
**Information technology — JPSearch —
Part 1:
System framework and components**

*Technologies de l'information — JPSearch —
Partie 1: Cadre système et composants*

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

In exceptional circumstances, when the joint technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide to publish a Technical Report. A Technical Report is entirely informative in nature and shall be subject to review every five years in the same manner as an International Standard.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC TR 24800-1 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

This second edition cancels and replaces the first edition (ISO/IEC 24800-1:2007) which has been technically revised.

ISO/IEC TR 24800 consists of the following parts, under the general title *Information technology — JPSearch*:

- *Part 1: System framework and components [Technical Report]*
- *Part 2: Registration, identification and management of schema and ontology*
- *Part 3: Query format*
- *Part 4: File format for metadata embedded in image data (JPEG and JPEG 2000)*
- *Part 5: Data interchange format between image repositories*
- *Part 6: Reference software*

Introduction

JPSearch aims at providing a standard for interoperability of still image search and retrieval systems. Many systems provide functionalities for storing, annotating, sharing, searching and retrieving images on computer desktops, on the World Wide Web, on imaging devices, and in other consumer and professional applications. Existing systems are implemented in a way that tightly couples the different functionalities, often providing only proprietary and restricted interfaces to the users and third-party applications. This severely constrains the users capacity to freely migrate their data and metadata between different systems. Moreover, it also limits the capacity of the different systems to interoperate.

JPSearch provides a set of standardized interfaces of an abstract image retrieval framework, facilitating the use and reuse of metadata and the use and reuse of metadata schemas to provide a common context for image data and metadata searching and interchanging. JPSearch also provides a common query language and a repository information interchange format, facilitating the deployment of distributed repositories and allowing users to easily migrate their data and metadata between different applications and devices.

In order to help the reader to understand the scope and usage of this part of ISO/IEC 24800, the informative Annexes A and B are provided. Annex A clarifies the scope of JPSearch by providing several use cases in different application domains. Annex B illustrates how to use ISO/IEC 24800 by presenting a representative use case and the way it would be implemented using ISO/IEC 24800.

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Information technology — JPSearch —

Part 1: System framework and components

1 Scope

This part of ISO/IEC 24800 provides a global view of the JPSearch framework. In the other parts of ISO/IEC 24800, several standardized technologies are specified. The scope and aims of the individual parts are highlighted in the following clauses.

2 Terms, definitions and abbreviated terms

For the purposes of this document, the following terms, definitions and abbreviated terms apply.

2.1

annotation

metadata added to an image by way of definition or comment

NOTE It is normally in text and done by a human.

2.2

metadata

data about data

EXAMPLE An image is a data item. Metadata about the image may include information such as the size of the image, the date it was created, etc.

2.3

query

request for information from a search and retrieval system

2.4

query-by-example

type of query where an example of the answer desired is used as the input to the search system

2.5

semantics

mapping between elements of a language and the real world

2.6

syntax

set of rules that govern whether a sentence (or other unit of communication) is well formed

3 Motivation

There are many applications that provide image search and retrieval functionality on computer desktops, on the World Wide Web, on imaging devices, and in other consumer and professional applications. These implementations are characterized by significant limitations, including:

- **Lack of the ability to reuse metadata:** Some relevant functionality of still image management systems (search, cataloguing, digital rights management, etc.) rely on or can be benefited by the existence of metadata describing aspects of user's images and image collections. Independently of the way these metadata have been obtained (automatically, manually or cooperatively), they can have an inestimable value, because their generation often involves a cost (in whatever form), and sometimes it cannot be redo (e.g. geolocation metadata). The usage of proprietary interfaces and metadata models by image management systems severely constraints the exploitation and reuse of the metadata by their legitimate owners, the users.
- **Lack of a common query format and search semantics:** There is a trend towards shared image repositories. These could be on the web, but there are also systems that publish user repositories residing on their local (e.g., home) machines for (normally access controlled) public viewing and annotation. As the number and size of such repositories increase (a monotonic increasing trend), search becomes an essential function for users and applications to look up images. Unfortunately, the various systems providing image search, whether on the desktop or on the web, do not provide a common way of specifying neither precise input parameters to describe the search criteria nor a set of output parameters to describe the aggregated return result sets for user presentation or machine consumption. System providers need a reference standard to remove ambiguity and make searching over shared repositories consistent.

