TECHNICAL SPECIFICATION FOR A FULL SERVICE IMAGE PORTAL

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BACKGROUND

The Pixus Image Portal builds on the earlier work of the Pixus Image Portal Demonstrator [PIXUS]. The demonstrator showed cross searching of 7 image collections from diverse domains including medicine and the visual arts. At the Pixus Image Portal Demonstrator interactive web site, users can enter search terms, select their domains of interest, and browse matching images. The demonstrator can pass the user to the web site of the collection to allow the user to pursue further their interest in a particular image. The demonstrator includes various additional services beyond the core cross-searching facility, to enhance the role of the portal in learning, teaching and research. These include "lightboxes", a facility to collect together images into named sets over multiple visits to the web site. This allows a teacher, for example, to collect together a set of images for use in a lecture course they are preparing.

The functional and user requirements of the Pixus Image Portal are set out in [PIXUS-FUNC] and [PIXUS-USER]. Along with this document, these three documents are a specification for a full JISC Image Portal Service.

The Pixus Image Portal development is a part of the JISC Information Environment [JISC-IE], DNER Portals Programme [DNER-PORT], strand 1, "Doorways to the future - Accessing online resources through portals".

OVERVIEW

The Pixus Image Portal provides a single point of access to a domain-independent virtual union collection of images. A set of image collections agree to participate in the Pixus Image Portal, for example, AHDS Visual Arts [VADS], and SCRAN [SCRAN]. The Pixus Image Portal is a system which makes it look as if the images in these collections are all pooled into a new Pixus image collection. In time, more image collections may decide to join Pixus. Pixus provides "thick portal" access to this virtual collection, meaning that it provides users with the service not only of finding relevant content, as does Google, but also of presenting the content to the user, and helping the user use the content by providing additional services to support the use of images in learning, teaching, and resarch. At some point in the user's dialogue with Pixus, the user may want to go directly to the underlying collection which holds the image. The collection can provide services beyond the scope of Pixus, such as licencing an image for publication. Pixus may also have served just as a single point of discovery for the most appropriate individual image collection for the user's needs. The user may then continue their research directly with the underlying

collection.

Pixus's primary mode of delivery is as an interactive web site. The web site developed during the demonstrator is shown in appendix 2. The web site can also be embedded into other web sites, for example, a university library may offer Pixus within their own web site in order to provide a single point of access to a wide range of locally-determined material, including images, for their users. Indeed, depending on branding policy. the existence of Pixus need not be apparent to the user, it simply provides images to illustrate the library (or other) catalogue.

Pixus can also have other delivery modes such as RSS and Z39.50.

Beyond the basic ability to find images, Pixus offers additional support for using images. Pixus provides guidance and references to guidance about the use of images in learning, teaching, and research. Pixus also offers personalized features such as saved searches, and lightbox facilities for grouping and remembering sets of images.

Pixus is domain independent. This means it will hold images from a wide variety of subject areas. Users from HE/FE only need to know of a single place, Pixus, for access to images for all purposes. This presents a challenge to Pixus developers to make a coherent and useful portal across such a diversity of content. The solution lies in employing very simple metadata schemas across the entire virtual collection, and providing mechanisms to determine the user's domain of interest through classification of the underlying collections by subject area.

As part of the JISC Information Environment, the Pixus Image Portal must adhere to the specifications in the Baseline Portal Functional Specification [JISC-PORTSPEC - http://www.ukoln.ac.uk/distributed-systems/jisc-ie/arch/portal/spec/].

Pixus wants to promote standards and good practice among participating collections. However, if the participation requirements are highly prescriptive, not many collections will be able to join Pixus. Therefore the interface between Pixus and individuals collections is flexible to allow wider participation at lower cost to the collections.

PIXUS ARCHITECTURE

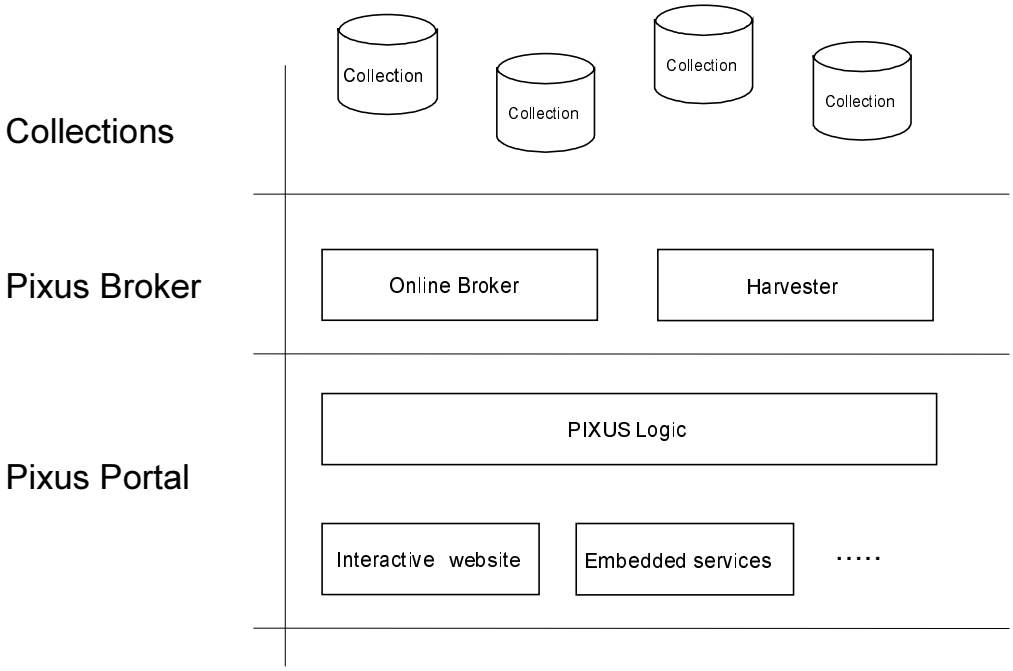


Figure 1. Pixus system architecture.

The abstract architecture of the Pixus system is shown in figure 1.

The Pixus Broker implements the virtual union image collection which is searched and served by Pixus. The Pixus Portal provides additional Pixus services, and delivers Pixus through its chosen delivery channels.

THE PIXUS BROKER

Introduction

Pixus provides access to a set of image collections which are each hosted remotely from Pixus. This is implemented in the Pixus Broker, a layer of software which manages remote connections and protocols and deals with metadata issues. Collections are, predominately, accessed using electronic network connections between the machines. Pixus supports two categories of connection:

- On-demand: Pixus contacts the remote collection in direct response to a user's request to Pixus. Protocols to achieve this include HTTP for images, and Z39.50 for metadata.
- Harvested: Pixus contacts the remote collection periodically and keeps a copy of relevant data. When a user requests access to this collection's data, Pixus accesses the local, harvested, copy. Protocols include OAI-PMH for metadata and HTTP for images. Ad hoc harvesting can also be done by manually loading a copy of an image collection onto Pixus's servers.

