



National Aeronautics and Space  
Administration  
Jet Propulsion Laboratory  
California Institute of Technology



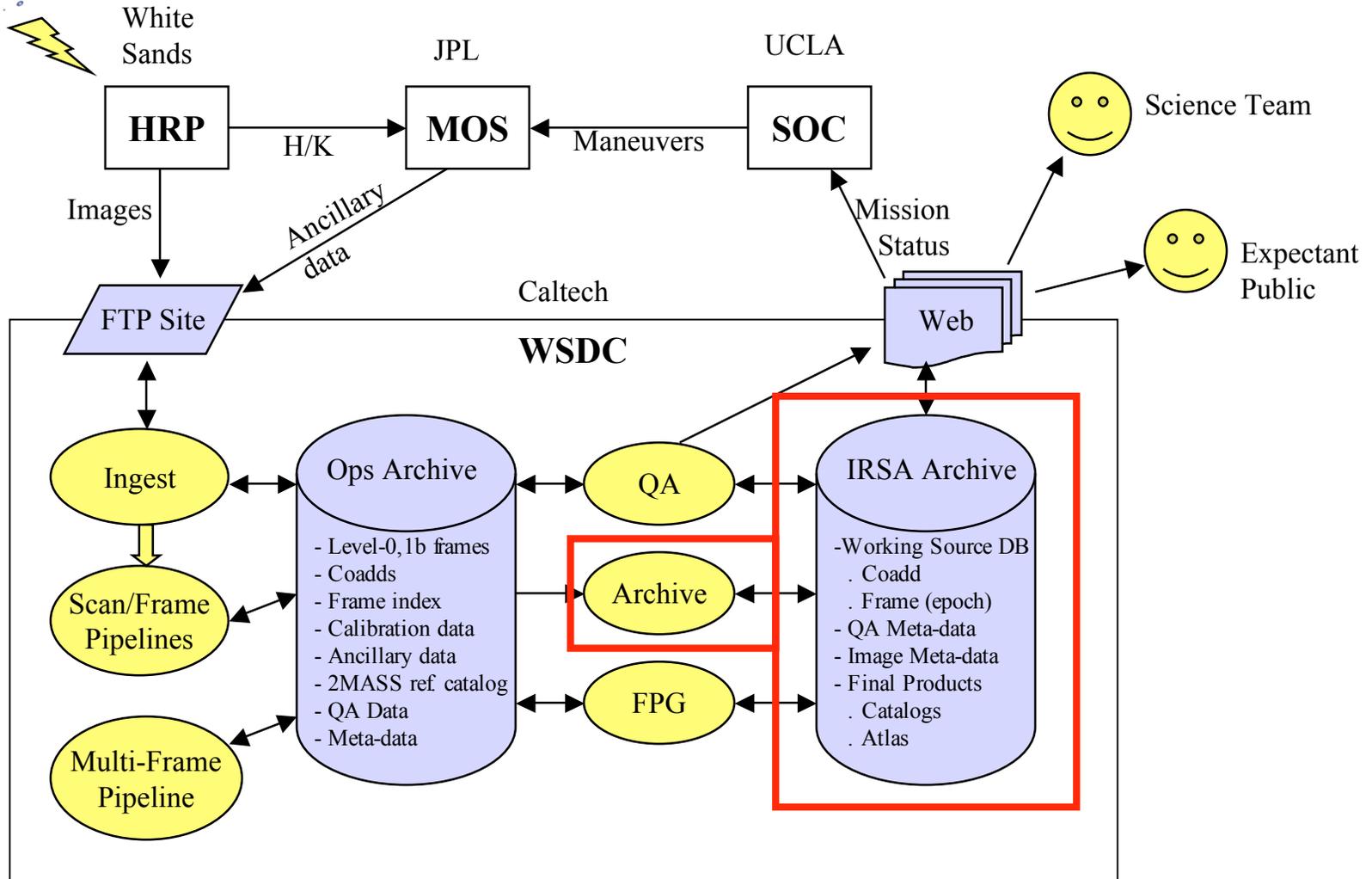
# WISE Archive

Bruce Berriman / Steve Groom  
Infrared Science Archive (IRSA), IPAC/Caltech





# WSDC Functional Block Diagram





# Driving Requirements - 1



Excerpted from WISE Science Data Center Functional Requirements, v2.0, 25 Nov 2007:

ID	Requirement
	<b>2.2.3 Archive</b>
L4WSDC-051	The WSDC shall make the WISE catalog and image products available to the community via the internet through appropriate web-based tools.
L4WSDC-052	As a goal, the WSDC will maintain the data products in a way that distribution of the complete WISE Source Catalog to users via portable media would be possible.
L4WSDC-053	The WSDC shall make the Image Atlas and Catalog products accessible to the astronomical community in collaboration with the NASA/IPAC Infrared Science Archive (IRSA) to ensure long-term availability beyond the end WISE missions operations and data processing phase, and to insure interoperability with other NASA mission archives.
L4WSDC-054	The WSDC shall maintain a complete copy of the WISE science data set and software source code at a secure off-site location during the WISE mission to ensure survivability in case of major catastrophe.
L4WSDC-056	The WSDC shall maintain an archive of metadata derived from data processing for the individual science images for the duration of the project for the purpose of analysis and support of image access tools.





# Driving Requirements - 2



ID	Requirement
	<b>2.2.3.1 Data Access</b>
L4WSDC-060	The WSDC archive shall provide a web-based interface to enable selection, display and retrieval of any or all single-epoch images and combined Atlas Images based on position or time of observation for the purpose of quality assurance, validation and analysis. The goal shall be to also allow image selection on any image metadata parameter.
L4WSDC-061	The WSDC archive shall provide a web-based interface to enable selection of sources extracted from single-epoch frames and/or combined Atlas Images based on position, flux, or combinations of any parameter maintained in the extracted source databases or Source Catalog.
L4WSDC-086	The web-based interface to the WISE Image Atlas shall allow the user to view and retrieve an image in any of the four WISE bands with any specified center (tangent point) and any size up to at least 10x10.





## Summary of functionality



- Provide interfaces for regular (daily-weekly) automated ingestion of WISE products
- Archive of source databases, catalogs, and metadata tables
  - Test data, operations data, long term archival data
- Provide data access services for science and project team and general public
  - Catalog search
  - Image retrieval
  - Image mosaics, cutouts
  - Multi-wavelength image comparison





# IRSA Overview



- IRSA is NASA's Archive node for IR and Submm data sets
  - Opened for business in 1999, and today has over 60 years combined archive experience on staff
  - Provided database management support and product generation for 2MASS
    - Driver for highly extensible and scaleable hardware and software architecture
  - Now serves data from 18 projects and missions & hosts seven contributed data sets
  - Physical archive hosts over 200 source catalogs, 11 million images, and 100,000 spectra
  - Archive services in wide use in the community
    - Web and program interfaces to deliver the full science content of the data sets, and maintains the *Montage* mosaic engine source code
    - Over 1000 peer reviewed papers cite IRSA and its services
    - Web page received over 12 million hits in 2007 (up x2 from 2007) and 32 TB of data downloaded
  - Interoperable with major astronomy archives
    - Member of *National Virtual Observatory* collaboration





# IRSA's Hardware Architecture



- IRSA uses high-end servers and mass storage to curate the data products with built in fault-tolerance and redundancy, and provide performance and throughput
  - 4x redundancy in file storage
    - Full copies of data on *two* independent disk farms
    - Each disk farm is configured at RAID level 5
  - All hardware placed under maintenance contracts to ensure 24 x 7 operations
  - Database tables backed up regularly by IRSA on dedicated tape farm in ASCII and binary formats
  - Hardware replacement interval is 3-4 years
  - **IRSA has never suffered permanent data loss in its operational lifetime**

