



The Mobius Project

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- **Möbius Overview**

- The Möbius project identifies, defines, and implements a set of services and protocols enabling the management and integration of both data and data definitions.
- Everything is broken into two components:
 - The protocol definitions and service interfaces.
 - The service implementation of those definitions.
- Möbius intends to conform to all standards set forth by the GGF and will attempt to leverage relevant existing grid technologies.
 - Currently support the GGF/DAIS XML Realization Proposed Specification

- **Why are we interested in grid data management?**

- Seamless data services integration.
- Large scale data management and processing.

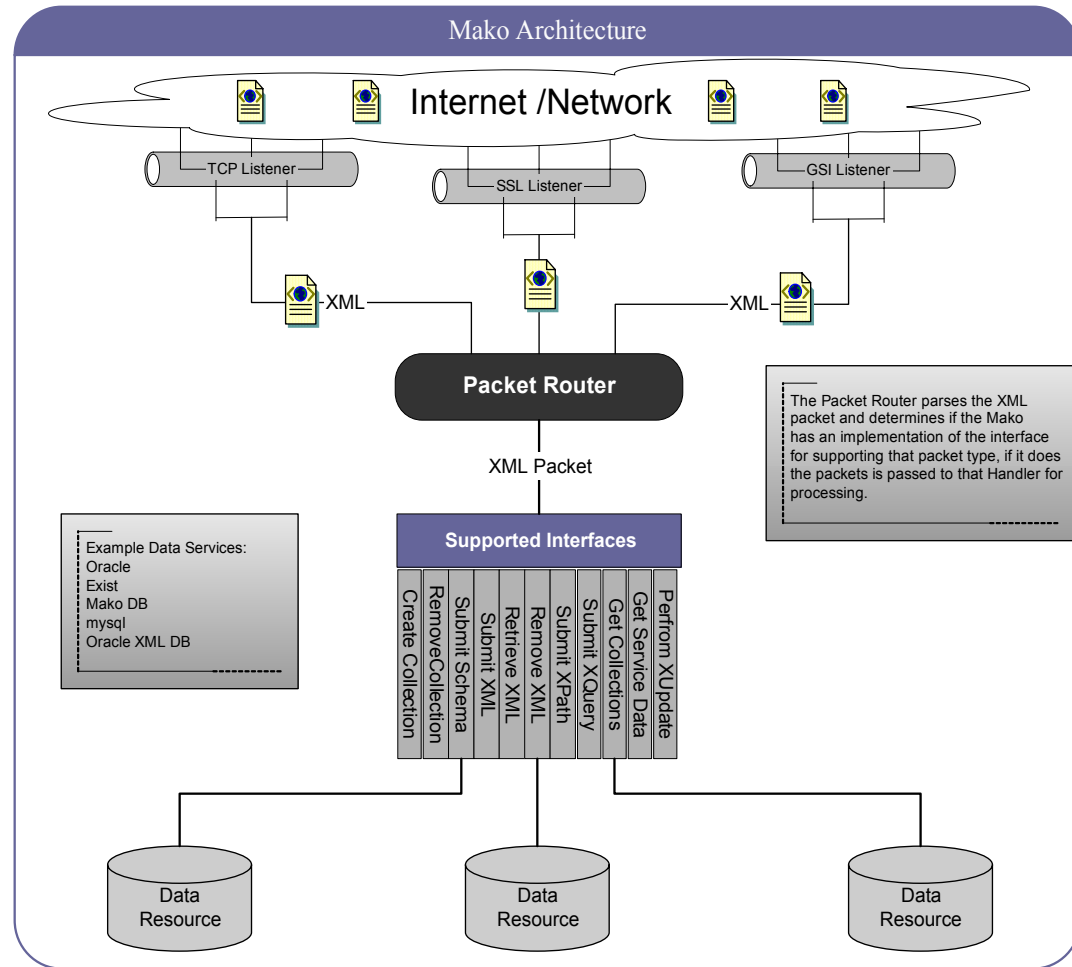


- **Mobius Core Services**
 - Mako (Federated Adhoc Storage Services)
 - Data Translation Service
 - Global Model Exchange (GME)
- **Mobius Extension Services**
 - VMako (Single virtual service view of a federation of Makos or VMakos)
 - Mentat (Semantic data management services)
- **Mobius Future Services**
 - Other Higher level query services (semantic query, inference services etc.)
 - Data Transportation Services.
- **Other Needed Grid Services**
 - Namespace Management
 - Service Naming
 - Data Replication
 - Security