The Pixus broker also manages metadata mappings, understanding the schemas of the collections and of Pixus, and knowing how to query into the collections and to retrieve and translate data. Similarly, Pixus understands the image formats, image sizes, etc. which are available at

the collections and how to convert them to those required by Pixus.

In this technical specification, access to images is described separately from metadata querying and delivery. This reflects the use of HTTP as the universal protocol for image delivery, and suggests a portal architecture. Note that the choice between on-demand access and harvested access to a collection's data can be made separately for metadata and for images.

Metadata Access

The image portal needs be able to provide additional information, metadata, with the images and to search this metadata to identify images for retrieval. In the DIG35 [DIG35] metadata standard, the Digital Imaging Group classify metadata as follows:

Basic:
: Generic information independent of any use of the image, such as the image size, format, compression, colour model etc.

Creation:
: Information about the creation of the image. This information is persistent and remains associated with the image throughout the workflow.

History:
: The history information describes any manipulations the image has undergone in deriving it from one or more source images.

Intellectual Property Rights and Exploitation:
: This information describes the rights associated with an image.

Content description:
: This information describes the subject depicted in the image. Where the image is of a creative work such as a painting, it may also describe the subject of the work itself.

Basic, creation and history metadata is sometimes referred to collectively as “technical metadata.”

A generic system architecture has to take into account the different interests in and applications for these different types of metadata and provide the appropriate interfaces to allow it to be accessed and maintained.

The Pixus demonstrator offers a common metadata model. Following current practice and the metadata actualy available from the targets, the common metadata model was based on the Dublin Core Metadata Element Set (DCMES) [DC]. This approach has worked well but there is a wish from the users to see more metadata at the portal so that they don't need to refer to the source collection.

The common metadata model provides essentialy content description metadata. This, together with free-text seaching into the metadata fields, has supported the Pixus searching function very well. Some users have wanted more detailed access points for searching but it's difficult to see how this can be provided in a generic way. One possibility would be to support a range of metadata schema and allow

the user to specify the metadata schema they want to use. This could work from a user interface point of view but it may be difficult to support with the metadata available from the source image libraries.

Users have asked for information other than the content description metadata of the common metadata model. In particular they have asked for more rights and exploitation information. They would like such information to be available on a per-image basis without reference to the collections themselves. A next-generation Pixus could provide such information following a model such as that developed by the Visual Resources Association (VRA Core) [VRA] or the Digital Imaging Group's DIG35 metadata standard. Where the collection applied the same rules to all images, the portal could hold this information in the service profile and add it automatically. That way collections which did not address rights and exploitation metadata on a per-image basis would not be at a disadvantage.

There is a less well articulated wish for additional technical metadata - typically to inform what sizes and formats of the image are available, again without reference to the collections themselves. It would be straightforward to supply this although it would be helped if there were a general agreement as to a standard set of image sizes.

Providing more information at the portal makes the user experience more like working with a single picture library. This is seen as desireable by many users. The same result could be achieved by more seamless integration between the portal and the source collection but this may be difficult to achieve in a heterogenous environment.

In addition to the DCMES schema, Pixus uses a Who-What-Where-When (4W) schema. 4W is used for searching. Where possible, the 4W view is a mechanically-derived simplification of the DCMES view of the data, although in the case of Z39.50 searching, this does not have to be the case. DCMES is used to present metadata to the user alongside an image.

Pixus supports two principle protocols for searching and retrieving metadata: Z39.50/ISO-23950 [Z3950] and the Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH) [OAI]. Collections which choose to be harvested using OAI-PMH will have their metadata collected at agreed times. The metadata will be stored locally at Pixus. Collections which choose to be searched using Z39.50 will be contacted each time a user causes Pixus to want to search or retrieve data from that collection.

Z39.50 support should include Bath Profile [BATH], although a wider degree of flexibility is needed to cover the actual Z39.50 offerings by collections. In particular, the mapping to Dublin Core and 4W will often happen in Pixus rather than in the Z39.50 server.

OAI-PMH support need harvest only the Dublin Core record which is always present in an OAI record. Some mapping will be necessary especially to identify the image reference in the record and to map to 4W.

Mappings need to be established with the collection holders. The mappings required during the Pixus Image Portal Demonstrator project

are set out in appendix 1.

Image Access

Images are delivered to users using HTTP. Pixus offers collections two options for image delivery: hosted at Pixus (harvested) or hosted at the collection (on-demand). Collections can choose to host their own images for Pixus delivery. In this case, Pixus generates URLs for images which point directly at the collection's own web servers. Otherwise, Pixus harvests the relevant images from the collection, and generates image URLs which point at Pixus's web servers. When Pixus is hosting a collection's images, Pixus can scale and reformat the images to meet the requirements of the delivery more precisely. When images are hosted by the collection, the image sizes or formats available may not be an optimum match for the delivery, and web site design etc. needs to be aware of this.

Image harvesting can be done by web-crawling a set of directories, or by fetching images in response to OAI harvesting, or in response to a Z39.50 query. To reduce load on servers and network traffic, mechanisms will generally be needed to ensure that this harvesting can be carried out incrementally, that is, so that only new or modified images are collected. Possibilities include using OAI's selective harvesting with datestamps, or profiling a Z39.50 query to retrieve recently modified images. As a last resort, HTTP's If-Modified-Since header field could be used, although this request will have to be issued for every image in the collection.

There are several hurdles to implementing a Pixus image harvester which are discussed in the Pixus Image Portal Demonstrator project Final Report.

Pixus can directly harvest a multiple-image "pack" at the required resolutions. More normally, however, Pixus will harvest a single higher resolution image and then scale it down and reformat it to the necessary image pack specification.

To support the demonstrator web site, the image pack consists of a 150x150 pixel thumbnail and a 500x500 pixel “quarter-screen” image. The demonstrator web site accomodates smaller thumbnails by displaying them centrally in a larger square; smaller quarter-screen images are accomodated by an HTML layout which adapts to the image size. For widespread web delivery, JPEG or GIF are prefered formats, although PNG is understood by many modern web browsers.

