
Qualifier : RP

The Retrieval Manager shall support a 'guest' group.

Note : The 'guest' group will be used as default profile if a user is not explicitly authenticated. The guest group could also be used as default for the session options (i.e. a user is a guest unless explicitly otherwise stated). Other groups could be defined as necessary, e.g. a group for ordering, a group for remote searching etc., but this is outside the scope of this document and will form part of an ICS administration manual.

UR Id : 269
Source : CIP-BS Team
Priority : 1
Need : B
Qualifier : T

The Retrieval Manager shall support the management of session options. The session options for a user on a Retrieval Manager shall include the assignment of the session options to a group.

Note 1 : This includes the creation, modification and deletion of the session options of a user at a particular Retrieval Manager.

Note 2 : The group membership of a user is essential for the checking of service options, as service options are not defined for individual users, but for groups of users.

UR Id : 270
Source : CIP-BS Team
Priority : 1
Need : B
Qualifier : T

The Retrieval Manager shall support special session options for Retrieval Managers for which an agreement for the ordering of data without user authentication has been defined.

Note : This will allow a Retrieval Manager to order products on behalf of its users. In this case, the session options shall include the credit limit agreed between the data providers. The session options will also include a special user name which will identify an agency rather than a user.

UR Id : 271
Source : DPRS Team
URD 2.0 Review [NASDA/SS/1]
URD 2.1 Comment [NASDA/SS/01]
Priority : 1
Need : A
Qualifier : T

The Retrieval Manager shall perform authentication of CIP domain users based on information obtained from either a local user database or access to an external user database.

Note : This does not necessarily give access to all data from every agency automatically. A user will have to get authorisation from each agency where necessary to place orders, etc. What it does permit is the view that the CIP domain is a single domain from the user perspective, within which there may be restricted areas of access. The RM will need to support a local user database for local user profile storage and also employ a standard interface to an external user database, for those user profiles already existing.

UR Id : 272
Source : CIP-BS Team
Priority : 1
Need : B
Qualifier : T

The Retrieval Manager shall validate the service options of a user before providing access to the services/resources requested.

Note : The validation is performed via the group in which the user has been previously authenticated.

UR Id : 273
Source : CIP-BS Team
Priority : 2
Need : B
Qualifier : T

The Retrieval Manager shall provide a user with explanatory information as to the location and nature of a refusal for the access to services/resources.

Note : The Retrieval Manager shall inform the user about the service options necessary for access to the services/resources requested by the user.

UR Id : 274
Source : URD 2.0 Review [NASA/LR/15]
Priority : 1
Need : B
Qualifier : T

The Retrieval Manager shall support the change of user identity within a session.

Note : This is to enable different privileges to be assumed, eg when a user wants to order data to which they are restricted with their current user profile.

UR Id : 275
Source : CIP-BS Team
Priority : 1
Need : B
Qualifier : T

The Retrieval Manager shall maintain records of user sessions.

Note : *The recording of the requests performed during a user session is performed in what is known as the CIP user log. For clarity, this requirement is refined in the following two sub-requirements.*

UR Id : 276
Source : CIP-BS Team
Priority : 1
Need : B
Qualifier : T

The Retrieval Manager shall maintain records of authentication requests. This includes the logging of the access to the session options performed for authentication purposes.

Note : *The CIP user log shall contain both records for both successful and failed authentication attempts.*

UR Id : 277
Source : CIP-BS Team
Priority : 1
Need : B
Qualifier : T

The Retrieval Manager shall maintain records of the access to the service options performed for user authorisation purposes.

UR Id : 278
Source : URD 2.0 Review [NASDA/SS/5]
Priority : 1
Need : B
Qualifier : T

The Retrieval Manager shall record the number of unsuccessful log in attempts that exceed a predetermined number.

Note : *The predetermined number could be a relatively small number such as 3 or 5 which would then highlight a systematic attempt to log in without existing knowledge of a valid username/password.*

UR Id : 279
Source : URD 2.0 Review [NASA/GP/25]
Priority : 1
Need : B
Qualifier : T

The Retrieval Manager shall enable session timeouts after which the User will be logged out and the authenticated session terminated. The Retrieval Manager will cancel any ongoing activity and clean up (eg result sets deleted and remote sessions closed).

Note : *Session timeouts are needed to ensure that Users do not remain logged in for an unnecessarily long period of time. The session timeout value should be configurable by a Retrieval Manager administrator.*

UR Id : 280
Source : SoW [R2, Section 4.3.5]
URD 2.0 Review [NASA/RWH/07, NASDA/SS/3]
Priority : 1
Need : B
Qualifier : T

The Retrieval Manager shall be capable of supporting a peak load of a minimum of 100 concurrent user interaction sessions.

Note : *It is expected that all ICS data providers should support a minimum of 30 simultaneous sessions for a Retrieval Manager, this includes remote sessions to remote Retrieval Managers*

UR Id : 281
Source : URD 2.0 Review [NASA/RWH/06]
Priority : 1
Need : B
Qualifier : T

Retrieval Manager performance requirements shall be met at user loads up to and including one half of the peak load of concurrent users.

Note : *The peak load of concurrent users is specified in requirement 76.0..*

3.1.2.6 Order Management

This section contains requirements related to the support of the Order process. In particular, the requirements to support local and remote ordering and primary and secondary ordering.

UR Id : 282
Source : CIP-BS Team
URD 2.0 Review [NASA/GP/09]
Priority : 1
Need : B
Qualifier : T

The Retrieval Manager shall support the generation of CIP order quotes, order validates and order submission requests.

UR Id : 283
Source : CIP-BS Team
URD 2.0 Review [NASA/GP/09]
Priority : 1
Need : B
Qualifier : RP

The Retrieval Manager shall support Primary Orders with Local ordering.

Note : *The Retrieval Manager, on receipt of a local order is likely to pass the request onto the local order handling system and update order status information.*

UR Id : 284
Source : CIP-BS Team
URD 2.0 Review [NASA/GP/09]
Priority : 1
Need : B
Qualifier : RP

The Retrieval Manager shall support Secondary Orders with Remote Order proxy.

Note : *Proxy in this context, means that the local Retrieval Manager acts as proxy to the remote Retrieval Manager which 'trusts' the origin Retrieval Manager. On receipt of a remote order, the Retrieval Manager will pass the request onto the remote Retrieval Manager, including verification that the local user is authenticated onto the local ICS node.*

UR Id : 285
Source : CIP-BS Team
URD 2.0 Review [NASA/GP/09]
Priority : 2
Need : B
Qualifier : RP

The Retrieval Manager shall support Secondary Orders with Remote Order passthrough.

Note : Passthrough in this context, means the passthrough of authentication information to the remote Retrieval Manager to enable authentication at the remote site.

UR Id : 286
Source : URD 2.0 Review [NASA/GP/09]
Priority : 2
Need : B
Qualifier : RP

The Retrieval Manager shall support the management of order requests.

Note : This may include support for cancellation and monitoring of order requests.

3.1.2.7 Error Management

UR Id : 287
Source : DPRS Team
Priority : 1
Need : A
Qualifier : T

The Retrieval Manager shall provide central error and fault logging facilities for the CIP and for the Retrieval Manager components

Note : These logging facilities are known as the CIP error log.

UR Id : 288
Source : DPRS Team
Priority : 1
Need : A
Qualifier : T

The Retrieval Manager shall provide access to and maintenance facilities for the CIP error log.

3.1.2.8 Batch Search Query Management

UR Id : 289
Source : DPRS Team
Priority : 1
Need : C
Qualifier : T

The Retrieval Manager shall provide batch search query facilities.

UR Id : 290
Source : DPRS Team
Priority : 1
Need : C
Qualifier : T

The Retrieval Manager shall manage the execution of batch search queries according to their priorities and batch execution times.

UR Id : 291
Source : DPRS Team
Priority : 1
Need : C
Qualifier : T

The Retrieval Manager shall provide control facilities for batch search queries including cancellation and priority changing.

3.1.2.9 Command Control

UR Id : 292
Source : DPRS Team
Priority : 2
Need : B
Qualifier : T

The Retrieval Manager shall enable CIP queries to be cancelled, suspended or resumed.

Note : It is recognised that support of suspending and resuming of queries could introduce an extra level of complexity for the protocol and the Retrieval Manager. As these are lower priority requirements than the key services, their implementation should not be carried out at the expense of the key services.