• Mako Service

- Exposes existing/new data services as XML data services through a set of well defined interfaces based on the Mako protocol. (GGF/DAIS XML Realization Specification).
- Configurable Protocol Handling
 - Admin specifies handlers to process incoming packets based on type.
 - Specific implementations of handler can easily be written and integrated.





- **Data Resource Support**

- Mako DB

- In house XML database.
 - Optimized for federated adhoc usage of XML.
 - Plugs into Mako framework.

- XML DB Support

- Built in support for XML databases that support the XML DB API.

- Other Data Resources

- Easily integrated, by implementing a small set of handlers for them
 - In the future these handlers will be publicly available.

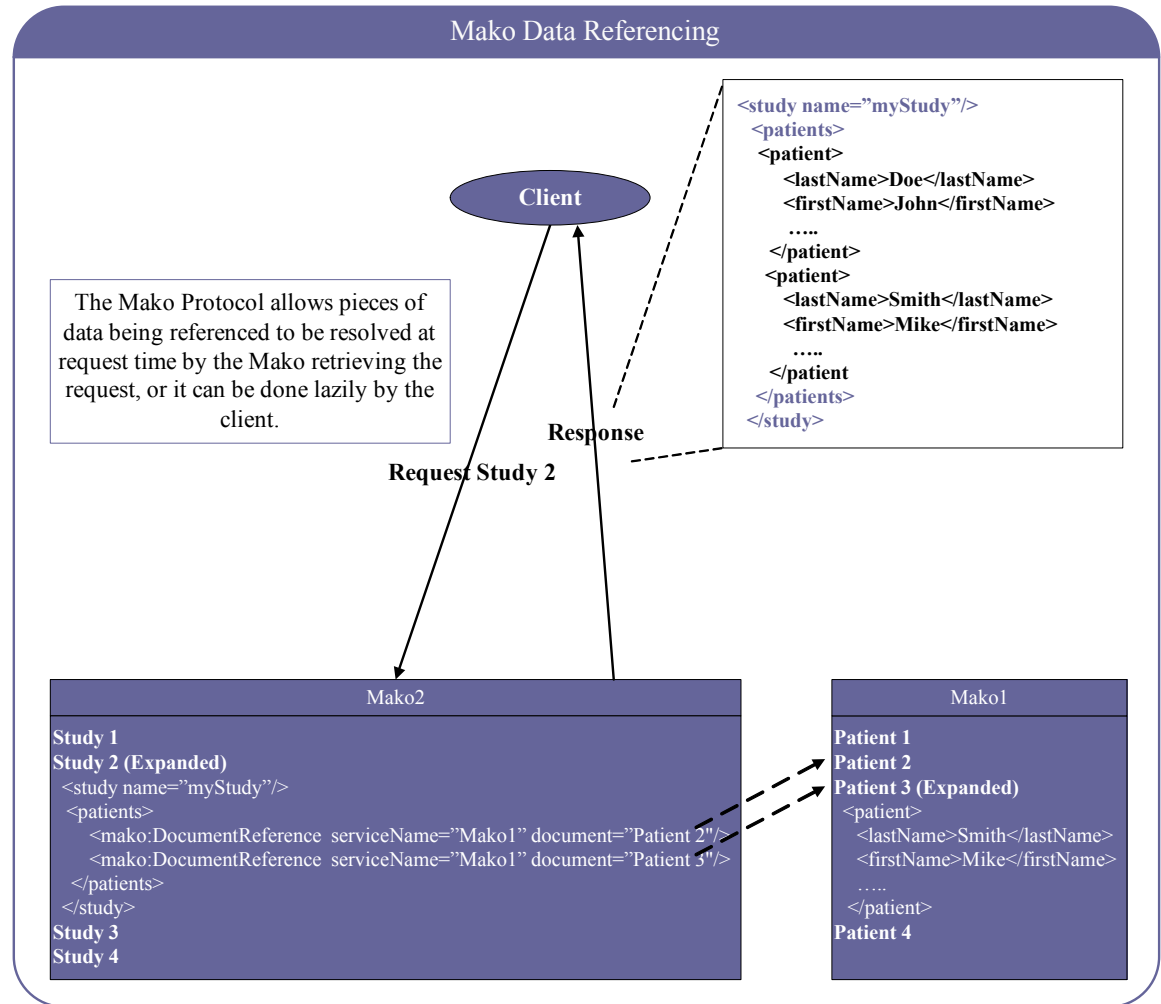


- **Mako Specialized Features**
 - Data Validation
 - Element Referencing
 - Static
 - Dynamic through xpath queries
 - Lazy Retrieval
 - Distributed Document Object Model (DOM)



- **Mako Data Referencing Use Case**

- Shows retrieving data that is federated across multiple Mako services.

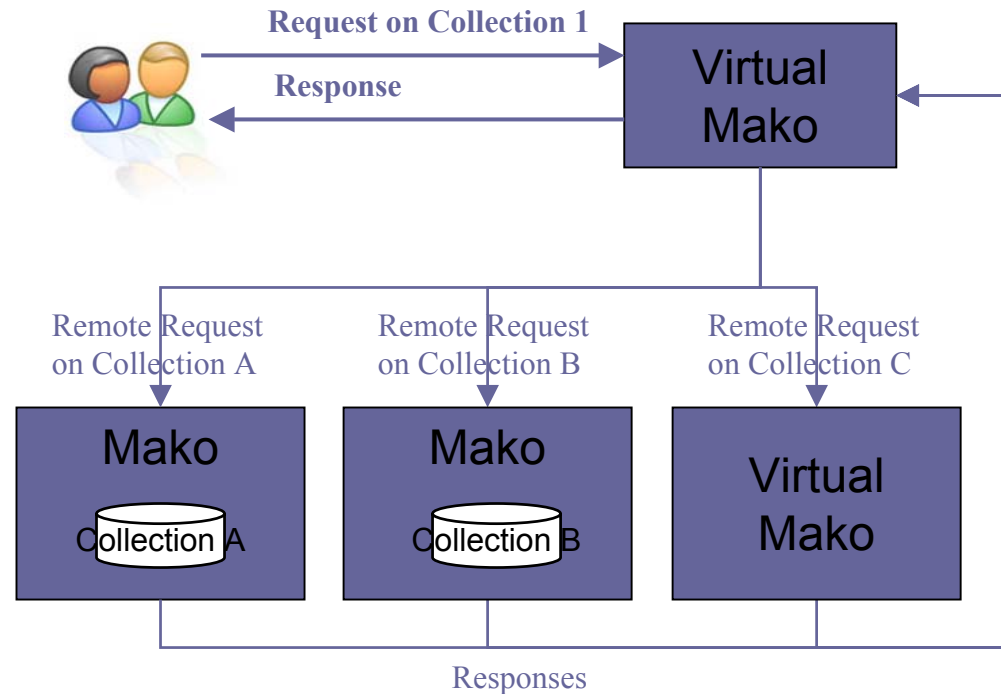




Virtual Mako

– Simplifies client-side complexity of interfacing with multiple Makos by presenting a single virtualized interface to a collection of federated Makos.

- “Is a” Mako service implementation
- Acts as a data integration point for distributed queries
- Pluggable algorithms for XML instance ingestion/distribution
- Protocol request broadcast and response aggregation
- Maps a Virtual Collection to a number of remote standard Collections