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These are just the two main problems where still image search systems can benefit tremendously from standardization. The provision of uniform ways to interact with these systems greatly improves the users' capacity to manipulate and relocate their data and metadata, but also enables interoperability between systems in a distributed scenario (e.g. content providers, aggregators and clients). Finally, the provision of uniform interfaces for programmatic access enables platform independence (which benefits also non-distributed scenarios); developers can write their applications involving access to an image repository independently of the underlying technology of the repository, which fosters software reusability and maintainability.

4 Overview of JPSearch

ISO/IEC 24800 (JPSearch) provides a set of standardized interfaces for digital image management and retrieval systems. Figure 1 shows the three main processes of the digital image life cycle which are covered in ISO/IEC 24800:

- **Creation/Maintenance:** The client can create or maintain data on a repository using standardized data exchange format in which a digital image (resource) and its associated metadata are packed in a single data entity to guarantee their persistent association. The format can be used for client to download/upload data on repositories, so image and metadata portability from one repository to another can be easily implemented.
- **Synchronization:** The client can synchronize entire or partial set of image on a repository with local data. Through the synchronization of local data with different two repositories, data migration from one repository to another, for an example between cloud and a portable device, can be achieved.
- **Search/retrieve:** Clients can express a set of precise input parameters to describe their search criteria in addition to a set of preferred output parameters to depict the return result sets.

The fact that these different processes depend on a certain way of referring to or expressing image metadata poses a challenge in terms of metadata interoperability, as JPSearch is not restricted to a single metadata schema. In on hand, the standard provides a reference metadata schema so called the JPSearch's Core Metadata Schema, which serves as metadata basis supporting interoperability among various image retrieval systems. On the other hand, the standard provides a translation rule language, which allows the publication of machine-readable translations between metadata terms in the JPSearch Core Metadata Schema and metadata terms belonging to proprietary metadata schemas.