UR Id : 293
Source : DPRS Team
CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The Retrieval Manager should query the user to confirm the cancel if the CIP request has already been submitted to the catalogue and the results of the CIP request have already been received and are available.

UR Id : 294
Source : DPRS Team
CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The Retrieval Manager should query the user to confirm the suspend if the CIP request has already been submitted to the catalogue and the results of the CIP request have already been received and are available.

UR Id : 295
Source : DPRS TN [R1, Section 4.1.6]
URD 1.0 Review [NASA RID 28]
CIP-BS Team
Priority : 2
Need : B
Qualifier : RP

The Retrieval Manager shall endeavour to handle any attribute for which the values of the semantic attributes are not set or are invalid.

Note : In particular, not all semantic attributes will be applicable to all attributes, e.g. a UNITS semantic attribute value for an 'Address' attribute is unlikely to be appropriate. Of course, a legitimate value could be 'Not Applicable' (or a similar). However, it is important to note that while the setting of valid semantic attribute values will be a significant factor in the processing of CIP requests, invalid values will obviously impair the CIP functions, this requirement is to ensure that the CIP will continue to try and 'do its best' in such circumstances.

3.1.2.10 Self Management

UR Id : 296
Source : DPRS Team
Priority : 1
Need : A
Qualifier : T

The Retrieval Manager shall manage its own environment and contain and utilise facilities for data caching, memory management, process control and resource management.

Note : This includes the management of errors and failures as defined in Section 3.1.1.9.4.

UR Id : 297
Source : STN [R32] / CIP-BS Team
Priority : 2
Need : B
Qualifier : T

The Retrieval Manager shall not depend on any central ICS component for its inclusion into the CIP domain.

UR Id : 298
Source : STN [R32] / CIP-BS Team
Priority : 2
Need : B
Qualifier : T

A data provider shall be able to add a Retrieval Manager to the CIP domain at its own discretion. (TBC)

3.1.2.11 Statistics

It may also be appropriate for dynamic user interaction session related user information to be maintained within the CIP domain and support by the Retrieval Manager. The following high level requirement is identified, but the impact of this requirement on other areas of the CIP has not been analysed.

UR Id : 299
Source : DPRS Team
Priority : 2
Need : B
Qualifier : RP

The Retrieval Manager shall support the management of dynamic user information.

Note: : Such user information could include the following dynamic information:

- *Login information - login/logout times, user interaction session lengths,*
- *Number of queries issued, collections accessed, orders made etc.,*

- *Ratio of successful/unsuccessful interactions.*

UR Id : 300
Source : DPRS Team
Priority : 2
Need : B
Qualifier : T

The Retrieval Manager should maintain a log of all user interaction sessions containing information such as details of user identification, location, start and end time and profile of tasks performed and resources used.

UR Id : 301
Source : URD 2.0 Review [CCRS/DOB/19]
Priority : 2
Need : B
Qualifier : T

The Retrieval Manager should log all queries.

Note: : The need to log all queries was recognised within the PTT, eg for the checking of cyclic queries. However, there may need to be additional logging, purging and statistics generations functions. It is likely that for CIP-C, there would be a set of 'System Management' requirements.

UR Id : 302
Source : URD 2.0 Review [PTT minutes, action item: 960926/2]
Priority : 2
Need : B
Qualifier : T

The Retrieval Manager shall support timestamping of CIP messages, in particular, on exchange of messages between CIP Client applications and Retrieval Manager, from Retrieval Manager to Retrieval Manager and between Retrieval Manager and backend server.

Note: : Timestamping requirements will be useful for performance measurement..

UR Id : 303
Source : URD 2.0 Review [PTT minutes, action item: 960926/2]
URD 2.1 Comments
Priority : 2
Need : C
Qualifier : RD

The ICS shall provide facilities to support the logging of performance statistics.

UR Id : 304
Source : URD 2.0 Review [PTT minutes, action item: 960926/2]
URD 2.1 Comments
Prority : 2
Need : C
Qualifier: RD

Logs of performance measures shall be maintained by Retrieval Managers.

Note: : This capability will require management of Logs by Retrieval Managers.

UR Id : 305
Source : URD 2.0 Review [PTT minutes, action item: 960926/2]
URD 2.1 Comments
Priority : 2
Need : C
Qualifier : RD

CIP clients should support logging of operations with timestamps.

3.1.3 CIP Client Applications

The requirements in this section describe functionality that a CIP Client will need to make use of the CIP. These are termed CIP Client Applications and are formally part of the ICS domain (refer to Section 2.1.1, Figure 2-1).This section focuses on the processing of information that a CIP Client will need to perform local to the client to take full advantage of the CIP and Retrieval Manager functionality. This section does not list requirements related to the user interface of a CIP client.

UR Id : 306
Source : SERC
URD 2.0 Review [WWW/13/DOB/13]
Priority : 1
Need : A
Qualifier : T

A CIP Client shall produce and be able to receive messages in conformance with the CIP Specification.

Note : The version of the CIP specification is as appropriate for the version of the client. For instance, a CIP-A Client would conform to the CIP-A Specification. It is most likely however that the versions will be from CIP-B onwards.

UR Id : 307
Source : URD 2.0 Review [WWW/10/DOB/06/AK/06]
Priority : 1
Need : A
Qualifier : T

A CIP Client shall be able to dynamically configure its environment using descriptive CIP attributes provided by the Retrieval Manager.

Note : This may be, for example, by loading data from the Explain database on client application initialisation.

UR Id : 308
Source : URD 2.0 Review [WWW/12/DOB/08]
Priority : 1
Need : A
Qualifier : T

A CIP Client shall be able to support private/encrypted transactions as required by the CIP and as specified in the CIP specification.

UR Id : 309
Source : SERC
Priority : 1
Need : A
Qualifier : RD

A CIP Client should not require the user to have an existing knowledge of the ICS design to make use of ICS.

Note : *For example the user should not required to know the structure of ICS collections in order to conduct distributed queries. Also the user should not be required to understand any CIP query language in order to request a query.*

UR Id : 310
Source : SERC
URD 2.0 Review [NASA/LR/13]
Priority : 1
Need : B
Qualifier : T

A CIP Client should allow the user to conduct incremental queries eg with the targetting of result sets using a historic result set identifier.

Note : *An incremental query is a query using the results of a previous query. This requirement means that it is implicitly required that the client that a client retains result set identifiers for more efficient incremental searching.*

UR Id : 311
Source : SERC
Priority : 1
Need : B
Qualifier : T

A CIP Client should support the conversion of a multi-site CIP result set to multiple single-site CIP orders.

Note : *Result sets will be returned containing information from multiple sites. Ordering using CIP can only be done to a single site at a time. To assist the user, the client should provide a facility for this conversion.*

UR Id : 312
Source : SERC
URD 2.0 Review [WWW/05/DOB/02]
Priority : 1
Need : B
Qualifier : T

A CIP Client should allow the user to convert a result set to a hot collection.

Note : *Hot collections will be stored at the Retrieval Manager as they can be made publicly available, eg with publicity of an appropriate URL.*

UR Id : 313
Source : SERC
Priority : 1
Need : TBD
Qualifier : T

A CIP Client should allow seamless integration of CIP with data retrieval protocols when retrieving browse data.

Note : *Similar to WWW Clients, a CIP client should not make visible to the user that a different protocol, e.g., ftp, http, is used to retrieve a browse image, versus the CIP which is used to retrieve the item descriptor containing the browse data location.*

UR Id : 314
Source : URD 2.0 Review [BTT/NASDA/SS/GM2]
Priority : 1
Need : A
Qualifier : T

A CIP Client should support the decompression of compressed browse data.

Note : Browse data could be compressed in a variety of formats including GIF, JPEG or lzh.

UR Id : 315
Source : URD 2.0 Review [BTT/NASDA/SS/GM3]
Priority : 1
Need : A
Qualifier : T

A CIP Client should support the display of browse data and browse attributes in the same window.

Note : This is to enable the user to have all browse information presented in an easily viewed and manageable manner.

UR Id : 316
Source : SERC
Priority : 1
Need : A
Qualifier : T

A CIP Client should allow a user to form nested collection/product queries.

Note : This requirement means that a Client should receive and understand collection hierarchy information and make it available to the User in a manner conducive to effective understanding and interpretation of the hierarchy for more effective searching.