• Data Translation Service

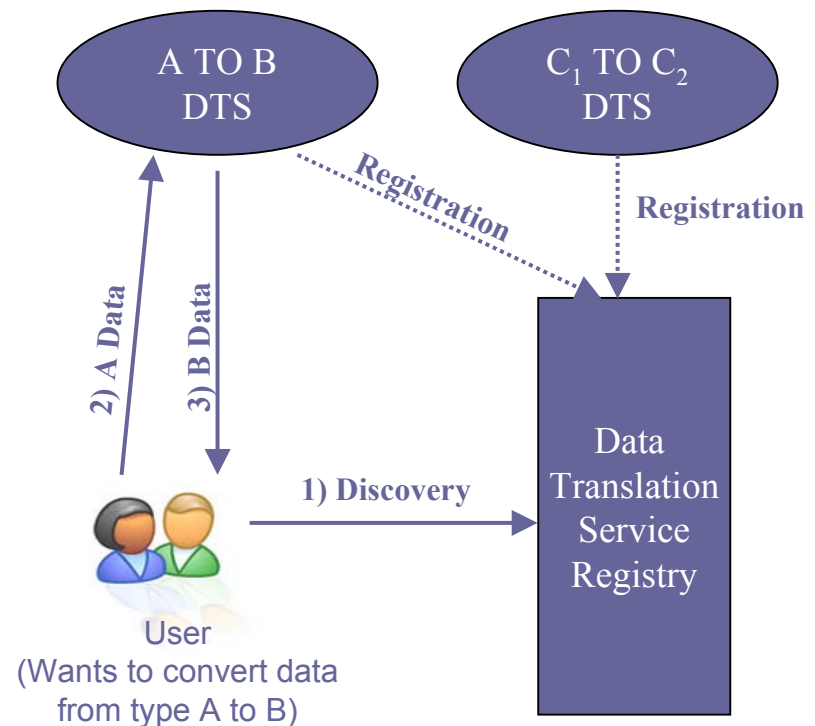
– Issues

- How do I translate one data type to another?
- How do I convert an old version of a data type to a newer one?

– Protocol and service framework for handling the mapping of one data instance or data definition to another should exist.

– Allows two protocol disjoint services to communicate

– Enables translating between changing data types.





- **Need for a global data definition management!**
 - What is “global data definition” (Global Models)?
 - Promote creation and evolution of standard definitions of data types.
 - For communication between multiple institutions they must agree on a common structure or a mapping between structures.
 - Allow for sharing and discovery of data definitions in a grid environment.