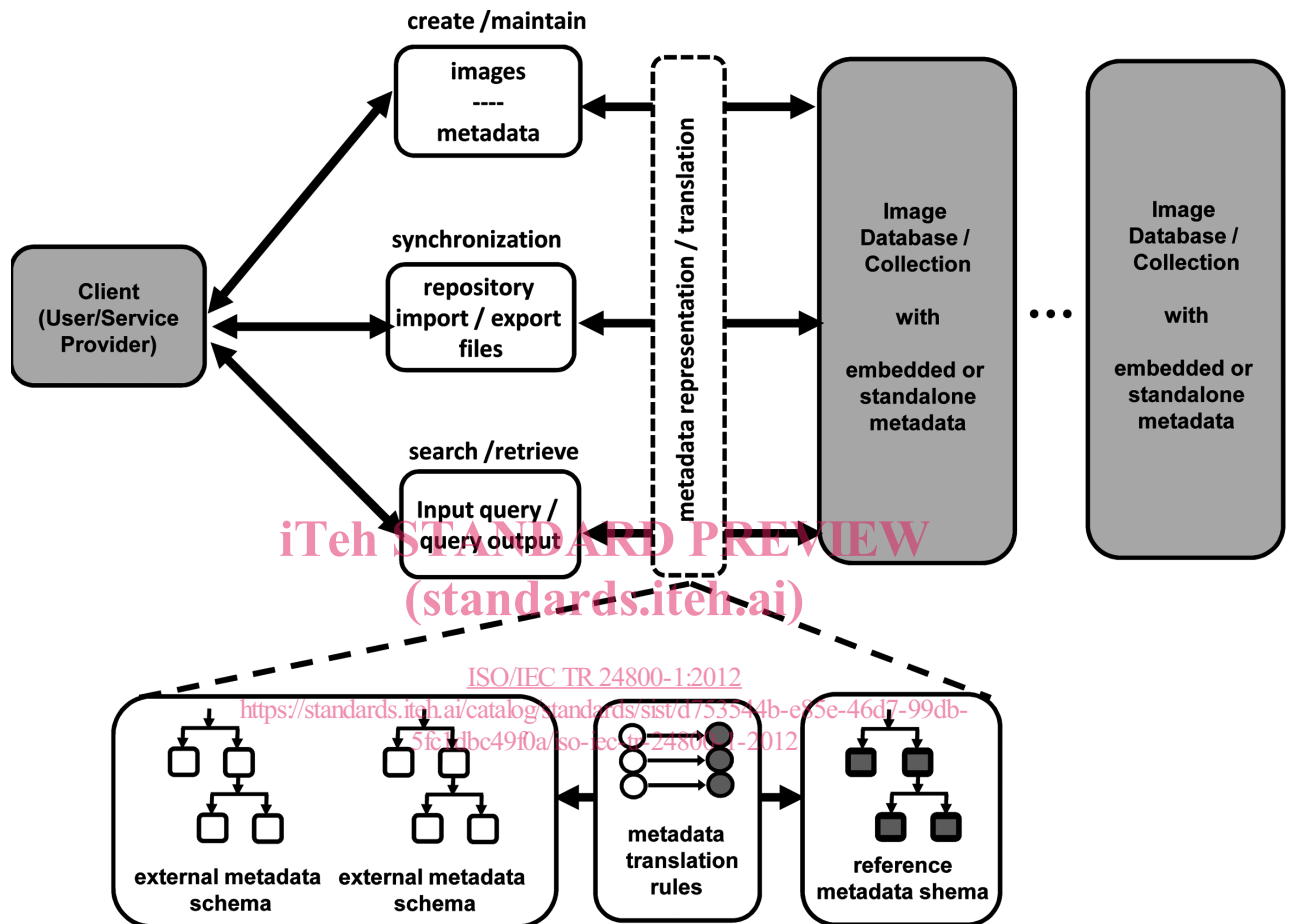


Figure 1 — Image search and management process

JPSearch is designed as a multi-part specification. Three main processes are standardized by JPSearch specification: search and retrieval by Part 3 (query format), the creation or maintenance of metadata by Part 4 (file format for metadata embedded in image data) and the synchronization or migration of repositories by Part 5 (data interchange format between image repositories). Part 2 (registration, identification and management of schema and ontology) links all the other parts to a common metadata interoperability model, which plays a key role in ISO/IEC 24800 and it is explained next. Part 1, i.e. this document, and Part 6 (reference software), are intended to help understanding and developing JPSearch compliant systems. Figure 2 shows the overall structure of the JPSearch standard. Note that it is not in the scope of JPSearch to standardize the individual components of an image retrieval repository (e.g., feature comparison, result generation, etc.). Instead, the standardization concentrates on specifying interface definitions among image retrieval components in order to ensure image search in a distributed heterogeneous environment.

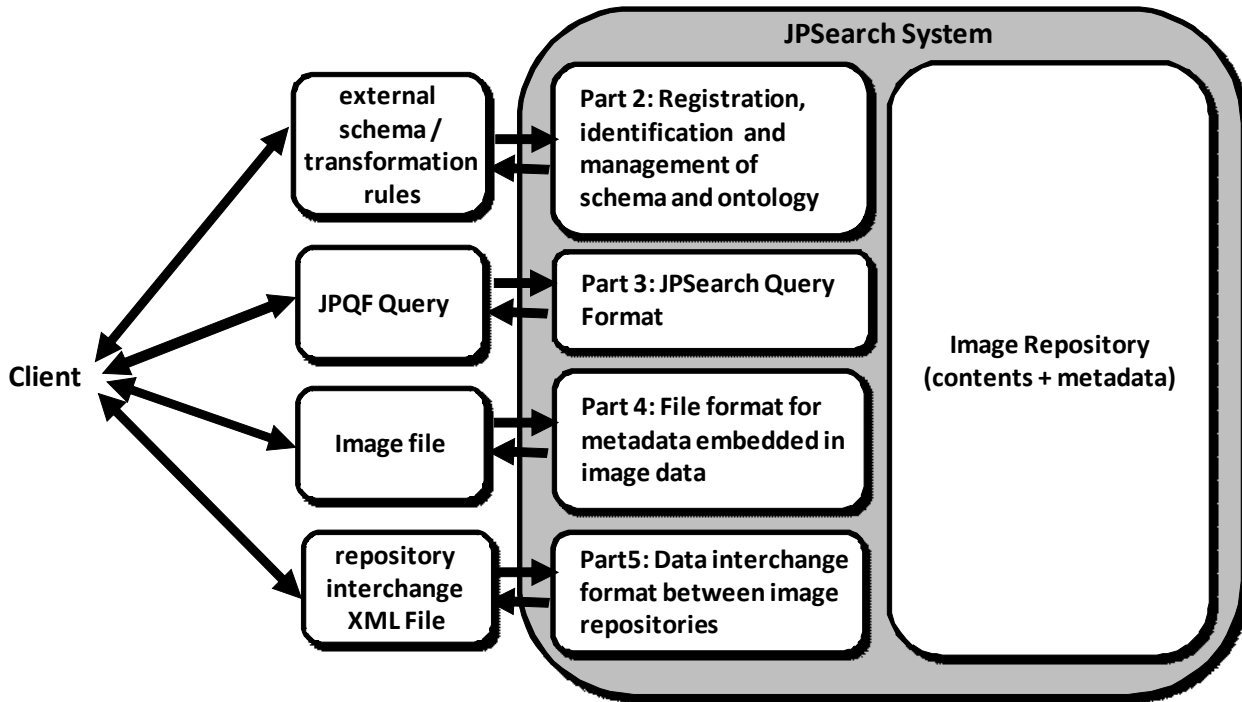


Figure 2 — Overall structure of ISO/IEC 24800 (JPSearch)