Data Flow Diagrams

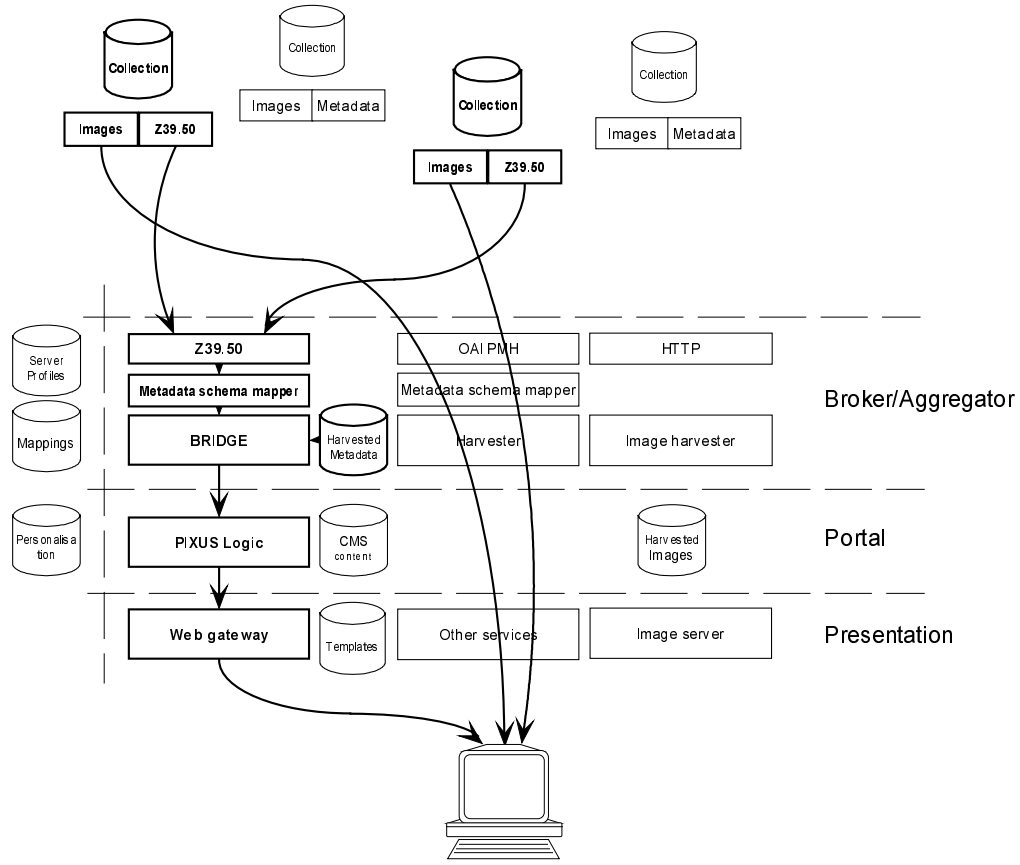


Figure 2. User request data flow.

Figure 2 shows the information flows while processing a request from a user. Collections with harvested metadata are queried by accessing the local store of harvested data; collections with on-demand metadata are queried across Z39.50 connections.

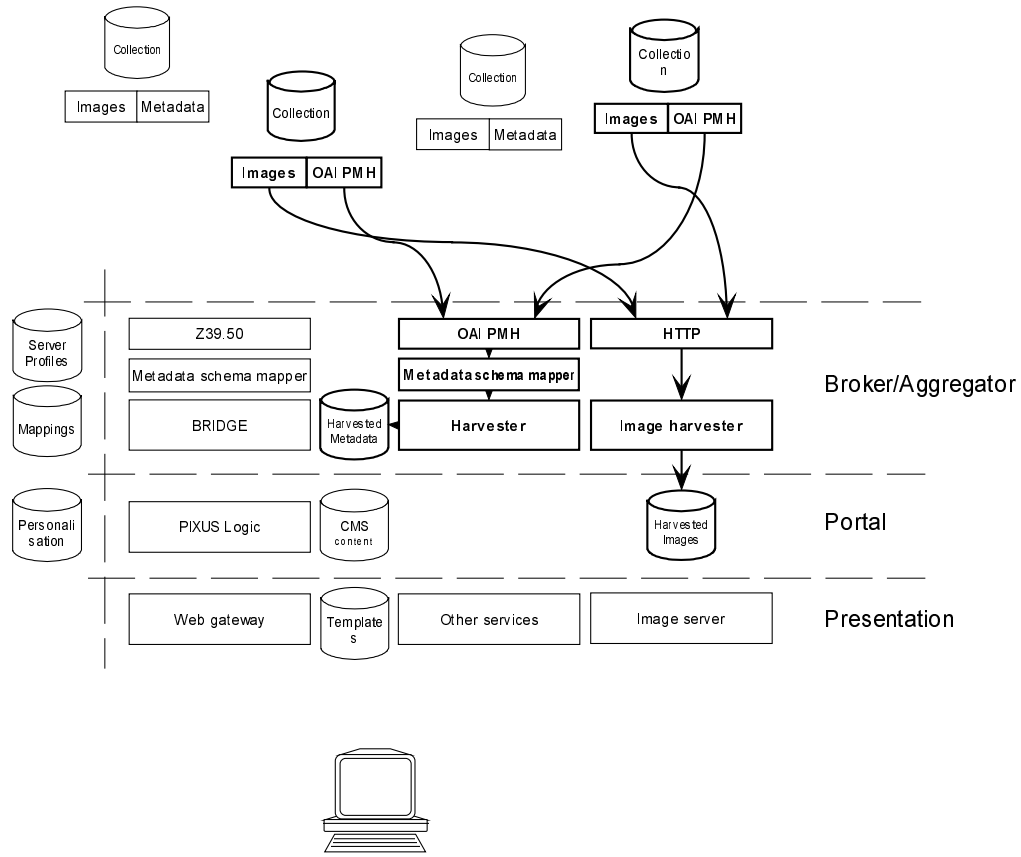


Figure 3. Harvesting data flow.

Figure 3 shows the information flows while off-line (“night-time”) harvesting is being carried out: images or metadata are taken from the collections and stored in the local harvester store.

ADDED SERVICES

Beyond the basic image brokering service, Pixus offers additonal services to help users to use Pixus and to use images found with Pixus in learning, teaching, and research. These services break down into services provided for each individual user, personalized services, and those which users experience equally.

Personalized services

Pixus offers a variety of personalization features. To do this, users need to be identified to Pixus, and this is done using the Athens Access Management System [ATHENS – http://www.athens.ac.uk/]. In the demonstrator, there was also a self-registration system which allowed non-Athens users access to the system. In a production system, access to some image collections or services may be restricted to certain categories of users, as determined by Athens credentials.

Personalized services could also be delivered without registration by using cookies [RFC2109].

- The *lightbox* facility allows users to store images in multiple named sets. The storage is persistant which allows users to accumulate images and work with their lightboxes over many visits to Pixus.

Lightboxes can be annotated which allows users to build up notes about the images, along side the images.