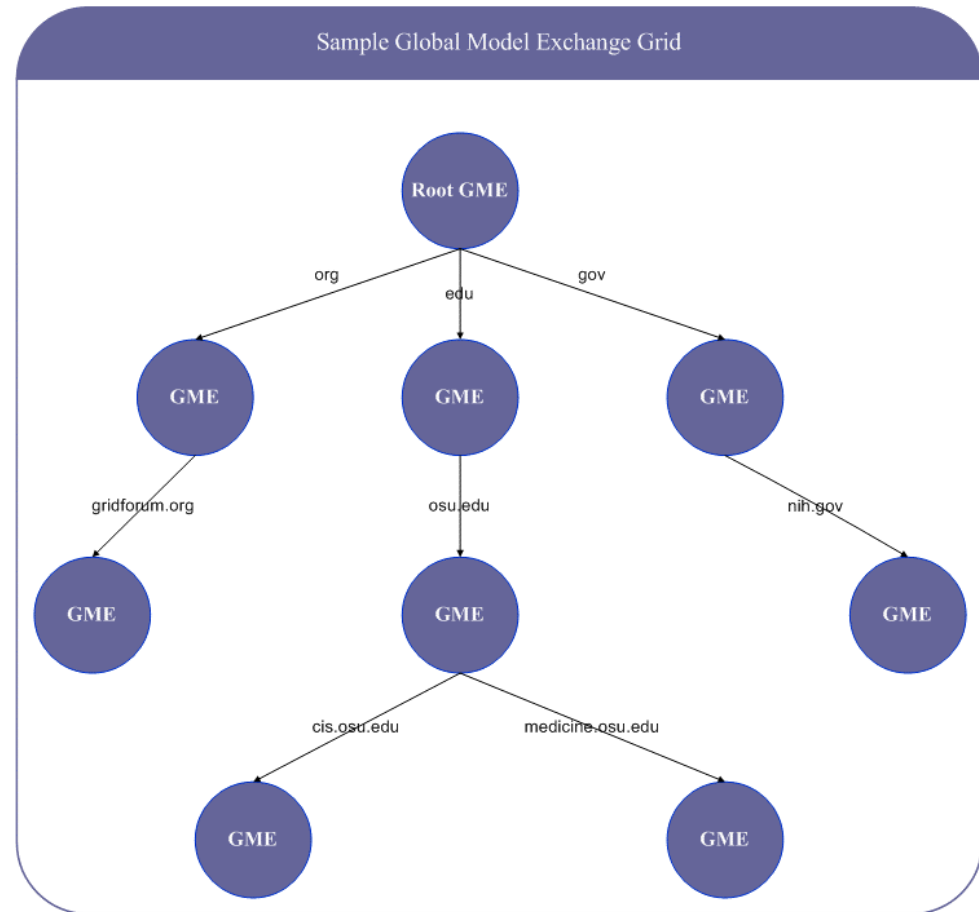
- **Global Model Issues**

- User/Organization defined entities
 - ex: *my “person” != your “person”*
- Changing models
- Models disappear
- Prevent conflicting models
- Discovering models
- Multiple definitions of similar models for different communities (syntactic / semantic mapping)