UR Id : 317
Source : URD 2.0 Review [WWW/01/YE/01]
Priority : 1
Need : A
Qualifier : T

A CIP Client should present an integrated view of search services to the user to support integrated collection/product descriptor, guide and hierarchical collection searches.

Note : Although this is a requirement for CIP-A, the protocol will not currently support integrated searching. This may be a CIP-C requirement.

UR Id : 318
Source : URD 2.0 Review [WWW/01/YE/02]
Priority : 1
Need : A
Qualifier : T

A CIP Client should present an integrated view of attribute definitions and allowed values for collection descriptor, product descriptor and guide descriptor attributes.

Note : Although this is a requirement for CIP-A, the protocol will not currently support integrated searching of attributes. This may be a CIP-C requirement.

UR Id : 319
Source : SERC
Priority : 1
Need : B
Qualifier : T

A CIP Client should support the user changing the user name during the middle of a CIP session.

Note : This will allow a user to typically browse ICS collections as a guest, without entering any authorisation information, until the user desires to order a product and requires more intimate authorisation to allow him ordering privileges. Note this implicitly means that result sets need to be retained at the client when the change of identity occurs, eg for retention of context.

UR Id : 320
Source : SERC
Priority : 1
Need : B
Qualifier : T

A CIP Client should allow the user to order by proxy or as a pass through order.

Note : Order by proxy means that the agency which hosts the Retrieval Manager on which the user has a the session in which the order is requested will be involved in the ordering process and will send the user an invoice. Pass through order means that the agency which granted the initial session to the user will not be involved in the order and the user will receive an invoice directly from the agency which ships the product.

UR Id : 321
Source : URD 2.0 Review [NASA/LR/05]
Priority : 1
Need : B
Qualifier : T

A CIP Client shall support the translation of geographic references or geographic names.

Note : A CIP Client could then be implemented so that geographic names such as specified in the USGS Geographic Names Information System, can be accessed for use in queries.

UR Id : 322
Source : URD 2.0 Review [NASA/LR/17]
Priority : 1
Need : B
Qualifier : T

A CIP Client shall support the translation of a geographical swath specification at the client side to a CIP swath specification.

3.1.4 CIP Catalogue Translator Applications

In ICS URD Release C, this section will define the requirements that a CIP Catalogue Translator will need to make use of the CIP. These are termed CIP Catalogue Translator Applications and are formally part of the ICS .

3.1.5 Collections Maintenance

This section defines requirements on the Retrieval Manager Administrators (specialist users and administrators of ICS domain catalogues). These tasks will be accomplished using the Collection Management functionality of the Retrieval Manager as defined in section 3.1.2.2.

It is important to note that these requirements are on RM Administrators, which are initially envisaged to be human operators.

UR Id : 323
Source : SERC
Priority : 1
Need : B
Qualifier : RD

The Retrieval Manager Administrators shall maintain the local Retrieval Manager in accordance with the ICS Collection Manual.

Note : This requirement is a 'shall' for those CEOS members in the ICS and a 'should' for other organisations hosting Retrieval Managers. Maintaining Retrieval Managers in uniform accordance with the Collection Manual will facilitate high quality results for ICS users. This is a general requirement, more detailed requirements follow.

UR Id : 324
Source : SERC
Priority : 1
Need : A
Qualifier : RD

Retrieval Manager Administrators shall establish Provider Archive Collections.

Note : Detailed procedures for conducting this function can be found in the ICS Collection Manual.

UR Id : 325
Source : SERC
Priority : 1
Need : A
Qualifier : RD

Retrieval Manager Administrators shall map local schemata to the CIP schema to allow population of collections

Note : Detailed procedures for conducting this function can be found in the ICS Collection Manual.

UR Id : 326
Source : SERC
Priority : 1
Need : A
Qualifier : RD

Retrieval Manager Administrators shall establish Provider Theme Collections.

Note : Detailed procedures for conducting this function can be found in the ICS Collection Manual.

UR Id : 327
Source : SERC
Priority : 1
Need : A
Qualifier : RD

Retrieval Manager Administrators shall establish Key Access Nodes.

Note : Detailed procedures for conducting this function can be found in the ICS Collection Manual.

UR Id : 328
Source : SERC
Priority : 1
Need : B
Qualifier : RD

Retrieval Manager Administrators should reference collections held in other Retrieval Managers.

Note : Detailed procedures for conducting this function can be found in the ICS Collection Manual.

UR Id : 329
Source : SERC
Priority : 1
Need : B
Qualifier : RD

Retrieval Manager Administrators shall support the establishment of the ICS Global Collection.

Note : Detailed procedures for conducting this function can be found in the ICS Collection Manual. This requirement is also dependent on the establishment of an ICS global collection, which is implicitly required to facilitate discovery.

UR Id : 330
Source : SERC
Priority : 1
Need : A
Qualifier : RD

Retrieval Manager Administrators shall periodically check the collection structure held in their Retrieval Managers for consistency.

Note : Detailed procedures for conducting this function can be found in the ICS Collection Manual. See section 3.1.2.2 for details on what consistency checks are supported by the Retrieval Manager functionality.

UR Id : 331
Source : SERC
Priority : 1
Need : A
Qualifier : RD

Retrieval Manager Administrators shall periodically review the Key Access nodes for their Retrieval Manager to insure that they are still meet the Key Access Node guidelines.

Note : Detailed procedures for conducting this function can be found in the ICS Collection Manual.

UR Id : 332
Source : SERC
Priority : 1
Need : A
Qualifier : RD

Retrieval Manager Administrators shall periodically check for stale links to remote collections.

Note : Detailed procedures for conducting this function can be found in the ICS Collection Manual. Stale links are links to remote collections which are no longer accessible.

UR Id : 333
Source : SERC
Priority : 1
Need : B
Qualifier : RD

Retrieval Manager Administrators shall periodically assess the storage of hot collections on their Retrieval Manager.

Note : Detailed procedures for conducting this function can be found in the ICS Collection Manual.

UR Id : 334
Source : URD 2.0 Review [NASA/LR/16]
CIP 2.1 Review [ESA/MF/9]
Priority : 1
Need : C
Qualifier : RD

Retrieval Manager Administrators shall review collection commonality attribute to check their applicability to the described collection.

Note : This may be performed by maintenance tools if necessary.

UR Id : 335
Source : URD 2.0 Review [NASA/LR/16]
CIP 2.1 Review [ESA/MF/9]
Priority : 1
Need : C
Qualifier : RD

Retrieval Manager Administrators shall review collection commonality attribute values within the collection hierarchy for consistency and completeness and to help maintain inheritance.

Note : This may be performed by maintenance tools if necessary.

3.2 ICS Contraint Requirements

This section contains the constraint requirements for the CIP, both for the CIP and the Retrieval Manager.

Constraint requirements place restrictions on how the user requirements are to be addressed. The constraint requirements are sub-divided into communications interfaces, hardware interfaces, software interfaces, HCI, adaptability, availability, portability, security, safety, standards, resources and timescales.

Within each subsection the requirements are ordered with the protocol requirements first followed by the software requirements on the Retrieval Manager.

3.2.1 Communications Interface Requirements

3.2.1.1 Communications

This section addresses the communications requirements on the CIP and Retrieval Manager. The key features of the requirements in this area are as follows.

- Communications will be layered. The messages used to convey CIP information will be self-contained and capable of embedding within and transporting over any suitable lower level electronic communications system.
- Two types of communications requirements are defined. The first (addressed in this section) can be used for any type of message passing used by the CIP. The second, covered in the following section, relates specifically to data delivery. Some (although not all) types of data delivery that can be initiated through the CIP may occur through communications channels which may not necessarily be able to support full two-way messaging.

UR Id : 336
Source : DPRS Team
Priority : 1
Need : A
Qualifier : RD

The CIP shall be specified so as to be independent of any specific lower level communications protocol.

Note : The protocol should not assume that any specific bearer mechanism, e.g. Internet, or at a lower level X.25 or TCP/IP, is used. At the application level, the protocol will be defined in terms of request-response message pairs, which will be exchanged between physical entities. The layering of this functional communication on top of lower level communications protocols should be restricted to specific implementations of the protocol such as the Retrieval Manager.

3.2.1.2 Data Delivery

This section provides specific requirements on data delivery. There may be some overlap between these requirements and the order requirements, but they are maintained here to ensure completeness.

