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# The Integration of Grid Technology with OGC Web Services (OWS) in NWGISS for NASA EOS Data

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**George Mason University (GMU)**

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# Outline

- ◆ Introduction
- ◆ Background
- ◆ Integration of Grid Technology with OWS
- ◆ System Architecture and Data Flow
- ◆ Conclusion and Future Work



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## Introduction -1/2

- ◆ Grid provides an approach for sharing geographically and organizationally dispersed heterogeneous computational resources.
- ◆ Globus is the key middleware that provides core Grid capabilities. It facilitates the creation of usable Grid.
- ◆ NASA Earth Science Enterprise (ESE) is generating a huge volume of remote sensing data in HDF-EOS format for supporting Earth system science and application research.
- ◆ OGC Web Service (OWS) is proposed for addressing the lack of interoperability of geospatial data and processing system based on the Web.



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## Introduction -2/2

- ◆ LAITS at GMU developed a OGC-specification compliant software package called the NASA Web GIS Software Suite (NWGISS), which includes WCS, WMS, MPGC etc.
- ◆ The Committee on Earth Observation Satellites (CEOS) Working Group on Information Systems and Services (CEOS WGISS) started a CEOS-Grid Testbed in September 2002 to evaluate the feasibility and applicability of Grid technology to the Earth Observation (EO) community.
- ◆ So we are contributing to NASA, OGC and CEOS-Grid by integrating OGC technology with Grid technology through the development of Grid-enabled NWGISS.



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## Background -1/2

- ◆ Globus Project just released Globus 3.0 Beta based on OGSA. But we used Globus 2.2 which includes GRAM, MDS, GSI, GridFTP, MCS, RLS and simple CA etc.
- ◆ HDF-EOS is a standard format for NASA EOS data and products. It inherits the portability and multiple data model support of HDF, also adds the three new EOS specific data models – point, swath and grid.
- ◆ LAITS' NWGISS significantly increases the accessibility, interoperability and inter-use of HDF-EOS data. It works with all generic HDF-EOS files.



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## Background -2/2

- ◆ Since 1999, OGC has successfully implemented three web-based geospatial interoperability programs: WMT I, WMT II and OWS I. And produced a set of web-based data interoperability specifications as WCS, WMS, WFS, and WRS.
- ◆ Currently, CEOS-Grid Testbed consists of five Grid demonstration projects:
  - NOAA Operational Model Archive and Distribution System (NOMADS)
  - USGS EDC's Data Delivery
  - ESA ESRIN Ozone
  - NASA GSFC's Advanced Data Grid
  - NASA EOSDIS Data Pools





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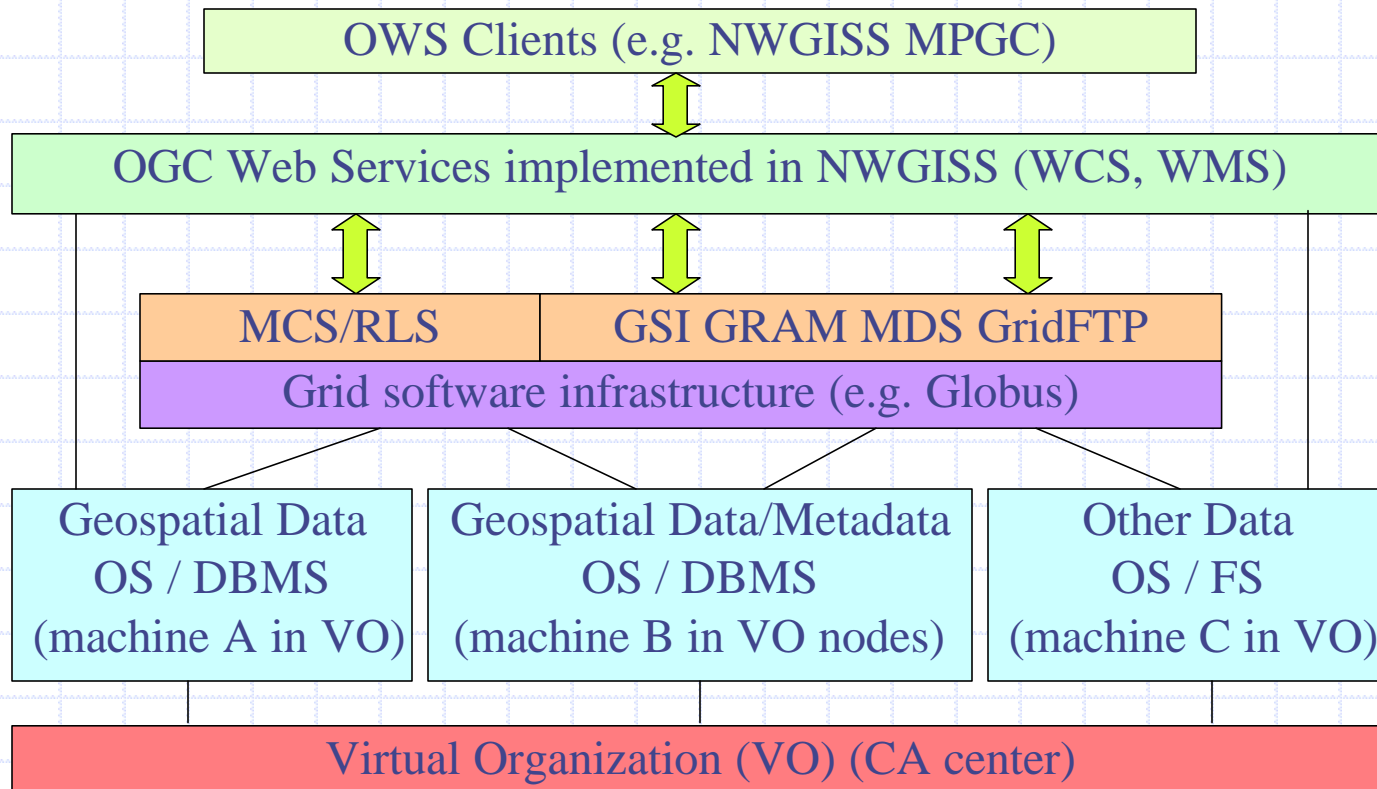
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# Integration of Grid technology with OWS