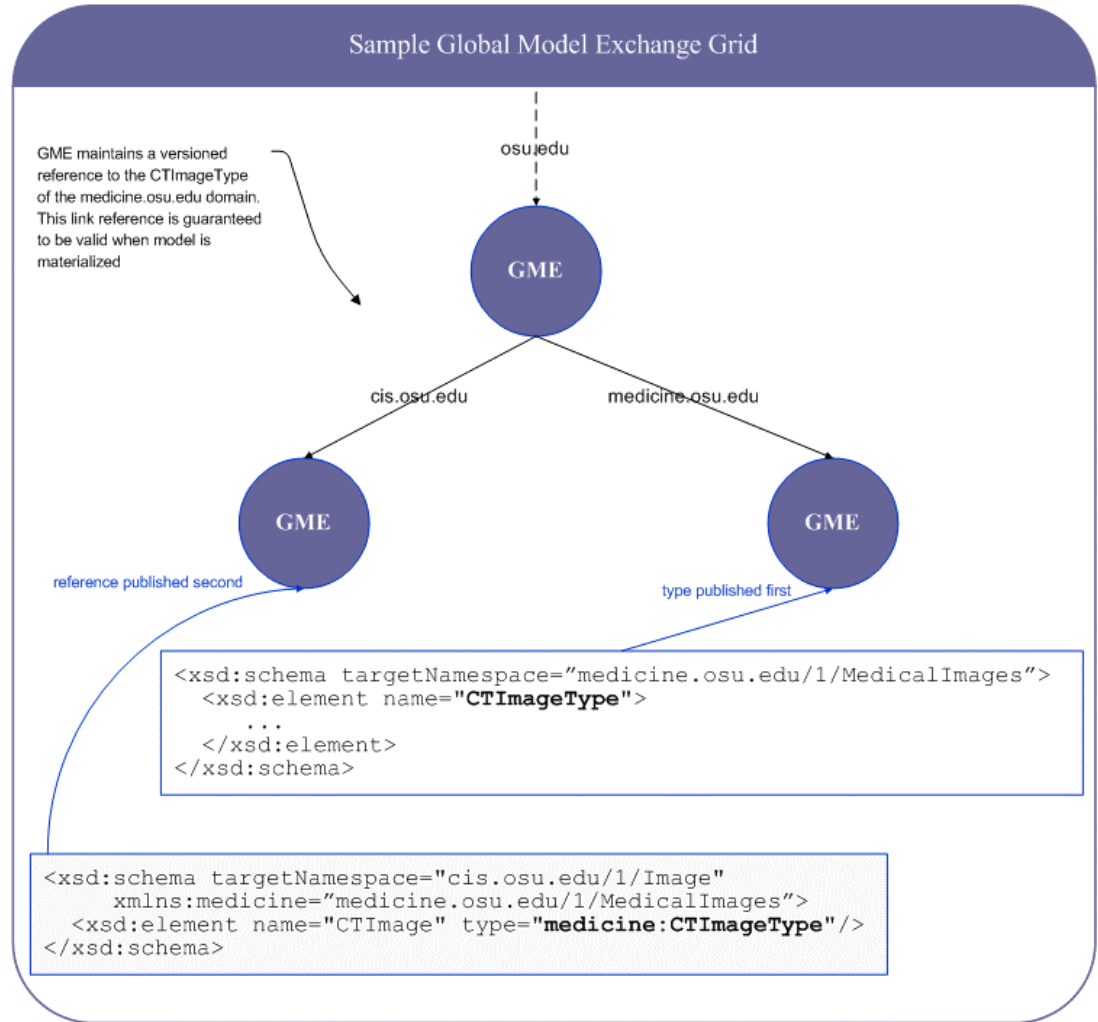
- **Global Model Exchange**

- Manages the Global Model
 - handles presented issues
- Provides submission and discovery protocol
- DNS like architecture
 - Hierarchical authority subordinate domain division
 - Model resolution query messaging
 - Local cache with TTL.





Users/Services publish schemas to the authoritative GME of that namespace. Then any other services/users from similar or different organizations who have the authority will be