- Pixus automatically saves users' searches providing a *recent searches* service.
- One of the possibilities explored in the Pixus Image Portal Demonstrator project and written up in the Final Report was *personalized RSS newsfeeds*. In essence, users can register searches of interest to them, and an RSS feed will be created which serves a different set of images each day which match the search.

Non-personalized services

Pixus offers a number of services which are not adapted to the specific user for delivery.

- The demonstrator included a Content Management System (CMS) which allowed the creation and maintenance of miscellaneous content, including
  - Pages of information to help users to understand how best to use images in their learning, teaching, and research work.
  - Infomation about the collection holders.
  - Pixus help pages.
- Sample searches. To help users understand the virtual collection, Pixus showcases selected images using sample searches. Pixus maintainers enter searches which produce interesting results, along with a sample image from each search. Visitors to the interactive web site are presented with one of these images selected at random on part of the home page. Clicking on the image executes the appropriate search, showing the user what kind of things Pixus can do.

DELIVERY MODES

The principle delivery mode of Pixus is as an interactive web site. The site built during the Pixus Image Portal Demonstrator project is shown in appendix 2.

The other key delivery mode is as an embeddable “portlet” for inclusion into other interactive web sites or services. This will allow, for example, a university library to provide image searching facilities without sending users off to a separate Pixus web site.

Further potential delivery modes are “up-facing” servers delivering the standard protocols, Z39.50, SRW [SRW] (see [SCULPTEUR] for an example), and OAI-PMH. See the Pixus Image Portal Demonstrator project final reports for a note about inapplicability of non-personalized RSS to Pixus.

SCALABILITY

General

As a Pixus system grows, various issues arise and strains are put on different parts of the system in different ways. Some of these are listed below, categorized into the issues as the number of collections and images grows and the issues as the number of users grows.

One general point is that the strains are not only on the Pixus system and its network connections, but also on the participating collections. Collections can often choose whether they are harvested by Pixus or contacted on-demand. When Pixus usage is low, fewer resources will be consumed if the collection is contacted on-demand. The load implications of a harvest, of metadata or of images, can be intense: suddenly the entire collection needs to shipped out to Pixus. However, as Pixus usage rises, the load imposed by a harvest is outweighed by the increasing load of the on-demand dialogues.

Collection and image growth

As the number of collections, and with that the number of images, grows, the issues which arise are:

- Harvested metadata and images require more local storage. By today's standards, the amount of local storage won't be high.
- Harvesting absorbs more network bandwidth. The use of bandwidth can be controlled since this is an off-line operation which will normally be scheduled at quiet times. The bandwidth requirements can be estimated and, again, by today's standards shouldn't be hard to cope with.
- The local harvested metadata repository will be more onerous to search and result sets will be bigger.
- It becomes more important to encourage users to restrict the number of collections at which they direct their search. Simple lists of check-boxes to select the collections to search do not scale well beyond a dozen or so collections. We have recommended elsewhere that a hierarchical subject or domain taxonomy be introduced to classify collections or parts of collections. A taxonomy browser at the user interface would then help users to select the appropriate sub-set of collections to search. Without this control, searches will place a load across all participating collections whose metadata is delivered “on demand”.
- Susceptability increases to servers which are down or uncontactable. Pixus will have to be more tolerant to servers which do not answer queries, since this will be a more frequent occurance.
- It becomes more important to present the search in a way which doesn't risk leave one collection at the tail end of any search result: one solution is to randomize the order of images in the search result.

User growth

As the number of users grows, the issues that arise are:

- The load on the Pixus servers increases, as does network usage.
- The load on collections' servers increases where they are participating in on-demand metadata or image access.
- Size of the user register, lightboxes, and other personalization support resources grows.

APPENDIX 1 – Service descriptions of the collections used in the demonstrator

During the Pixus Image Portal Demonstrator project, 7 collections were integrated into Pixus. The service descriptions are included on the following pages to show examples of how real collections have been integrated into Pixus.

SCRAN

Description		SCRAN is an image library based in Edinburgh
Access Method		On-demand
Protocol		Z39.50
Indexes Searched		
	“Any”	Bib-1 any
	“Who”	Bib-1 author
	“What”	Bib-1 title
	“Where”	Bib-1 any
	“When”	Bib-1 date
Record Format		GRS-1
Fields Retrieved		
	DC-Title	GRS-1 Title
	DC-Description	GRS-1 Description
	DC-Publisher	GRS-1 Publisher
	DC-Identifier	GRS-1 LocalControlNumber
	DC-Source	GRS-1 Source
	DC-Language	GRS-1 Language
	DC-Rights	GRS-1 Rights
Image Display		
	Image Location	Remote (Scran)
	Thumbnail Image URL	Contents of the GRS-1 RenditionResource field from the SCRAN Z39.50 record.
	Thumbnail Size and Format	150 x 150 Maximum – JPEG Format
	Larger Image URL	None available: We use the thumbnail image URL instead.
	Link to Source Site	“http://www.scran.ac.uk/ixbin/hixclien t?_IXDB_=freesite&_IXFPFX_=t&submit-button=SUMMARY&%24%3F%3A+with+has_media_index=.&_IXSPFX_=z&%24%24="+ LocalControlNumber

VADS

Description	VADS is an image library containing Art and Design related images
Access Method	Weekly Harvest
Protocol	OAI
Indexes Searched	
“Any”	All harvested DC-fields
“Who”	DC-Creator, DC-Publisher and DC-Contributor
“What”	DC-Subject, DC-description and DC-Identifier
“Where”	DC-Coverage
“When”	DC-Date
Record Format	Dublin Core XML
Fields Retrieved	
DC-Title	DC-Title (VADS field *title*)
DC-Creator	DC-Title (VADS field *creator*)
DC-Description	DC-Description (VADS field *description*)
DC-Subject	DC-Subject (VADS fields *style* & *subject*)
DC-Publisher	DC-Publisher (VADS field *publisher*)
DC-Contributor:	DC-Contributor (VADS fields *creator* & *location*)
DC-Date	DC-Date (VADS field *date*)
DC-Type:	DC-Type (VADS field *type*)
DC-Format:	DC-Format (VADS fields *measurements* & *techniques*)
DC-Identifier	DC-Identifier (VADS fields *id_number* & *location_digital_image*)
DC-Source	DC-Source (VADS field *source*)
DC-Language	DC-Language (VADS field *language*)
DC-Relation:	DC-Relation (VADS field *relation*)
DC-Coverage:	DC-Coverage (VADS fields *collection*, *date*, *style* & *culture*)
DC-Rights	DC-Rights (VADS field *rights*)
Image Display	
Image Location	Remote (VADS)
Thumbnail Image URL	“http://www.vads.ahds.ac.uk/images/" +DC-Identifier[1] +“/small/” +DC-Identifier[0] If the result does not end in “.jpg” one is added. *VADS returns a two element array for DC-Identifier.*