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5 JPSearch metadata interoperability model

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All JPSearch interfaces (querying, file format, synchronization) depend on a certain way of referring to or expressing image metadata, so metadata interoperability plays a crucial role in ISO/IEC 24800. The JPSearch framework is extremely flexible in terms of metadata management, and it is not restricted to a single metadata format. In order to achieve the maximum level of flexibility, the JPSearch framework supports image metadata compliant with any metadata format which can be serialized in XML. Examples of supported metadata formats include Dublin Core and MPEG-7. Figure 3 shows a graphical overview of the JPSearch Metadata Interoperability Model.

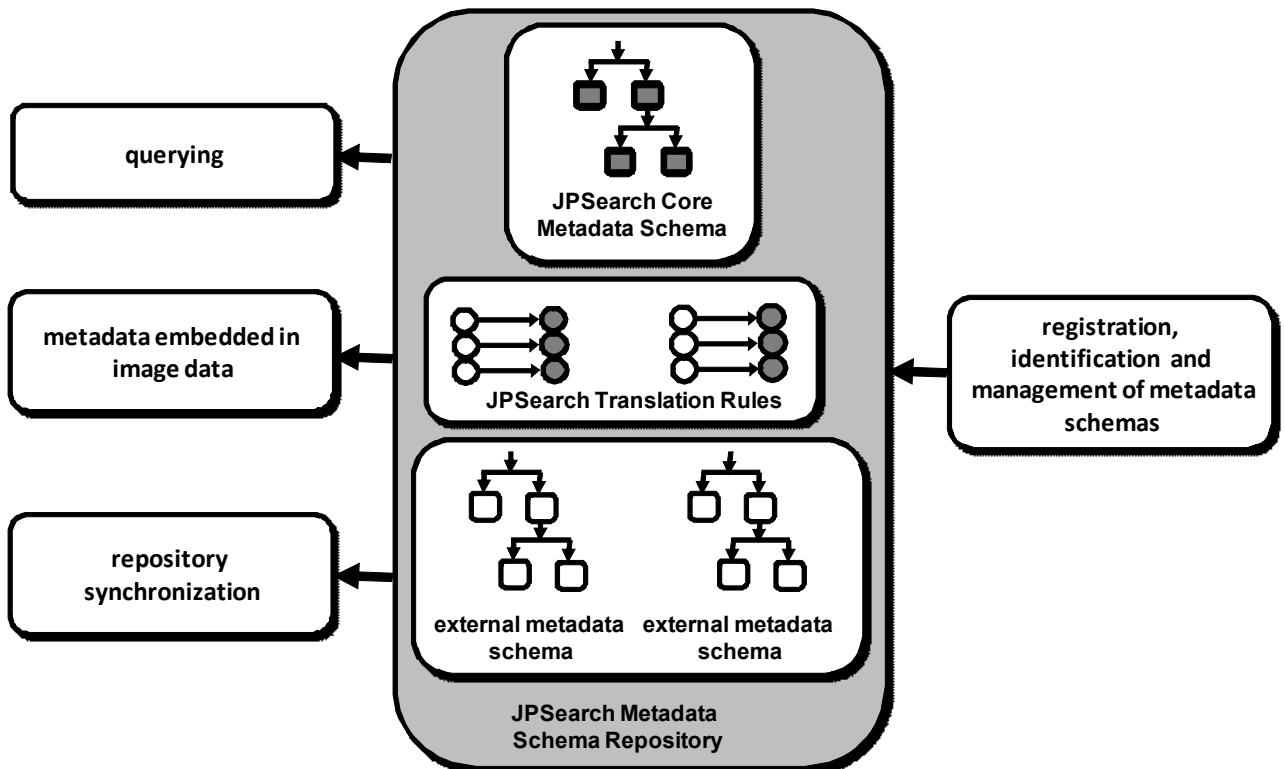


Figure 3 — JPSearch metadata interoperability model overview
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Despite of the fact that any XML-based metadata format can be used, JPSearch specifies the JPSearch's Core Metadata Schema as the cornerstone of metadata interoperability in ISO/IEC 24800. The Core Schema specifies the structure and rules to which any metadata of images must conform in order to be considered valid within a JPSearch compliant system. In addition to the definition of JPSearch Core Metadata Schema, ISO/IEC 24800 provides a mechanism that allows a JPSearch compliant system taking profit from proprietary or community-specific metadata schemas. A translation rules language allows the publication of machine-readable translations between metadata terms belonging to proprietary metadata schemas and metadata terms in the JPSearch Core Metadata Schema. Users can choose which metadata language to use in a JPSearch-based interaction (annotation, querying, etc.) if the proper translations are available. ISO/IEC 24800-2 specifies the general rules which govern the usage of metadata in JPSearch.

6 JPSearch Part 2: Registration, identification and management of schema and ontology

6.1 Basic structure and benefits

ISO/IEC 24800-2 provides a specification which:

- Provides rules for the representation of image metadata descriptions, consisting in the definition of the JPSearch Core Metadata Schema.
- Provides rules for the publication of machine-readable translations between metadata terms belonging to proprietary metadata schemas and metadata terms in the JPSearch Core Metadata Schema.
- Provides rules for the registration and request of metadata schemas and its translation rules or links to them.

JPSearch is an extensible standard. The normative method of extending the structures and rules beyond the JPSearch Core Metadata Schema is provided in the standard.

6.2 JPSearch Core Metadata Schema