The services leading up to a product retrieval (search query submission and result return, whether at guide, collection, or product descriptor level) will be based on the exchange of messages (the message size assumed to be of a size commensurate with performance and data transmission requirements). The communications mechanism used for these messages may be specified by the user (possibly transparently) as part of their login/configuration information, but is essentially a matter for the system and will not change from one message to the next.

For product retrievals, in contrast (and this may include browse retrievals, subselection retrievals etc.), where data volumes are higher and delays are longer, it is a basic requirement that the user must be able to specify the format and mechanism for the transfer.

Under constraint requirements, one would normally specify the specific formats and mechanisms to be supported by the baseline Retrieval Manager. However, in practice this is not necessary. It is assumed that when a product delivery request (order) is accepted by a server, the preparation and packaging of the data will be the responsibility of the part of the archive or inventory server (which is outside the CIP domain). The CIP elements, including the Retrieval Manager, will then pass the resulting data held in

file(s),back to the requesting client. The unpacking and manipulation of the product will then similarly be the responsibility of the part of the client (also outside the CIP domain).

The net effect of this is that the CIP and Retrieval Manager should be able to support the transport of product data files from server to client in a transparent manner, so that any product format may be supported within the files. The only requirements to be addressed here are therefore those relating to the transport of the files

The other key communications issue, is that of communication over the Internet. This needs to be supported within the CIP domain and a specific requirement is stated here to ensure this.

UR Id : 337
Source : DPRS Team
URD 2.0 Review [CCRS/DOB/17]
Priority : 1
Need : N/A
Qualifier : T

The Retrieval Manager shall support the electronic delivery of products to a specified machine.

Note : The electronic delivery might by FTP/push, FTP/pull, e-mail or a CIP internal method and is likely to be specified as part of the order options. Also, the specified machine might not be the same machine as the user is operating from when the request is issued.

UR Id : 338
Source : DPRS Team
Priority : 1
Need : N/A
Qualifier : RD

The Retrieval Manager shall handle product retrievals in a manner independent of the product format, so that any file format that can be generated by a CIP connected server and utilised by a CIP connected client can be supported.

Note : The Retrieval Manager and the CIP will provide transport of data products but will not be responsible for formatting and interpreting them.

UR Id : 339
Source : DPRS Team
Priority : 1
Need : N/A
Qualifier : T

The Retrieval Manager shall support the retrieval of individual products consisting of one or more files.

Note : This is to ensure support for product formats in which individual products consist of multiple files. Note that, the requirement could be worded so as to support zero or more files, to cover retrieval of non existent files, but this is rather self contradictory and may cause confusion so the wording assumes retrieval of existing files.

UR Id : 340
Source : SoW [R2, Section 4.3.3.4]
URD 2.0 Review [NASDA/SS/4]
Priority : 1
Need : N/A
Qualifier : T

The Retrieval Manager shall support transfer of data via standard networks including the Internet.

Note : This assumes the ability to handle Internet addresses (mnemonic and numeric). Note also that there may be dedicated agency to agency lines for more efficient Retrieval Manager to Retrieval Manager communications.

3.2.2 Hardware Interface Requirements

A hardware interface requirement specifies all or part of the computer hardware the software is to execute on.

There are no specific hardware requirements at present for the CIP domain.

3.2.3 Software Interface Requirements

A software interface requirement specifies whether the CIP is to be compatible with other software (e.g. other applications, compilers, operating systems, languages and database management systems).

This section is split into those requirements pertaining to commercial software interfaces e.g. to operating systems, databases etc. and those requirements pertaining to related systems and applications e.g. existing EO systems such as IMS and MUIS.

With respect to the commercial software interfaces and development methodologies, it is assumed that different agencies may in fact build their own Retrieval Managers against the Retrieval Manager specification. Compliance with the CIP will ensure that these separately developed software elements will be able to interoperate. This development concept leads to a division of the commercial software requirements into two parts.

- General requirements which apply to all Retrieval Manager implementations. These are addressed below.
- Specific requirements which a particular agency such as ESA may wish to apply to its Retrieval Manager implementation. As different agencies may have different standards for documentation, development tools, etc., these requirements are not included here.

3.2.3.1 Commercial Software Interface Requirements

The analysis of the CIP performed within CINTEX and within this document already reflects an object oriented view of the domain, which is appropriate for the CIP domain. It is important that this early analysis work is not neglected in subsequent phases and it provides a logical approach for design and implementation.

UR Id : 341
Source : SoW [R2, Section 4.4.2]
Priority : 2
Need : N/A
Qualifier : RD

The Retrieval Manager should be designed using a recognised object oriented design methodology.

Note : This may be for instance be the Coad-Yourdon design methodology for object-oriented analysis, supported by a subset of the OMT (Rumbaugh) diagramming conventions or it could be another architectural design methodology such as HOOD.

UR Id : 342
Source : DPRS Team
Priority : 2
Need : N/A
Qualifier : RD

The Retrieval Manager shall be implemented using the ANSI C language or an extended variant thereof.

Note : At the current time, C or an object oriented derivative, such as C++, is the most appropriate implementation language, as a number of existing information management and retrieval systems are implemented in C, and the typical operating system for client/server software is UNIX (at least for the server and management software), for which C implementations are more closely aligned. However to specify an exact variant seems excessively restrictive at this stage.

UR Id : 343
Source : DPRS Team
Priority : 1
Need : N/A
Qualifier : RP

The Retrieval Manager shall use a Commercial-Off-The-Shelf (COTS) database management system to store database information.

Note : This could be an RDBMS such as Oracle or Ingres, or possibly an Objected Oriented DBMS (OODBMS). Database information that may need to be stored by the Retrieval Manager could include user log in info, user privileges, records of queries etc.

UR Id : 344
Source : DPRS Team/URD 0.1 Review [RID 26]
Priority : 2
Need : N/A
Qualifier : RD

If components of the Retrieval Manager are intended for distribution as shareware, then they should endeavour to be as independent as possible from COTS toolkits, libraries, commercial databases, etc.

Note : Whilst this requirement is desirable, there is a certain trade-off between developing all software required, including possibly an RDBMS, and the commercial cost and reliability. At an extreme one would have to go as far as developing compilers, etc., but this is unlikely to be feasible or practical.

UR Id : 345
Source : DPRS Team
Priority : 1
Need : N/A
Qualifier : T

It shall be possible to access Retrieval Manager functionality using a standard World Wide Web compatible client.

Note : This could be, e.g. Mosaic or Netscape. Whilst users with these standard clients will not receive the full range of services that the CIP and Retrieval Manager can support, they would receive a sufficient range and quality of service to carry out key functions. Note further that this requirement does not imply that the Retrieval Manager contains an http interface or a WWWW Server - this would be outside the ICS scope. An external CIP/HTML translator is assumed.

3.2.3.2 System Software Interface Requirements

There are no required interfaces to existing or heritage systems, however, the existing systems should be analysed and where protocols or system components would match CIP requirements, these should be incorporated, as appropriate, in the Retrieval Manager design.

Particular consideration has been given to the relationship of the CIP and Retrieval Manager to the UIT and IMS V0 systems. The current development is designed to learn from and build on these existing attempts at interoperability, and is certainly likely to have a significant amount of commonality with them. However, to mandate full compatibility with either system would be overly restrictive, indeed it might be very difficult to provide a system which met all of the requirements in this document and also had this backwards compatibility. This does not mean that translation software will not be developed to enable UIT/IMS V0 users to interact with CIP compliant systems in a transitional phase, but such software should be seen as an extension to the existing systems rather than an inherent part of the CIP or Retrieval Manager. The requirements in this area have been prepared with this in mind.

UR Id : 346
Source : DPRS Team
Priority : 1
Need : A
Qualifier : RP and RD

Experience gained and lessons learnt from the development of similar systems, such as the IMS V0 and Z39.50 protocol and servers, shall be reused in the specification of the CIP and development of the Retrieval Manager.

Note : This requirement is to ensure that the CIP specification and Retrieval Manager development pays careful attention to the work done so far in similar fields.

UR Id : 347
Source : DPRS Team
Priority : 2
Need : A
Qualifier : RP and RD

The CIP and Retrieval Manager shall be developed with reference to the existing ESA User Interface Terminal (UIT) system and interfaces.

Note : This requirement is to ensure that the development takes account of this existing development the lessons learnt from it.

UR Id : 348
Source : DPRS Team
Priority : 1
Need : A
Qualifier : RP and RD

The CIP and Retrieval Manager shall be developed with reference to the existing DLR ISIS system and interfaces.