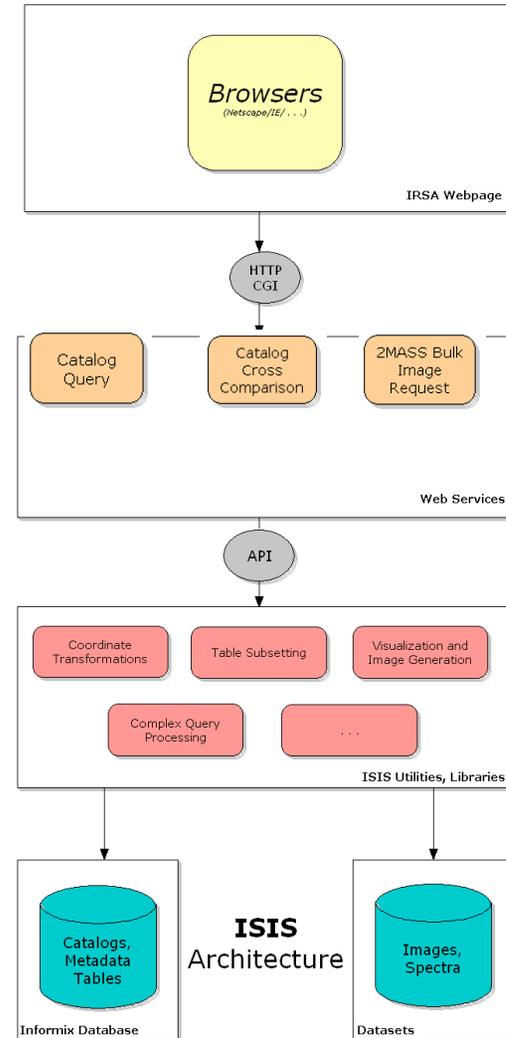




# IRSA's Software Architecture



- WISE will inherit a mature, operational software architecture
  - Developed to provide archiving support to 2MASS
  - Re-usable, component based architecture allows efficient development of new services
  - New services are “thin” front ends sitting atop the Infrared Science Information System (ISIS)
    - Minimize new development
  - Catalogs and metadata tables reside in Informix database





# IRSA Catalog Services



- General query tool (Gator)
  - Constraints against all catalog fields
  - Cross-matching of uploaded source tables against catalogs
  - Unique capabilities in astronomy
- Quick access to IRSA's most popular catalogs (BabyGator)
- *Catalog services will naturally include WISE catalogs*
  - User interface built dynamically
  - New catalogs served with **no** new development

NASA/IPAC Infrared Science Archive  
for NASA's Infrared and Submillimeter Data

Home About Holdings Missions Sitemap Helpdesk

**General Catalog Query Engine**  
**Gator**

Quick Guide Tutorial Catalog List Process Monitor Program Interface

IRSA CATALOGS

- 2MASS (Two Micron All-Sky Survey)
- IRAS (Infrared Astronomical Satellite)
- Spitzer Space Telescope Legacy Science Programs
- MSX (Midcourse Space Experiment)
- COSMOS (Cosmic Evolution Survey)
- Project Internal (Password protected)

Search

Contact the IRSA Help Desk

IRSA Charter :: IRSA Acknowledgement :: Privacy/Security Policy

This site has been optimized for Mozilla Firefox 1.5.x, Opera 8.x/9.x, Netscape Communicator 7.x/8.x, and Microsoft Internet Explorer 6.x. JavaScript must be enabled in order for the site to display properly.

<http://irsa.ipac.caltech.edu/applications/Gator/>



# IRSA Image Services



WISE Archive

- Image Retrieval - interactive search of image holdings
- Image Mosaic - generate custom mosaics, sub-image cutouts, and multicolor cross-comparison images
- Finder Chart - create catalog overlays and multicolor cross-comparison images from various missions and epochs
- *WISE Specific interfaces similar to these interfaces will be developed*

**Image Mosaic Service**

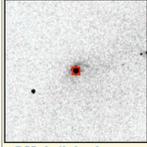
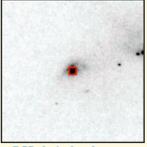
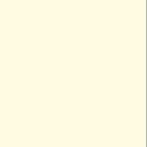
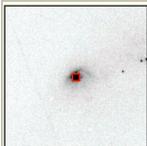
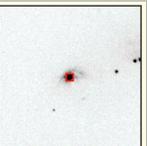
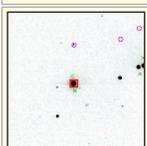
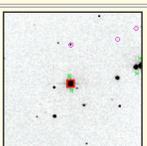
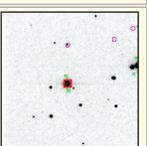
Returns science-grade mosaics that preserve fluxes and astrometry and rectify backgrounds to a common level.

Coordinate / Object:   
 Survey / Band:   
 Region Size (deg):    
 Pixel Resolution:   
 Coordinate System:   
 Label (optional):

*Users are currently limited to 10 simultaneous jobs. Results will be kept for about three days and then purged.*

4h27m4.70s 26d 6m16.31s eq J2000  
69.19381 +4.32766 eq J2000 171.84235 -15.67229 gal  
Input Location: DG Tau 5.9 arcmin North up, East to the left

Found five DSS images, and three 2MASS images. Click each image to interact with it in full resolution. Download all. Printer version. View color images: DSS, 2MASS. Query IRSA, NED, Vizier datasets in this region.