able to reference, use, alter, etc the data definitions of that schema.





- **Globus Integration**

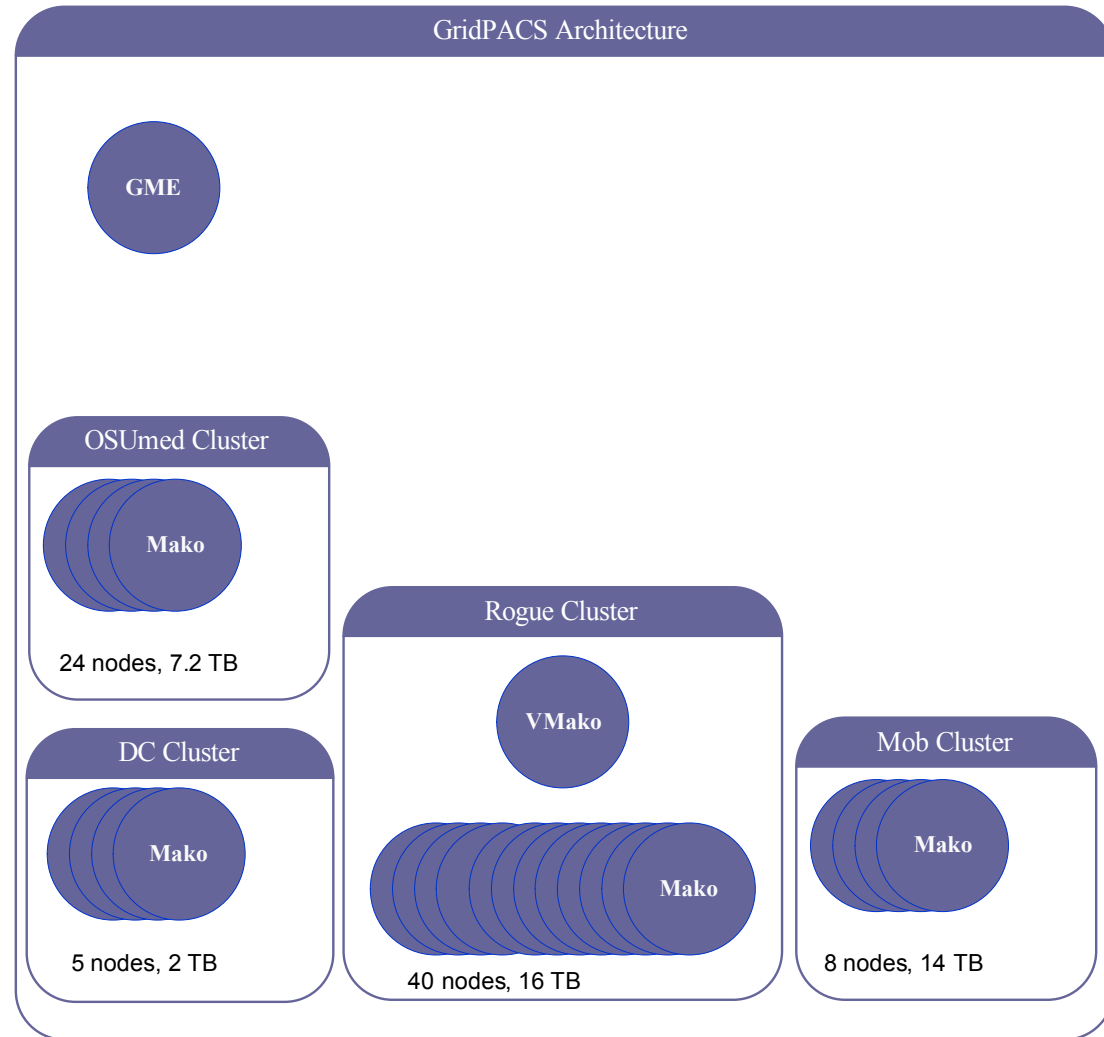
- Mobius Services have been integrated with Globus and can be run as Globus Grid Services
 - Mobius protocol layered on top of the OGSI protocol
 - Mobius services can be leveraged and discovered using Globus toolkit.
- Integrated Mobius Services take advantage of Globus Security Infrastructure (GSI) .
 - Secure Communication
 - Authentication.