Note : This requirement is to ensure that the development takes account of this existing development the lessons learnt from it.

3.2.4 Human Computer Interaction (HCI) Requirements

An HCI requirement may specify any aspect of a user interface. This may include requirements about style, format, dialogues, menus, response times. Hardware (e.g. display and mouse requirements) may also be included.

It is not currently envisaged that the CIP includes any specific HCI interaction for functions such as query, generation or retrieval, as these would be provided by the attached client, whether standard (e.g. Mosaic/Netscape) or bespoke. However, it is likely that the Retrieval Manager will need to provide MMI dialogues to support maintenance, reporting, logging, configuration changes, error/fault reporting etc.

The following HCI requirements are general and relate to any HCI software that is developed as part of the Retrieval Manager.

It is important to note that these requirements are NOT CIP Client requirements.

UR Id : 349
Source : DPRS Team
Priority : 1
Need : N/A
Qualifier : RD

All HCI interactions should be based on the X-Windows environment.

UR Id : 350
Source : DPRS Team
Priority : 1
Need : N/A
Qualifier : RD

The OSF/Motif standard should be used as the basis for the X-Windows environment.

UR Id : 351
Source : DPRS Team
Priority : 1
Need : N/A
Qualifier : RD

All screens and screen operations shall utilise a common ‘look and feel’.

Note : Look and feel in this respect shall be considered to cover the format, size, shape and or usage of standard user interface features, such as: display windows; menus; scrolling displays & scroll bars; cursor movement and insertion keys; pointing device (e.g. mouse) buttons; function keys (accelerators or 'hot keys'); on screen widget appearance and functionality (buttons, toggles, sliders, icons, etc.); general form layout. It is thought unlikely that the CIP MMIs will include such a large range of user interface features, but those that are provided need to 'look and feel' the same to the human user.

UR Id : 352
Source : DPRS Team
Priority : 1
Need : N/A
Qualifier : RD

In addition, the following aspects of HCI interaction will be standardised across the development:

- **terminology and naming conventions:**
- **naming of standard functions (quit, exit, save, help, etc.)**
- **standard use of widgets for similar functions**
- **standard use of symbolic/iconographic labels**
- **standard cursor styles for different user input modes**
- **use of colour**
- **audible confirmation/warning/error signals**
- **information/warning/error message formats**

UR Id : 353
Source : DPRS Team
Priority : 1
Need : N/A
Qualifier : T

All HCI screens (menus, forms, and dialogues) shall have clearly identified titles.

UR Id : 354
Source : DPRS Team
Priority : 1
Need : N/A
Qualifier : RD & RP

All dates and times shall be presented to the user in ISO/CCSDS standard format[R16], i.e.: yyyy-mm-ddThh:mm(:ss).

UR Id : 355
Source : DPRS Team
Priority : 1
Need : N/A
Qualifier : T

During alphanumeric text entry, keystrokes shall be echoed to the screen within 0.05 seconds to maintain pace with normal typing speeds.

UR Id : 356
Source : DPRS Team
Priority : 1
Need : N/A
Qualifier : T

Visual and or audible evidence confirming all transactions requested by the user shall be provided within 0.3 seconds of initiation of the action.

Note : This is especially intended to ensure that where a transaction may last for a considerable time (normally where remote access is occurring), that the user is given an immediate signal that the system has accepted the request and begun work on it.

UR Id : 357
Source : DPRS Team
Priority : 1
Need : N/A
Qualifier : T

Pop-up menus, dialogue boxes and forms shall be displayed (with initial data where appropriate) within 1.0 seconds of request.

UR Id : 358
Source : DPRS Team
Priority : 1
Need : N/A
Qualifier : T

Hidden or iconised windows shall be displayed within 0.5 seconds of request.

UR Id : 359
Source : DPRS Team
Priority : 1
Need : N/A
Qualifier : T

Requests for display refreshes shall be completed within 0.5 seconds of request.

Note : This is for a simple display update, not for an update that incorporates a background operation such as a new query which may well take longer.

3.2.5 Adaptability Requirements

The adaptability of a system is a measure of how flexible the system, particularly with respect to requirements or architectural design changes. Flexibility will be achieved partly through the use of standard methods and products (see Section 3.2.3) and partly through the imposition of specific design features and constraints, addressed below.

UR Id : 360
Source : DPRS Team
Priority : 2
Need : N/A
Qualifier : RD

The Retrieval Manager shall have a modular design to facilitate the addition of new functionality.

UR Id : 361
Source : URD 2.0 Review [NASA/GP/29]
Priority : 1
Need : N/A
Qualifier : RD

The Retrieval Manager shall be designed to enable the disabling and enabling of CIP services.

Note : This requirement is to help ensure that if a site does not want to support a CIP service such as Order, that this can be disabled without re- coding or significant reconfiguration of the Retrieval Manager software.

UR Id : 362
Source : DPRS Team
Priority : 1
Need : N/A
Qualifier : RD

The Retrieval Manager should be implemented using the client-server paradigm for its interactions with both user clients and supplier servers.

UR Id : 363
Source : DPRS Team
Priority : 1
Need : N/A
Qualifier : RD

The Retrieval Manager shall have an evolutionary, open architecture.

UR Id : 364
Source : DPRS Team
Priority : 1
Need : N/A
Qualifier : RP and RD

The Retrieval Manager shall support the addition of new catalogue sites and new collections without the need for software changes to the Retrieval Manager.

UR Id : 365
Source : DPRS Team/URD 0.1 Review [RIDs 50 & 90]
Priority : 1
Need : A, B, C
Qualifier : RD

New CIP releases should be backward compatible with previous releases, so as not to invalidate existing implementations.

Note : If a serious technical error is found in a release then this requirement may not be achievable following error correction, but the general philosophy of backward compatibility must be aimed for so as to ensure continued and future interoperability. It is important to note that changes in CIP-B occurred, which caused that CIP-B is not completeley backwards compatible with CIP-A.

UR Id : 366
Source : DPRS Team
Priority : 1
Need : N/A
Qualifier : RD

The Retrieval Manager should support extensions to the CIP data dictionary without the need for significant software changes.

3.2.6 Availability Requirements

Availability is the ability of a system to be used during the intended periods of operation. The definition of CIP functional availability is dependent on degree of capability loss. A complete loss of capability is termed a 'failure' and is caused by one or more 'faults'. A partial loss of capability is called a 'degradation', and typically occurs when functionality is maintained but, e.g. performance or capacity is reduced. The average time between the occurrence of internal software faults measures the software reliability. The average time taken to rectify faults measures its maintainability.

As the Retrieval Manager is a software only system, the availability requirements are not applicable in the case of loss of capability due to hardware failure, although the CIP may be concerned with indirect affects of hardware failure, e.g. with the consideration of time outs on server failure.

UR Id : 367
Source : DPRS Team
Priority : 1
Need : N/A
Qualifier : T & RD

The Retrieval Manager shall be capable of operating on a 24 hours per day basis without human intervention.

Note: : This is because the CIP domain is anticipated to integrate catalogue systems found all over the world and hence 'normal working hours' are very different depending upon the user. The Retrieval Manager must be available at all times.

UR Id : 368
Source : URD 2.0 Review [NASA/RWH/01]
Priority : 1
Need : N/A
Qualifier : T & RD

The Retrieval Manager shall have an operational availability of (0.9) and a mean down time (MDT) of 5 hours or less.

Note: : MDT is the time the system is not available, including preventative maintenance, repair time, administrative delays and logistics delays. For the purposes of this requirement, the Retrieval Manager includes the RM software and any underlying support hardware and software.

UR Id : 369
Source : DPRS Team
Priority : 1
Need : N/A
Qualifier : RD

The Retrieval Manager shall detect and report internal faults via a (TBD) alarm/messaging scheme.

UR Id : 370
Source : DPRS Team
Priority : 1
Need : N/A
Qualifier : RD

The Retrieval Manager shall endeavour to recover from internal faults without the need for human intervention.

Note : This may mean e.g. retries on an attempt to establish a communications link to a remote site.

UR Id : 371
Source : DPRS Team
Priority : 1
Need : N/A
Qualifier : T

The Retrieval Manager shall maintain a log of all faults with details of their context (other entities involved/affected), symptoms, and any recovery actions taken by the system.