Integrating Grid technology with OWS I



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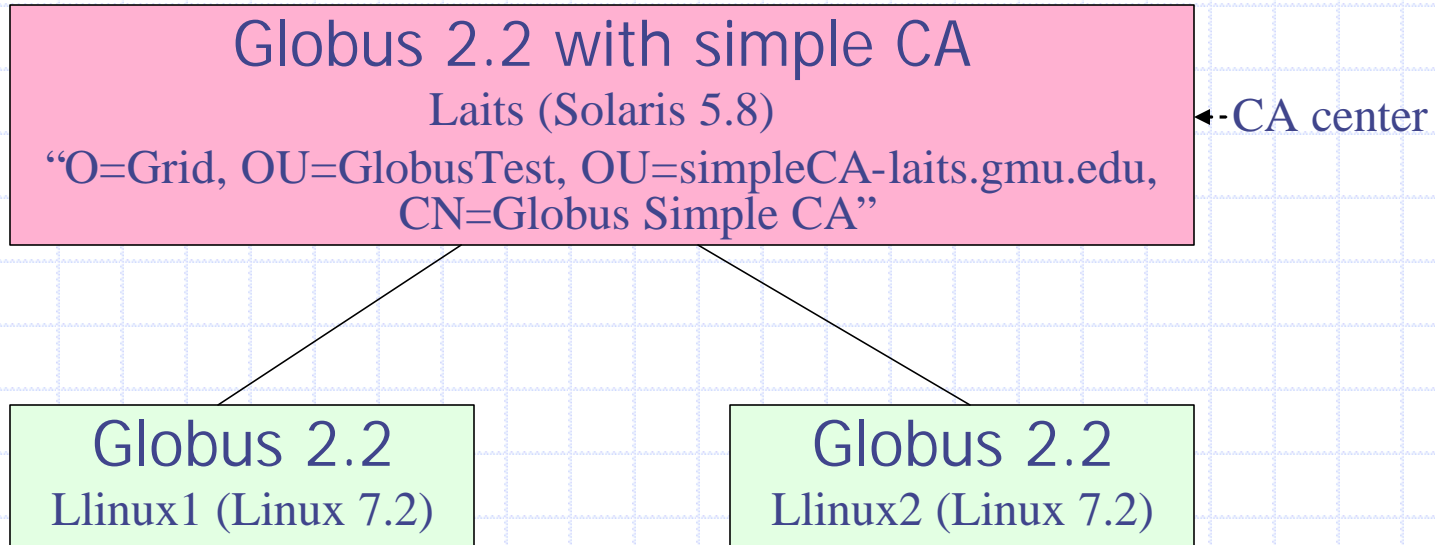
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# System Architecture and Data Flow -1/3