	Thumbnail Size and Format	150 x 150 pixels maximum – JPEG Format
	Larger Image URL	“http://www.vads.ahds.ac.uk/images/" +DC-Identifier[1] +“/medium/” +DC-Identifier[0] If the result does not end in “.jpg” one is added. *VADS returns a two element array for DC-Identifier.*
	Larger Image Size and Format	500 x 500 pixels approximate – JPEG Format
	Link to Source Site	Not implemented

Wellcome

Description	Wellcome Medphoto is an image library containing images generally relating to the field of medicine
Access Method	Weekly Harvest
Protocol	OAI
Indexes Searched	
"Any"	All harvested DC-fields
"Who"	DC-Creator, DC-Publisher and DC-Contributor
"What"	DC-Subject, DC-description and DC-Identifier
"Where"	DC-Coverage
"When"	DC-Date
Record Format	Dublin Core XML
Fields Retrieved	
DC-Title	DC-Title (Medphoto field *brief description*)
DC-Creator	DC-Title (Medphoto fields *creator, secondary creator,* & *author*)
DC-Description	DC-Description (Medphoto field *description*)
DC-Subject	DC-Subject (Medphoto fields *subject name*)
DC-Publisher	DC-Publisher (Medphoto field *publisher*)
DC-Date	DC-Date (Medphoto fields *creation date, date of publication* & *date of printing*)
DC-Type:	DC-Type (Medphoto field *genre*)
DC-Format:	DC-Format (Medphoto fields *format* & *size*)
DC-Identifier	DC-Identifier (Medphoto field *image number*)
DC-Source	DC-Source (Medphoto field *archive name*)
DC-Coverage:	DC-Coverage (Medphoto fields *place of publication*, *place of printing*)
DC-Rights	DC-Rights (Medphoto field *credit line*)
Image Display	
Image Location	Remote (Wellcome)
Thumbnail Image URL	"http://medphoto.wellcome.ac.uk/ixbin/imageserv?MIRO="+DC-Identifier
Thumbnail Size and Format	150 x 150 pixels maximum – JPEG Format
Larger Image URL	"http://medphoto.wellcome.ac.uk/ixbin/imageserv?MIDMIRO="+DC-Identifier

	Larger Image Size and Format	500 x 500 pixels approximate – JPEG Format
	Link to Source Site	"http://medphoto.wellcome.ac.uk/ixbin/hixclient.exe?submit-button=SUMMARY&_IXDB_=wellcome&_IXSPFX_=full%2Ft&_IXMAXHITS_=1&%_ANYFIELD_=with+image_no+is+"+DC-Identifier

AMICO

Description	AMICO is an image library hosted by SCRAN
Access Method	On-demand
Protocol	Z39.50
Indexes Searched	
“Any”	Bib-1 any
“Who”	Bib-1 author
“What”	Bib-1 title
“Where”	Bib-1 any
“When”	Bib-1 date
Record Format	GRS-1
Fields Retrieved	
DC-Title	GRS-1 Title
DC-Description	GRS-1 Description
DC-Publisher	GRS-1 Publisher
DC-Identifier	GRS-1 LocalControlNumber
DC-Source	GRS-1 Source
DC-Language	GRS-1 Language
DC-Rights	GRS-1 Rights
Image Display	
Image Location	Remote (AMICO at Scran)
Thumbnail Image URL	Contents of the GRS-1 RenditionResource field from the AMICO Z39.50 record.
Thumbnail Size and Format	150 x 150 Maximum – JPEG Format
Larger Image URL	None available: We use the thumbnail image URL instead.
Link to Source Site	"http://amico.scran.ac.uk/ixbin/hixclient?_IXDB_=amico_free&_IXFPFX_=t&submit-button=SUMMARY&with_has_media_index=.&%24%24="+usi+"+in+usi&_IXSPFX_=z"+LocalControlNumber

RLS

Description	RLS is an image library hosted by SCRAN
Access Method	On-demand
Protocol	Z39.50
Indexes Searched	
“Any”	Bib-1 any
“Who”	Bib-1 author
“What”	Bib-1 title
“Where”	Bib-1 any
“When”	Bib-1 date
Record Format	GRS-1
Fields Retrieved	
DC-Title	GRS-1 Title
DC-Description	GRS-1 Description
DC-Publisher	GRS-1 Publisher
DC-Identifier	GRS-1 LocalControlNumber
DC-Source	GRS-1 Source
DC-Language	GRS-1 Language
DC-Rights	GRS-1 Rights
Image Display	
Image Location	Remote (RLS at SCRAN)
Thumbnail Image URL	Contents of the GRS-1 RenditionResource field from the RLS Z39.50 record.
Thumbnail Size and Format	150 x 150 Maximum – JPEG Format
Larger Image URL	None available: We use the thumbnail image URL instead.
Link to Source Site	“http://www.rls.org.uk/ixbin/hixclient?_IXDB_=rls_free&_IXFPFX_=t&submit-button=SUMMARY&with_has_media_index=.&%24%24="+LocalControlNumber+"+in+usi&_IXSPFX_=z"