UR Id : 372
Source : DPRS Team
Priority : 2
Need : N/A
Qualifier : T

The Retrieval Manager shall maintain statistics on the number and nature of detected faults.

UR Id : 373
Source : DPRS Team
Priority : 2
Need : N/A
Qualifier : T

The Retrieval Manager shall maintain statistics on operational throughput (number of queries received/dealt with, data volume sent out, etc.) over appropriate time periods.

UR Id : 374
Source : ESA/NASA co-location
URD 2.0 Review [NASA/RWH/04]
Priority : 2
Need : N/A
Qualifier : T

With a load of half the anticipated peak user load, the Retrieval Manager should provide a response to an exclusive local search query request, within an average of 5 seconds of receiving the request, which shall either be a confirmation of the request or the search query results.

Note : This requirement provides a guide for the Retrieval Manager performance in dealing with a query within the local Retrieval Manager domain. The performance should be measured with a client and target server running on the same machine as the Retrieval Manager (to exclude network traffic) with no additional, unrelated loading on the Retrieval Manager, e.g. maintenance functions.
Note that the peak load number of users is given in UR 280..

UR Id : 375
Source : URD 2.0 Review [NASA/RWH/05]
Priority : 2
Need : N/A
Qualifier : T

The Retrieval Manager peak load response time should not exceed twice the average response time in 99 percent of exclusive local search queries.

3.2.7 Portability Requirements

Software portability is the ease that it can be moved from one environment to another. Note that portability is likely to increase the potential life of the software but may also increase the development time and could adversely affect performance.

Portability can be measured in terms of the number of lines of code and/or modules that do not have to be changed to port the software from one environment to another.

UR Id : 376
Source : DPRS Team
Priority : 1
Need : A
Qualifier : RP

The CIP specification shall be platform independent.

UR Id : 377
Source : DPRS Team
Priority : 1
Need : N/A
Qualifier : RD

The Retrieval Manager software shall avoid the use of non-portable (platform or machine-specific) functions. Where avoidance is not possible, justification must be provided at an architectural level.

UR Id : 378
Source : DPRS Team
Priority : 1
Need : N/A
Qualifier : T

The Retrieval Manager software shall run on a POSIX compliant operating system.

UR Id : 379
Source : DPRS Team
Priority : 1
Need : N/A
Qualifier : RD

Retrieval Managers and other software built to any release of the CIP specification shall be backwards compatible with equivalent systems built to earlier releases.

Note : This requirement is included as an objective. Whether it is actually achieved is dependent on the implementation schedules of the various ICS service providers and ICS component implementers.

UR Id : 380
Source : URD 2.0 Review [NASA/GP/23]
Priority : 2
Need : N/A
Qualifier : RD

The Retrieval Manager shall be designed to allow installation and configuration in three days, including the time spent reading the files onto the target machine, configuring the Retrieval Manager software and establishing a default collection structure.

Note : This requirement may be met by a build and configuration toolkit, logically viewed as part of the Retrieval Manager system, but not part of the active CIP serving functions..

3.2.8 Security Requirements

Security of a software system can be described in terms of access to the system capabilities, in particular, secure against threats to confidentiality, integrity and availability of the system. Protection

could be against threats such as viruses, unwarranted intrusion, fires and computer breakdown as well as operator misuse.

UR Id : 381
Source : DPRS Team
Priority : 1
Need : N/A
Qualifier : T & RD

The Retrieval Manager shall be secure against unauthorised access.

UR Id : 382
Source : DPRS Team
Priority : 1
Need : N/A
Qualifier : T & RD

The Retrieval Manager shall be secure against users attempting to access services to which they are not entitled, either accidentally or deliberately.

UR Id : 383
Source : DPRS Team
URD 2.1 Comment
Priority : 2
Need : N/A
Qualifier : T

The Retrieval Manager shall ensure that password information is not passed across communications links in a clear form.

UR Id : 384
Source : DPRS Team
Priority : 1
Need : N/A
Qualifier : RD

The Retrieval Manager shall ensure that order information is stored in a secure manner.

3.2.9 Safety Requirements

Safety requirements are in terms of consequences of software or hardware failure and protection of the needs of the user in terms of such failures.

UR Id : 385
Source : DPRS Team
Priority : 1
Need : N/A
Qualifier : T

The Retrieval Manager shall, where appropriate, provide graceful degradation as opposed to loss of functionality.

Note : An obvious example here is a search query that fans out from the Retrieval Manager to several sites. If some sites cannot be reached, the Retrieval Manager should not abandon the overall function but should continue with the available sites and provide a suitable 'health warning' to the user along with the successfully retrieved data at the end of the operation.

UR Id : 386
Source : DPRS Team
Priority : 1
Need : N/A
Qualifier : T

The Retrieval Manager shall isolate non-recoverable faults so as to minimise their impact on overall operations.

Note : The specific point to be considered here is that the Retrieval Manager will typically be addressing multiple transactions from multiple clients, servers, and users. These transactions should be separately managed so that a failure in one of them (e.g. an unexpected user interaction session termination or unexpected or illegal message from a client or server) should only affect the immediately related operations and not the behaviour or integrity of the Retrieval Manager as a whole.

UR Id : 387
Source : DPRS Team
Priority : 1
Need : N/A
Qualifier : T & RD

The Retrieval Manager shall use transaction logging or similar mechanisms to minimise the amount of data loss or corruption that can occur in the event of a system failure.

3.2.10 Standards Requirements

There are two types of standards requirements: process standards and product standards. Product standards may include export file formats and report formats that the system needs to conform to. Process standards may include product assurance standards and accounting procedures to be followed.

A number of constraints affecting this area have been addressed in the sections on interfaces (Section 3.2.3) and portability (Section 3.2.7). These requirements are not duplicated here.

UR Id : 388
Source : SoW [R2, Section 4.4.1]
Priority : 1
Need : N/A
Qualifier : RD

The Retrieval Manager shall be designed and implemented in accordance with the PSS-05 Software Engineering Standards[R7].

UR Id : 389
Source : SoW [R2, Section 4.3.1]
Priority : 1
Need : A
Qualifier : RP

The protocol specified in the CIP specification shall so far as possible be defined using a formal information interchange language, such as ASN.1[R11][R12] or Parameter Value Language (PVL)[R22][R23].

UR Id : 390
Source : DPRS TN [R1, Section 4.1.6]
CCSDS [R10]
CIP-BS Team
URD 2.0 Review [BNSC/16] *UR moved to this section*
Priority : 1
Need : A
Qualifier : RP

The CIP should be flexible so that new attributes can be defined and supported with minimum impact on the CIP and the Retrieval Manager software.

UR Id : 391
Source : DPRS TN [R1, Section 4.1.6]
CCSDS [R10]
URD 2.0 Review [BNSC/16] *UR moved to this section*
Priority : 1
Need : A
Qualifier : RP

The CIP should be flexible so that new semantic attributes can be defined and supported with minimum impact on the CIP and the Retrieval Manager software.

UR Id : 392
Source : DPRS Team
Priority : 1
Need : C
Qualifier : RP

The protocol specification language shall be an internationally recognised language that is either an existing standard or being defined as a standard.

Note : This requirement must be set to Release C as the DPRS team have no control over international standards bodies and the timing of when the CIP may be authorised as an international standard is not clearly predictable.

UR Id : 393
Source : SoW [R2, Section 4.3.3.1]
CIP-BS Team
Priority : 1
Need : A
Qualifier : RP

The CIP specification shall be based on the ANSI/NISO Z39.50 protocol specification[R27].

UR Id : 394
Source : URD 2.0 Review [NASA/GP/17]
Priority : 1
Need : B
Qualifier : RP

The Retrieval Manager shall be designed and implemented so that any Z39.50 V3 compatible client should be able to access the Retrieval Manager and ICS domain.

Note : This requirement means that, eg GEO clients (when they are Z39.50 V3 compatible) should be able to search ICS domain catalogues, at least for product descriptors.

UR Id : 395
Source : CIP-BS
Priority : 1
Need : A
Qualifier : RP

Experience gained from the developments in the ZIG community shall be reused in the specification of the CIP.

Note : This requirement is to ensure that the CIP specification phase pays careful attention to the work done so far in the ZIG community so that reuse of ZIG profiles or definitions occurs where appropriate.