LAITS' Host, User and Service certificates:

“O=Grid, OU=GlobusTest, OU=simpleCA-laits.gmu.edu, CN=host/laits.gmu.edu”,

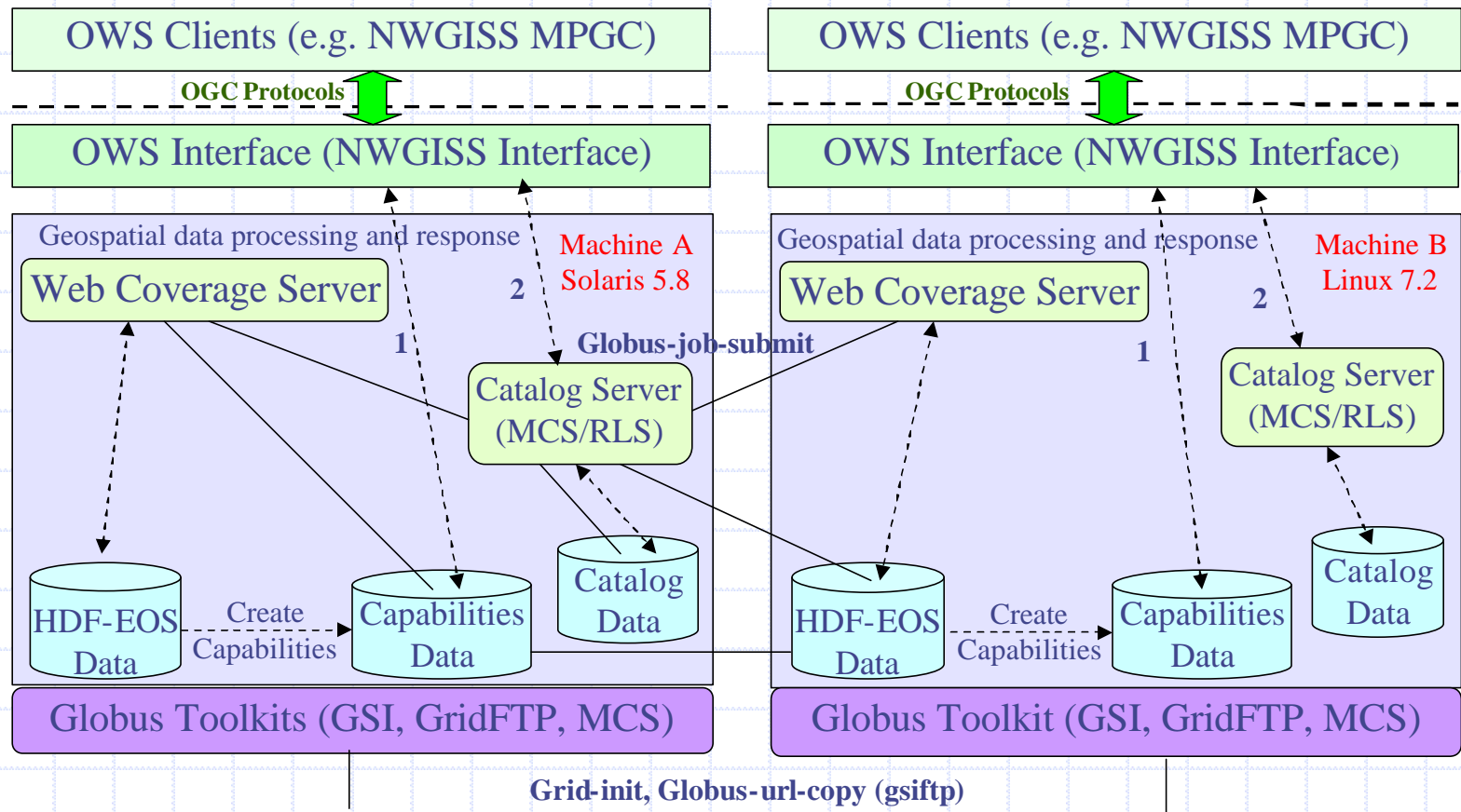
“O=Grid, OU=GlobusTest, OU=simpleCA-laits.gmu.edu, OU=laits.gmu.edu, CN=Aijun Chen”

“O=Grid, OU=GlobusTest, OU=simpleCA-laits.gmu.edu, CN=ldap/laits.gmu.edu”