Bristol Biomed

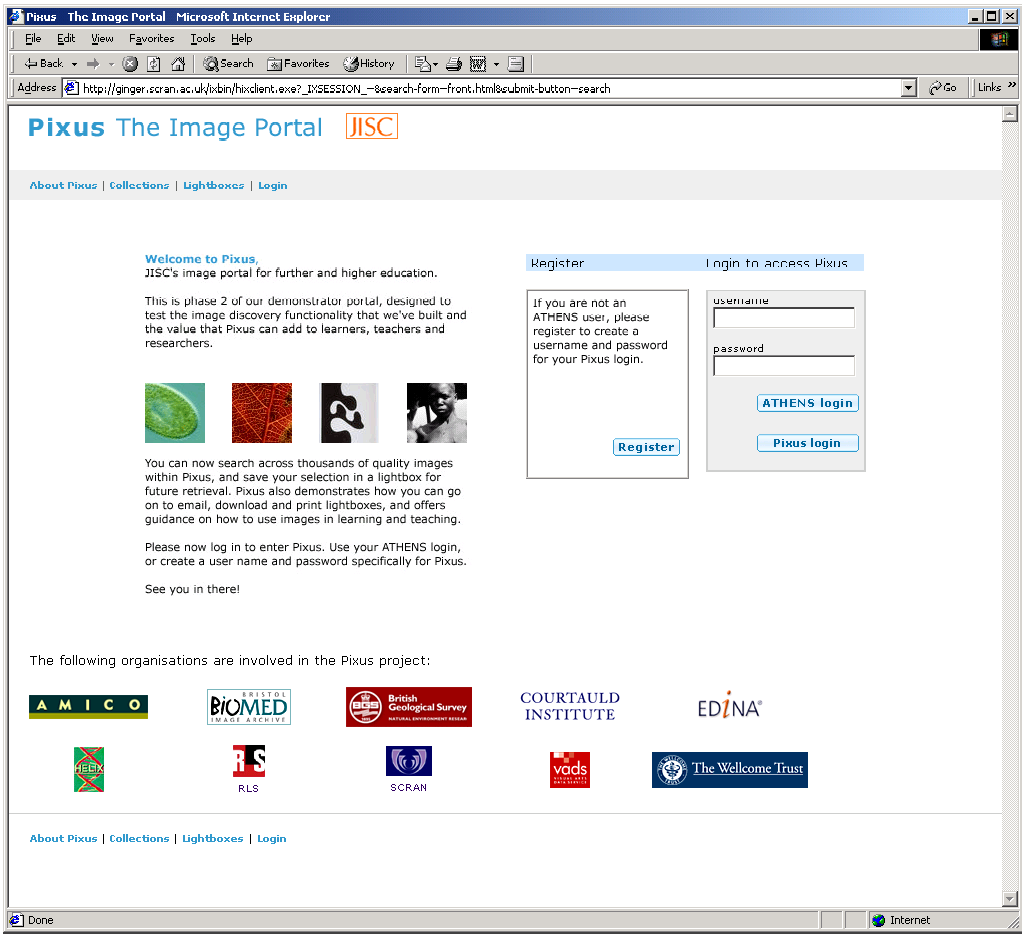
Description		Bristol Biomed is an image library of biological and medical images
Access Method		On-demand
Protocol		Z39.50
Indexes Searched		
	“Any”	Bib-1 any
	“Who”	Bib-1 author
	“What”	Bib-1 title
	“Where”	Bib-1 any
	“When”	Bib-1 date
Record Format		Marc21
Fields Retrieved		
	DC-Title	Marc Title (Field 245 $a)
	DC-Description	Marc Summary (Field 520 $a)
	DC-Identifier	Marc System Control Number (Field 035 $a)
Image Display		
	Image Location	Remote (Bristol Biomed)
	Thumbnail Image URL	"http://www.brisbio.ac.uk/ROADS/cgi-bin/BIO2URL?id="+ System Control Number
	Thumbnail Size and Format	150 x 150 Maximum – JPEG Format
	Larger Image URL	None available: We use the thumbnail image URL instead
	Link to Source Site	"http://www.brisbio.ac.uk/ROADS/cgi-bin/tempbyhand.pl?database=BRISBIO+IMAGES&query="+System Control Number

BGS

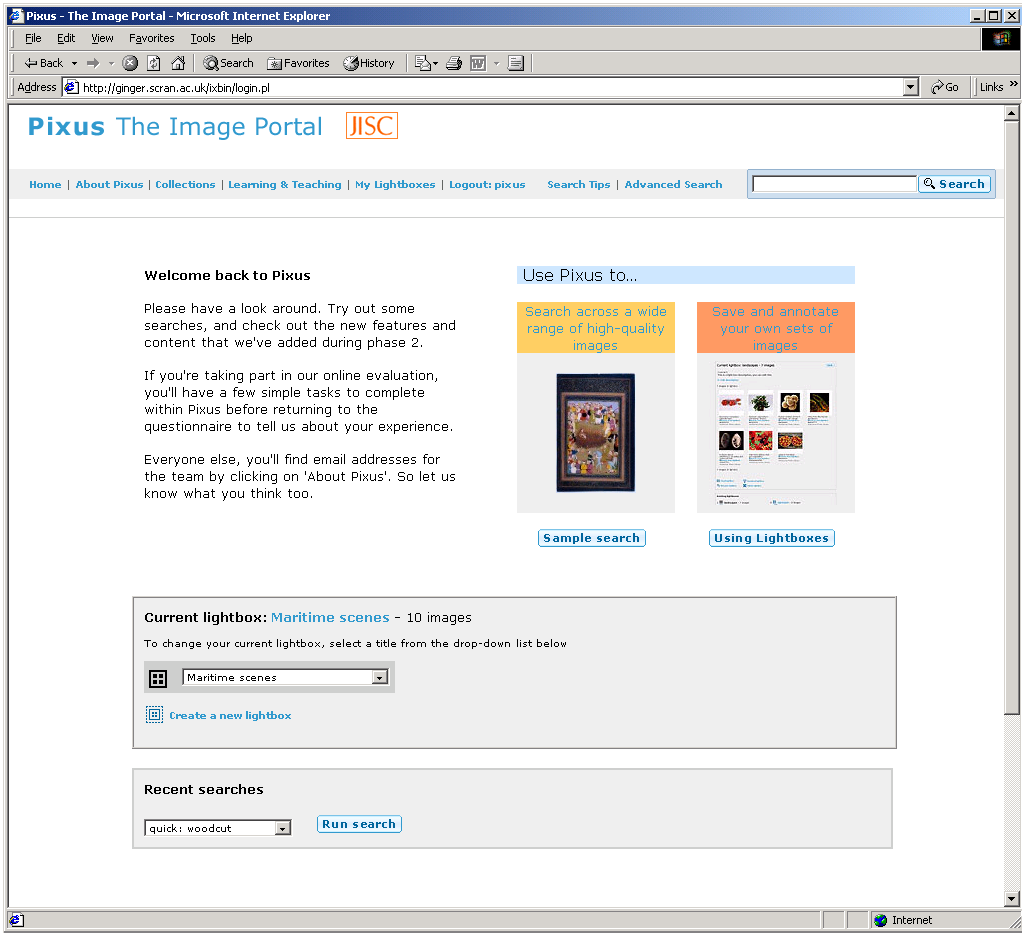
Description		The British Geological Service have an Image Library hosted by Edina
Access Method		On-demand
Protocol		Z39.50
Indexes Searched		
	“Any”	Bib-1 any
	“Who”	Bib-1 DC-Creator (Indexed as “people”)
	“What”	Bib-1 title
	“Where”	Bib-1 Name Geographic
	“When”	Bib-1 Author Name Conference (Indexed as “General”)
Record Format		GRS-1
Fields Retrieved		
	DC-Title	GRS-1 Title
	DC-Description	GRS-1 Description
	DC-Creator	GRS-1 Creator
	DC-Identifier	GRS-1 Identifier
	DC-Date	GRS-1 Date
	DC-Type	GRS-1 Type
	DC-Format	GRS-1 Material
	DC-Rights	GRS-1 Copyright Status
	DC-Coverage	GRS-1 Region
Image Display		
	Image Location	Local
	Thumbnail Image URL	Contents of the GRS-1 Filename field with any characters from a final period “.” removed and added the end of this string :”../images/bgs/thumbnail/” with a final “.jpg” added to the end.
	Thumbnail Size and Format	150 x 150 Maximum – JPEG Format
	Larger Image URL	Contents of the GRS-1 Filename field with any characters from a final period “.” removed and added the end of this string :”../images/bgs/standard/” with a final “.jpg” added to the end.
	Larger Image Size and Format	200 x 200 Maximum – JPEG Format
	Link to Source Site	Not available