Mobius Application Examples

(www.projectmobius.org)

- GridPACS
 - Distributed image management and analysis application.
- BlockMan
 - Large-scale data de-clustering and querying application.



The MOBIUS PROJECT



Distributed PACS Viewer

File Tools Window Configuration Help

Submit Query Upload Image Submit Nuclear Query Image Research Assistant

Medical Data Sets Browser - COMPLETED

Thumbnail View Metadata View

0 1 2 3 4 5 6 7

S0 S1 S2 S3 S4 S5 S6 S7

Pause Resume

Image Research Assistant

File View Study Actions

IP4G Process Model MIRA

NuclearSegmentationWorkflow
NuclearSegmentation
XPathQueryAndStream#er

Welcome to MIRA

Parameter	Value
mobiusHost	isp01.kmi.ohio-state.edu
mobiusCollection	/jpacsc-dicomly
defaults	projectmobius.org/1/Basi...
query	[Select]

Nuclear Query

Range Query Expert Query

Subject ID =

Nuclear Count
Min = 200 Max = 500

Reset Values Submit Query

Nuclear Query Results - COMPLETED

Patient	Nuclear Count	Date	Time	Results
1	422	2004/11/04	21:46:06	View
1	300	2004/11/04	21:46:09	View
1	297	2004/11/04	21:46:46	View
1	422	2004/11/05	08:38:17	View
1	300	2004/11/05	08:38:21	View
1	297	2004/11/05	08:39:24	View

104.95 MB

Nuclear Result Viewer

Patient ID: 1

Nuclear Count: 297

Date: 2004/11/04

Time: 21:46:46

Tile Mask
ID: /data/archive/Placenta/RB

Group ID: 3185

xmin: 1536 xmax: 2033
ymin: 3072 ymax: 3563

Region Infos

den...	xmin	xmax	ymin	ymax	ymin	zmax
1	1536	1567	3072	3103	0	0
1	1568	1599	3072	3103	0	0
1	1600	1631	3072	3103	0	0
7	1632	1663	3072	3103	0	0
4	1664	1695	3072	3103	0	0
1	1696	1727	3072	3103	0	0
1	1728	1759	3072	3103	0	0
3	1760	1791	3072	3103	0	0
3	1792	1823	3072	3103	0	0
1	1824	1855	3072	3103	0	0

Image Actions

- High Density Nuclei
- Medium Density Nuclei
- Low Density Nuclei
- Red Blood Cells
- Cytochromes

Close



Mobius in the Community

- **NIH-CaBIG**
 - Mobius has been adopted as a core middleware component of the NIH Cancer Grid effort.
- **OGSA-DAI**
 - Mobius has been selected as a principle sister project to the E-Sciences project OGSA-DAI effort.
- **GGF**
 - Active members of Data Access and Integration Services Working Group (DAIS-WG)
- **Biological Research Technology Transfer (BRTT)**
 - Mobius is currently funded under a State of Ohio technology transfer grant.