UR Id : 396
Source : URD 2.0 Review [ESA/SM/09]
Priority : 1
Need : A
Qualifier : RP

Experience gained from the definition of the Z39.50 Digital Collections ([R40]) Profile shall be reused as appropriate in the specification of the CIP.

Note : There are a number of potentially useful aspects of the Digital Collections profile, which is a relatively new Z39.50 profile and the ZIG/CEOS PTT are looking to harmonise the CIP/DC approach as much as possible.

UR Id : 397
Source : CIP-BS Team
Priority : 1
Need : A
Qualifier : RP

The CIP shall used URLs defined according to the Z39.50 definition for URLs defined in [R43].

Note : The ZIG community are currently defining Z39.50 URL formats. When this is complete, the appropriate reference can be included. A draft specification is proposed as a proposed standard, [R43].

UR Id : 398
Source : CINTEX 2nd Protocol Workshop (20 - 22 April '95)
Priority : 2
Need : B
Qualifier : RP

The method of CIP password encryption shall be an internationally recognised security method.

Note : This could be, for instance, the PGP method.

UR Id : 399
Source : SoW [R2, Section 4.3.3.1]
Priority : 1
Need : A
Qualifier : RP

Experience gained from the development of the object definitions in NASA's EOSDIS IMS Messages and Development Data Dictionary as defined in [R21] shall be reused in the specification of the CIP.

Note : This requirement is to ensure that the CIP specification phase pays careful attention to the work done so far in the IMS V0 ODL and protocol development so that reuse of IMS objects occurs where appropriate.

UR Id : 400
Source : CIP-BS Team
Priority : 1
Need : A
Qualifier : RP

Experience gained from the development of the object definitions in NASA's ECS system shall be reused in the specification of the CIP.

Note : This requirement is to ensure that the CIP specification phase pays careful attention to the work done so far in the ECS development so that reuse of ECS objects occurs where appropriate.

UR Id : 401
Source : CIP-BS Team
Priority : 1
Need : A
Qualifier : RP

Experience gained from the development of the object definitions in CEO's Enabling Services shall be reused in the specification of the CIP.

Note : This requirement is to ensure that the CIP specification phase pays careful attention to the work done so far in the Enabling Services development so that reuse of Enabling Services' objects occurs where appropriate.

UR Id : 402
Source : SoW [R2, Section 4.3.3.1]
Priority : 2
Need : A
Qualifier : RP

Experience gained from the development of the data description languages used in ESA's Earth Observation Formatting System (EOFS) shall be reused in the specification of the CIP where applicable.

Note : This requirement is again to ensure that relevant work carried out in parallel Earth observation areas such as the EOFS is taken into account, as appropriate, during the specification phase.

UR Id : 403
Source : SoW [R2, Section 4.3.3.2]
Priority : 1
Need : A
Qualifier : RP

The CIP specification shall be produced with reference to the HTTP protocol, in particular, the CIP shall be defined to ensure communication (possibly by virtue of translation) with an HTTP client at the application level.

Note : This requirement is to indicate the importance of the CIP being able to communicate with a World Wide Web (WWW) client, at least at the application level. More specific requirements are in the constraints section. It is recognised however that a WWW client is unlikely to be able to support all the CIP client functions, but is likely to be able to support, at a minimum: guide, directory and inventory.

UR Id : 404
Source : SoW [R2, Section 4.3.3.1]
Priority : 1
Need : A
Qualifier : RP

Experience gained from practical EO interoperable data retrieval activities such as those carried out by the CEOS Interoperability Experiment (CINTEX) shall be reused in the specification of the CIP.

UR Id : 405
Source : DPRS Team
Priority : 1
Need : A
Qualifier : RP

Appropriate existing data description techniques such as those defined by the Consultative Committee for Space Data Systems (CCSDS) shall be reused in the specification of the CIP.

Note : This requirement again is to indicate the importance of recognising progress to date in related areas and reuse of relevant definitions.

UR Id : 406
Source : CIP-BS Team
Priority : 1
Need : A
Qualifier : RP

Experience gained from existing EO data dictionary activities such as those carried out by the CEOSDN (IDN) shall be reused in the specification of the CIP.

UR Id : 407
Source : URD 0.1 Review [RID 66]
Priority : 1
Need : A
Qualifier : RP

The CIP specification shall be produced with reference to the CEOS Inventory Exchange Format (IEF)[R24] for missions with floating orbits and the equivalent Inventory Exchange Format (IEF)[R25] defined by ESA for missions with fixed reference systems.

UR Id : 408
Source : URD 0.1 Review [RID 66]
Priority : 1
Need : A
Qualifier : RP

The CIP specification shall be produced with reference to the Directory Interchange Format (DIF)[R26].

UR Id : 409
Source : CIP-BS Team
Priority : 1
Need : A
Qualifier : RP

The CIP specification shall be produced with reference to the Global Change Master Directory (GCMD)[R35].

UR Id : 410
Source : CIP-BS Team
Priority : 1
Need : A
Qualifier : RP

The CIP specification shall be produced with reference to the GEO data definitions (GEO)[R36].

UR Id : 411
Source : CIP-BS Team
Priority : 1
Need : C
Qualifier : RP

The CIP specification shall be produced with reference to the forthcoming GIS standard (GIS)[R37].

Note : The production of the standard is to some extent TBC and outside of the PTT control. This requirement is included to ensure that it is taken into account as appropriate when it is complete, as it is likely to be an important specification that will aid facilitate CIP/GIS interoperability.

UR Id : 412
Source : STN [R32] / CIP-BS Team
Priority : 2
Need : B
Qualifier : T

The Retrieval Manager shall comply with CEOS guidelines for inclusion of Retrieval Managers into the CIP domain as specified in the ICS SDD ([R34]).

Note : This is to ensure that Retrieval Managers added to the CIP domain are CIP compliant so that the addition of a new Retrieval Manager does not negatively affect the CIP domain as a whole. Further documents, such as System Administration manuals, CIP-C specification etc may also be referenced in later versions of this document.

UR Id : 413
Source : CTN [R33] / CIP-BS Team
Priority : 1
Need : B
Qualifier : R

The Retrieval Manager shall maintain the collection hierarchy it owns in accordance to the guidelines defined in the ICS Collection Manual (TBC).

Note : This is to ensure that the collection hierarchies in the CIP domain comply with the ICS guidelines for their maintenance.

3.2.11 Resources Requirements

No resource requirements can be currently identified for production of the CIP beyond the staff resources currently employed. The Retrieval Manager is not yet planned for design and implementation, so resource requirements are also not yet appropriate.

3.2.12 Timescales Requirements

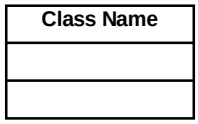
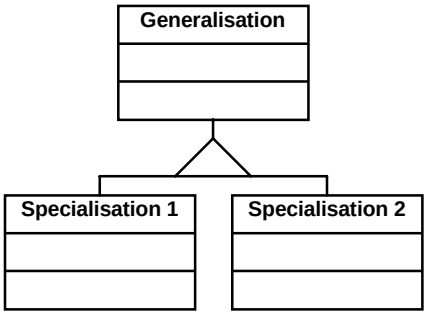
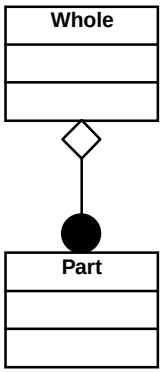
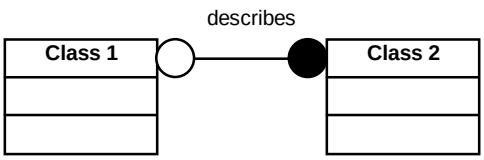
A constraint on the software design may be the timescales for its specification, design and implementation. These may be phased, in the case of the CIP development, current plans are only for the CIP specification production. The timescales for this are reflected in the requirement defined in this section.

UR Id : 414
Source : DPRS Team
Priority : 1
Need : N/A
Qualifier : N/A

The CIP specification production shall be performed to the timescales defined for the Release A, Release B and Release C phases.

Note : Release A was completed and approved by CEOS in March 1996.. Releases B is planned to be approved in January 1997. The timescales for Release C are currently envisaged to be January 1998 and February 1997 [TBC].