APPENDIX 2 - Demonstrator Interactive Web Site

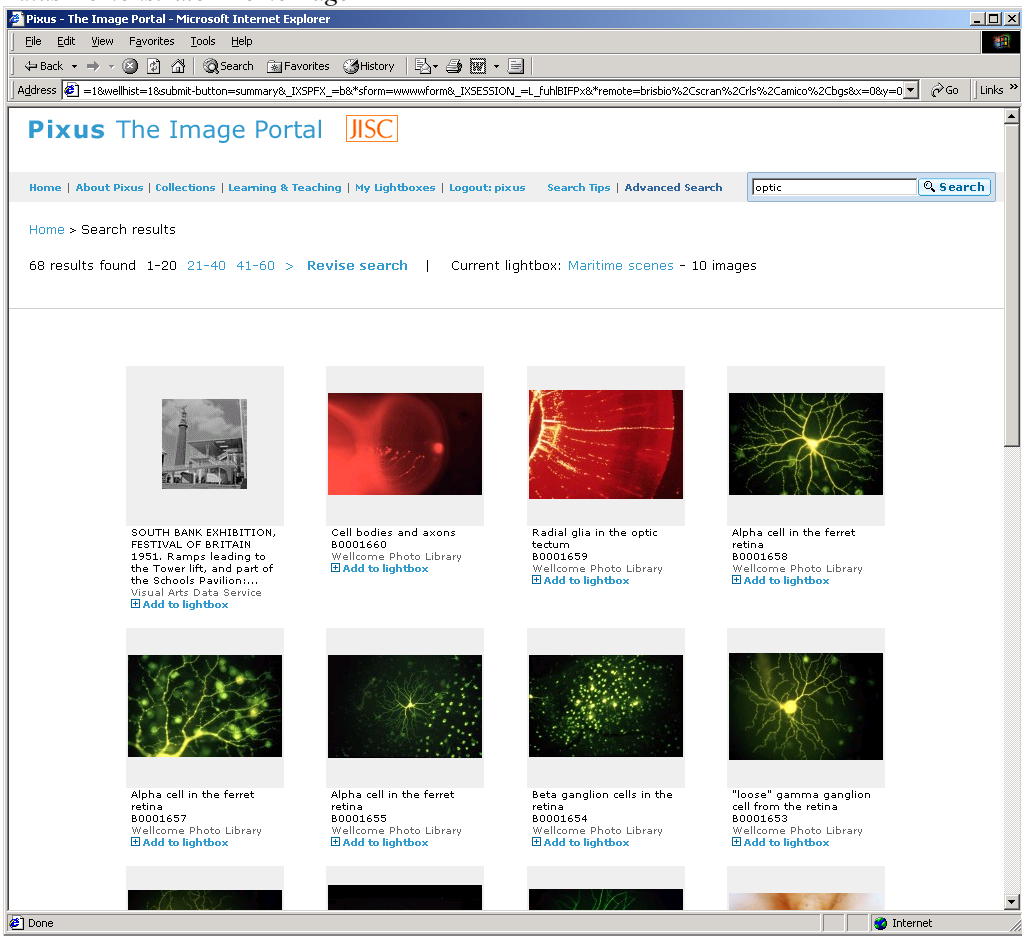
The Pixus Image Portal Demonstrator's principle delivery mode was an interactive web site. This appendix contains screen-shots from that site.



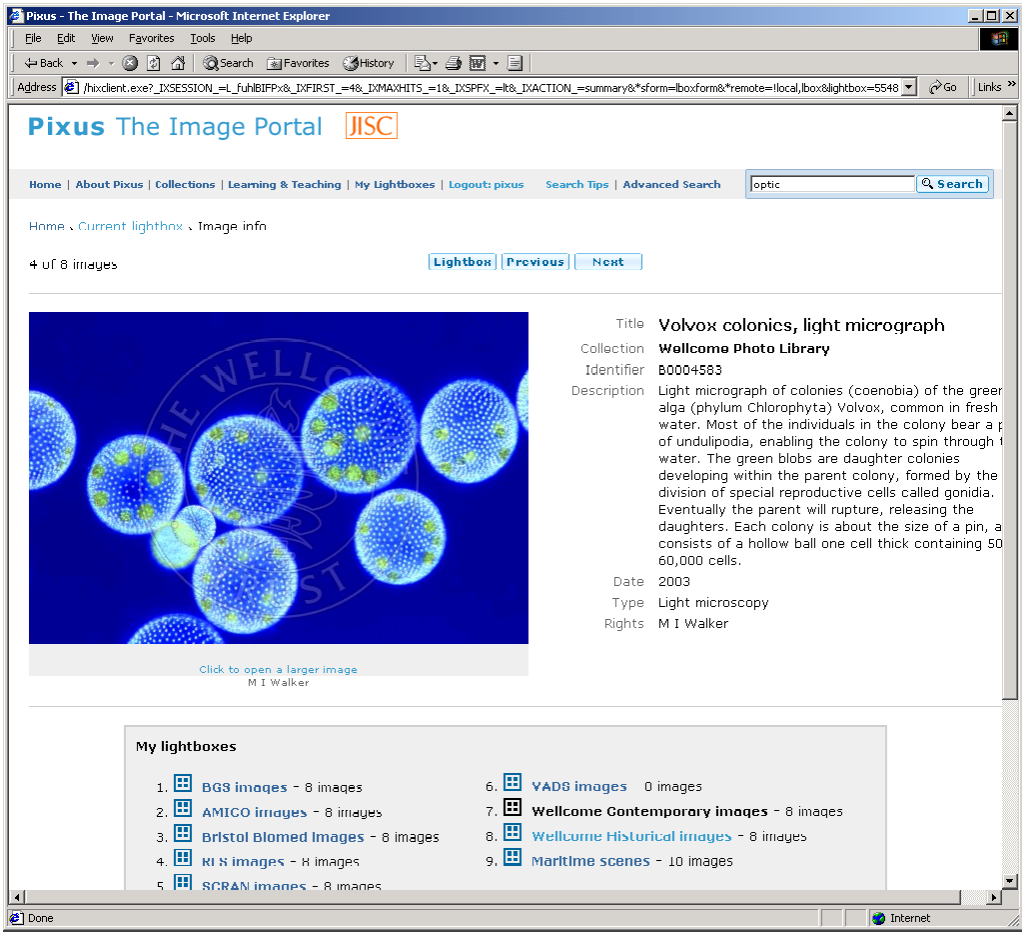
Pixus demonstrator welcome and login page