The JPSearch Core Metadata Schema is the main component of the metadata interoperability strategy in ISO/IEC 24800. It specifies the structure and rules to which any image metadata must conform in order to be considered valid within a JPSearch compliant system. The core schema serves as metadata basis supporting interoperability during search among multiple image retrieval systems. The core schema is used by clients to formulate, in combination with the JPEG Query Format, search requests to JPSearch compliant search systems. Note, that only metadata described by the core schema is guaranteed that its semantics is recognized by JPSearch compliant systems.

The following example shows the description of a fictional image.

```
<?xml version="1.0" encoding="iso-8859-1"?>
<ImageDescription xmlns="urn:jpeg:jpsearch:schema:coremetadata:2009"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="urn:jpeg:jpsearch:schema:coremetadata:2009 24800-2-core.xsd">
  <Identifier>urn:unique:identifier:1:2:3</Identifier>
  <Creators>
    <GivenName>John</GivenName>
    <FamilyName>Smith</FamilyName>
  </Creators>
  <CreationDate>2011-12-17T09:30:47.0Z</CreationDate>
  <ModifiedDate>2011-12-17T09:30:47.0Z</ModifiedDate>
  <Description>Sample description</Description>
  <Keyword>Sardinia</Keyword>
  <Keyword>Italy</Keyword>
  <Keyword>50th JPEG meeting</Keyword>
  <Title>Example Instance document of the JPSearch core schema</Title>
  <GPSPositioning latitude="34" longitude="34" altitude="10"/>
  <RegionOfInterest>
    <RegionLocator>
      <Region dim="2"> 0 0 100 100</Region>
    </RegionLocator>
    <Description>A short description about the selected region
    </Description>
    <Keyword>plenary meeting</Keyword>
  </RegionOfInterest>
  <Width>640</Width>
  <Height>480</Height>
</ImageDescription>
```

However, the core schema neither is intended to be the unique schema used for annotating images, nor is it intended to replace existing well-established metadata schemas such as MPEG-7 or Dublin Core. The JPSearch Core Metadata contains a set of minimal core terms that can be extended in two different ways:

- 1) By extending the Core Schema through ExternalDescription elements, as is in the following example:

```
<ImageDescription>
...
  <ExternalDescription>
    <TagName fromNamespace="urn:mpeg:mpeg7:schema:2004"
fromNamespacePrefix="mpeg7">mpeg7:ColorLayout</TagName>
    <StructuredValue fromNamespace="urn:mpeg:mpeg7:schema:2004">
      <mpeg7:Mpeg7 xmlns:mpeg7="urn:mpeg:mpeg7:schema:2004"
xsi:schemaLocation="urn:mpeg:mpeg7:schema:2004 M7v2schema.xsd">
        <mpeg7:DescriptionUnit xsi:type="mpeg7:ColorLayoutType">
          <mpeg7:YDCCoeff>1</mpeg7:YDCCoeff>
          <mpeg7:CbDCCoeff>2</mpeg7:CbDCCoeff>
        </mpeg7:DescriptionUnit>
      </mpeg7:Mpeg7>
    </StructuredValue>
  </ExternalDescription>
</ImageDescription>
```