 DSS dss1h band Obs date: 1950-12-10	 DSS dss1r band Obs date: 1950-12-10	
 DSS dss2h band Obs date: 1989-12-27	 DSS dss2r band Obs date: 1994-10-10	 DSS dss2g band Obs date: 1995-12-19
 2MASS J band Obs date: 1997-11-30	 2MASS H band Obs date: 1997-11-30	 2MASS K band Obs date: 1997-11-30

Interactive 2MASS Image Service

NASA/IPAC Infrared Science Archive  
for NASA's Infrared and Submillimeter Data

Home About Holdings Missions Sitemap Helpdesk

**Interactive 2MASS Image Service**

This service enables rapid interactive viewing and retrieval of a single 2MASS Image set (J, H, and K<sub>s</sub>). The desired image can be specified based on position, target object name, or one of several image parameters. In the case of an image requested by position or object name, if more than one 2MASS Image covers the target, the image returned is the image on which the target is best centered. A listing of all 2MASS Images covering a specific position or object can be obtained by using the 2MASS Image Inventory Service.

**CAUTION:** Always use 2MASS Atlas Images for photometric measurements - 2MASS Quicklook Images are restored from lossy-compressed files.

For a detailed explanation of all the retrieval modes and options provided by this service, please visit the Interactive 2MASS Image Service Help web page.

Retrieve an Atlas or  Quicklook Image by Position or Object Name

2MASS Data Sets:  All Sky Release Survey Images  Full Survey Images  Full 6X Images  6X Catalog Images  Calibration Images

Coordinates or Object Name:   
Examples: NGC 7479 | 2MASXJ23045666-1219223 | 23h04m56.63s 12d19m22.7s Equ J2000

Subimage Size (arcsec):  10.0 arcseconds minimum, 1024.0 arcseconds maximum

Date (yyyymm):  Hemisphere:  North  South

DHS or coadd key constraints: Scan Number:  Image Number:

coadd\_key:  Note that if a coadd key is specified, DHS constraints will be ignored.

Band:  J  H  K<sub>s</sub>  All

Retrieve an Atlas or  Quicklook Image by coadd\_key

2MASS Data Sets:  All Sky Release Survey Images  Full Survey Images  Full 6X Images  6X Catalog Images  Calibration Images

coadd\_key:

Band:  J  H  K<sub>s</sub>  All

Retrieve an Atlas or  Quicklook Image by Date, Hemisphere, Scan, and Image number

2MASS Data Sets:  All Sky Release Survey Images  Full Survey Images  Full 6X Images  6X Catalog Images  Calibration Images





# Co-add Pixel Query Service



- Atlas Image products will be accessed via a WISE image server interfacing with IRSA. Users can retrieve a co-add *portion* or mosaic from multiple co-adds at any sky location , orientation and pixel scale.
- IRSA already supports on-request mosaics and image cutouts that make use of the *Montage* mosaic engine.



## Image Mosaic Service



New user?  
[Create Account](#)

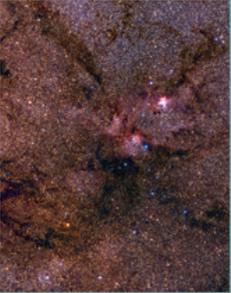
[Login](#)

[Preferences ...](#)

[Job Status](#)

[Help](#)

Returns science-grade mosaics that preserve fluxes and astrometry and rectify backgrounds to a common level.



2MASS Galactic  
Plane Three-Color  
Mosaic

Coordinate / Object:

Survey / Band:

Region Size (deg):  1.0 Max

Pixel Resolution:

Coordinate System:

Label (optional):

Users are currently limited to 10 simultaneous jobs. Results will be kept for about three days and then purged.





# IRSA Services for WISE



- Periodic delivery of WISE products into IRSA (~20GB/day)
  - Source DB's, metadata, images
  - Software Interface Spec (SIS) for transfers to be developed
- WISE databases & catalogs will be searchable through Gator
- Image services will provide access to original WISE L1B and L3 products and Atlas image products
- Mosaic and cutout services will provide custom images with full traceability to original WISE products





# Development Schedule



Version	Date	Deliverable
Version 1	7/17/08	Database schema, test databases for load and query tests
Version 2	2/28/08	WISE-specific interfaces defined and prototyped
Version 3	8/4/09	Mature database schema, hardware deployed, first pass processing
Version 3.5	1/26/10	Small schema updates
Version 4	10/18/10	Final H/W deployed, final updates to database schema and metadata tables; mature image services





## Issues/Concerns



- IRSA has handled throughput as high as that from WISE
  - 2MASS All Sky processing completed in three months
- Challenge: periodic re-indexing of very large tables
  - DBMS indices must be updated regularly to maintain good performance on large dynamic tables (e.g. regular deliveries from WISE)
  - Re-indexing can require many hours to perform depending on size, activity
    - Creating four indices on a 1.3 billion row table takes 12 hours on IRSA's current hardware
  - Investigating options for maintaining DB performance while re-indexing