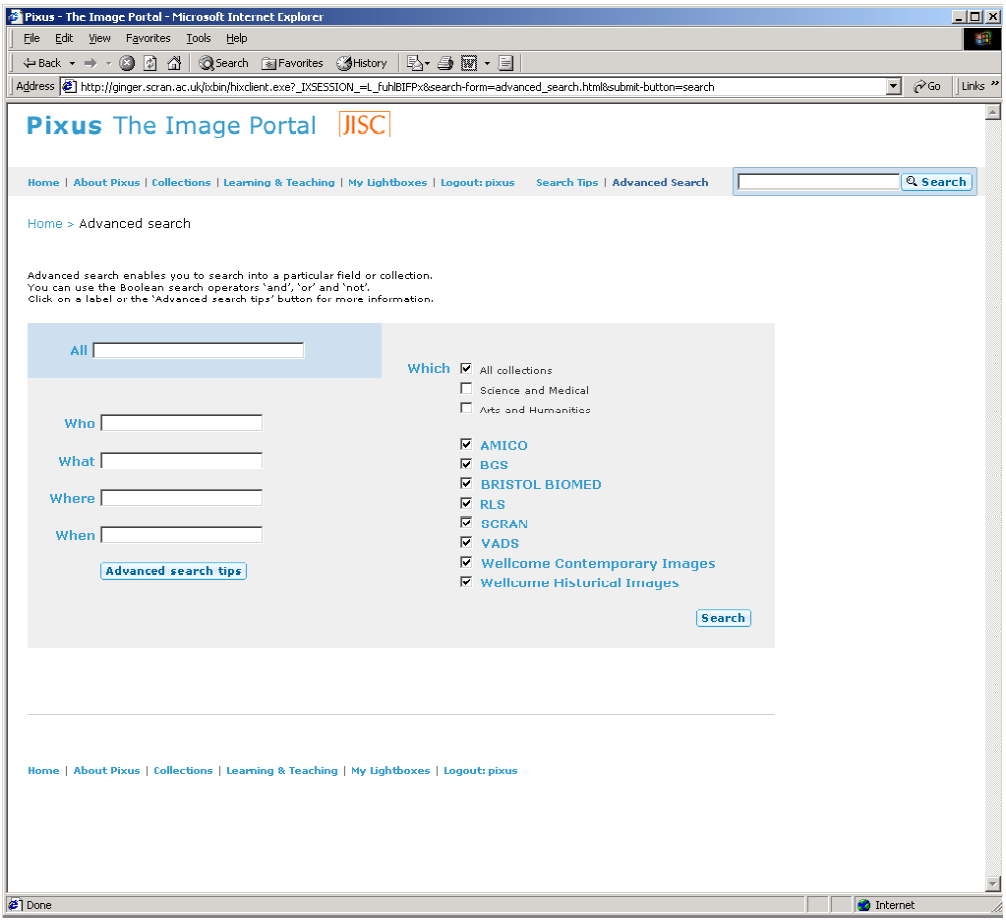
Pixus Demonstrator Home Page



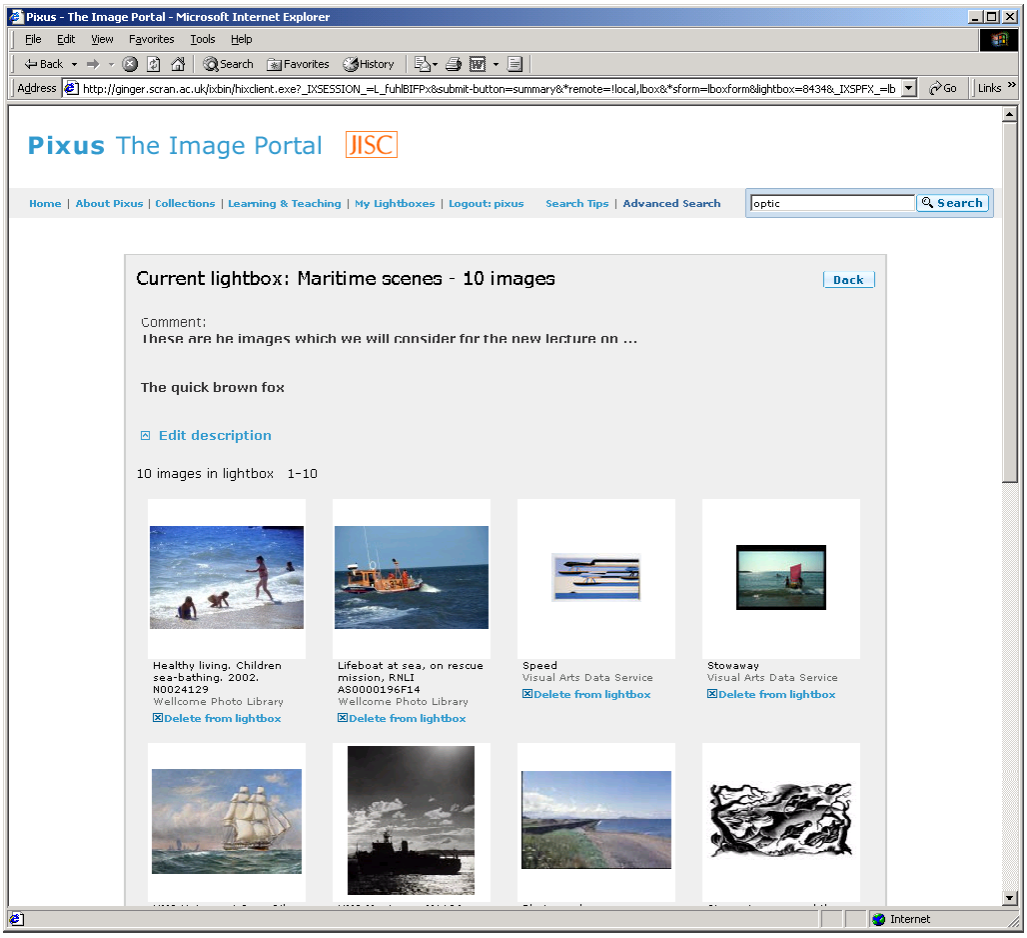
Pixus demonstrator main results page



Pixus demonstrator full record display



Pixus demonstrator advanced search page



Pixus demonstrator lightbox display