Appendix A. OBJECTED ORIENTED DIAGRAM NOTATION

Class-&-Object		Defines a class and its associated objects which provide an abstraction of something within the problem domain. The class contains attributes (data) and methods (functions) which are common between all objects of the class. Example: **item descriptor** is a class (or object).
Generalisation; Specialisation		Defines generalisation-specialisation relations between classes. The specialisation classes inherits the attributes and services of the generalisation class. A generalisation class can have one or many specialisations. A specialisation can have one or more generalisations. Example: a **guide-item descriptor** object is a specialisation of an **item-descriptor** object.
Whole-Part		Defines whole-part relations between objects. The whole object can have zero or more parts. A part belongs to one or more wholes. The cardinality of the relation is shown as: ● (zero or more), ○ (zero or one), ●***1+*** (one or more), or — (one). Example: an **item descriptor** object comprises of one or more **attribute** objects.
Instance Connection		Defines associations between objects. An object may need to know about other objects in order to fulfil its duties. The cardinality of the relation is as defined for whole-part relations. A relation has two labels, these labels help to define the role of the classes with respect to the relation. The role of a class, with respect to a relation, is defined by the closest label. Example: a **package-collection item descriptor** object describes one or more **product data** objects.

Appendix B. Deleted URD Requirements

This appendix is a list of those URD requirements that have been deleted during the development of this document. The deleted requirements are maintained in this appendix so as to maintain traceability throughout the development of the document.

For the definition of the ICS URD/CIP-B URD, the requirements were significantly reworked and renumbered, effectively removing the traceability. This appendix therefore contains untraceable deleted requirements from the 0.1 Review and will contain any requirements deleted from the ICS URD PTT review.

Requirements Deleted Following URD 0.1 Review (30 July 1995)

UR Id	:	D 2.2
Source	:	DPRS TN [R1, Section 4.1.5]
Priority	:	1
Need	:	A
Qualifier	:	RP

The CIP shall support hierarchical collections of collection descriptors.

Note	:	*A hierarchical layer comprising a collection of one or more collections, each of which contains only EO product descriptions, maps onto a CEOS 'Directory'.*

UR Id	:	D 13.0
Source	:	DPRS TN [R1, Section 4.1.6]
Priority	:	2
Need	:	B
Qualifier	:	RP

The CIP shall endeavour to correctly process those objects whose attributes are described by only some or none of the required semantic attributes.

Note	:	*As the semantic attributes are primarily to aid the CIP, particularly to reduce ambiguous queries, it may be that queries of data with reduced semantic attributes sets may produce unexpected results, but it is important that the queries are attempted wherever possible.*

UR Id	:	D 17.0
Source	:	DPRS TN [R1, Section 4.1.6]
Priority	:	1
Need	:	A
Qualifier	:	RP

The CIP shall support an 'Extended' set of extra optional attributes to the minimum set, which will be defined in the CIP specification.

Note	:	*This 'Extended' set of attributes will be understood by the CIP but not necessarily applicable to all on-line catalogue systems.*

UR Id : D 22.0
Source : DPRS Team
Priority : 2
Need : A
Qualifier : RP
The CIP search query language objects should be derived from those used in the CIP specification.
Note : This requirement is so that a 'reader' of the CIP will be able to understand the search query language and vice-versa.

UR Id : D 24.10
Source : DPRS Team
Priority : 1
Need : B
Qualifier : RP
The CIP search query language shall support the use of logical choice operators such as 'IF', 'THEN', 'ELSE' for use in defining queries.
Note : The above list is not a conclusive list.

UR Id : D 34.0
Source : DPRS Team
Priority : 1
Need : A
Qualifier : RP
The CIP shall support specification of the 'level' of collection search within a collection hierarchy.

UR Id : D 69.0
Source : DPRS Team
Priority : 1
Need : N/A
Qualifier : T
The Retrieval Manager shall support the query traversal of hierarchical collection trees.

UR Id : D 78.1
Source : SoW [R2, Section 4.3.3.4]
Priority : 1
Need : N/A
Qualifier : RD
The Retrieval Manager shall support communications via electronic ground links.
Note : This may be based on ESA supported network infrastructure in the case of the ESA Retrieval Manager implementation.

UR Id : D 78.2
Source : SoW [R2, Section 4.3.3.4]
Priority : 1
Need : N/A
Qualifier : RD
The Retrieval Manager shall support communications via satellite links.

Note : *This could include e.g. 64 kbps broadcast dissemination and 2 Mbps point to point dissemination for the ESA Retrieval Manager implementation.*

UR Id : D 78.3
Source : SoW [R2, Section 4.3.3.4]
Priority : 1
Need : N/A
Qualifier : RD
CIP data communications via ground or satellite links shall be based on TCP/IP.

UR Id : D 78.4
Source : SoW [R2, Section 4.3.3.4]
Priority : 1
Need : A
Qualifier : RP and RD
All telecommunication mechanisms should follow the client-server paradigm.

UR Id : D 88.0
Source : DPRS Team
Priority : 2
Need : B
Qualifier : RP and RD
The CIP and Retrieval Manager shall be developed with reference to the requirements of the ESA ENVISAT programme.
Note : *This requirement is to ensure that the development takes account of this development which could be one of the first major uses and demonstrations of the CIP and Retrieval Manager. The specific demands of ENVISAT form an excellent test-bed for verifying the CIP concepts. ENVISAT is part of the International Earth Observing System (IEOS) and features large data volumes and instruments with a wide range of geometries and product structures.*

UR Id : D 89.0
Source : DPRS Team
Priority : 1
Need : A
Qualifier : RP
The CIP and Retrieval Manager shall be developed with reference to the requirements of the ESA MUIS programme.
Note : *This requirement is to ensure that the development takes account of this development which could be a major user and demonstration of the CIP and Retrieval Manager. The specific demands of MUIS form an excellent test-bed for verifying the CIP concepts. -MUIS will include a strong element of interoperation between existing systems and missions.*

UR Id	:	D 98.0
Source	:	DPRS Team
Priority	:	1
Need	:	N/A
Qualifier	:	RD

The Retrieval Manager should support extensions and additions to the CIP without the need for significant software changes.

Requirements Deleted Following URD 2.0 Review (September 1996)

UR Id : D 58.0
Source : CINTEX 2nd Protocol Workshop (20 - 22 April '95)
STN [R32] / CIP-BS Team
UR deleted as a result of RID [CCRS/BM/27]
Priority : 2
Need : B
Qualifier : RP

The CIP shall support confidentiality.

Note : *This is to ensure that information exchanged via the CIP remains confidential when desired. This shall include the encryption of the user entered password. It should also include the encryption of sensitive information, such as the content of order request, and in particular pricing information.*

UR Id : D 38.1
Source : DPRS TN [R1, Section 4.1.5.10]
UR deleted as a result of RID [BNSC/17]
Priority : 1
Need : A
Qualifier : RP

The CIP shall support browse retrieval requests where a product descriptor has not previously been retrieved.

Note : *This requirement is so that an already known product identifier can be used to obtain the browse data without having to locate the product descriptor. It also implies that the CIP does not have to validate the potential existence of browse data prior to processing the request.*

UR Id : D 87.1
Source : SERC
UR deleted as a result of RID [WWW/05, WWW/06]
Priority : 1
Need : B
Qualifier : T

A CIP Client shall name hot collections in accordance with the syntax for collections as defined in the CIP specification.

UR Id : D 49.3
Source : OTN [R31] / CIP-BS Team
UR deleted as a result of RID [NASA/LR/09]
Priority : 2
Need : C
Qualifier : RP

The CIP shall support the automatic update of order request status information to a user.

Note	:	*This requirement allows users to be automatically informed about every status change of their order requests. This information could be passed to the user either via the client (which supposes a client which would be continuously available)or via e-mail.*
UR Id	:	D 31.1
Source	:	DPRS TN [R1, Section 4.1.5.9] *UR deleted as a result of RID [NASA/LR/06]*
Priority	:	1
Need	:	A
Qualifier	:	RP

The CIP shall support a product descriptor search query via attribute names.

Note	:	*This search is to enable location of product descriptors that are defined by certain attributes, the specification is not by attribute value but by the attribute's name (i.e. the attribute identifier).*

UR Id	:	D 60.0
Source	:	STN [R32] *UR deleted as a result of RID [NASA/GP/26]*
Priority	:	2
Need	:	B
Qualifier	:	RP

The CIP shall support the use of application firewalls. (TBC)

Note	:	*It may be that this is in fact transparent to the CIP and that it is the responsibility of CIP data providers to ensure that application firewalls do not impeded or restrict the CIP usage. This will be explored further in practical investigations*