Laits' Virtual Organization and Certificate Authorization center



# System Architecture and Data Flow -2/3



----- Broken lines show internal requests of NWGIS

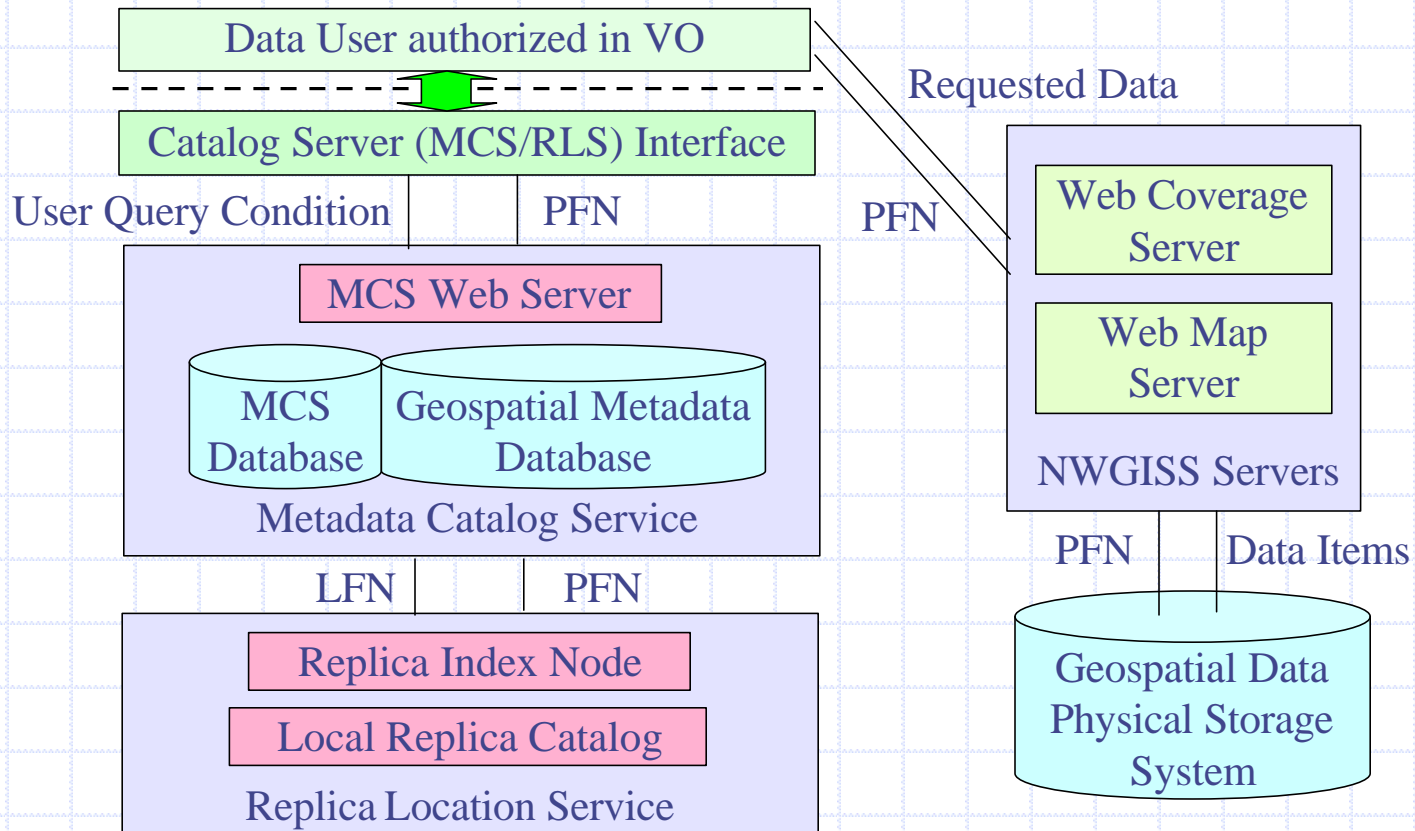
————— Solid lines show requests related to Globus.

System architecture and simplified data flow (request from machine A to machine B)



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# System Architecture and Data Flow -3/3



LFN: Logical File Name; PFN: Physical File Name

Integration mechanism of Globus MCS with geospatial metadata



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## Conclusion

- ◆ Extended the applications of Grid technology to the EO community.
- ◆ Made OGC technology Grid enabled.
- ◆ Finally, we provides the user community a standard, secure, disciplinary specific access to a huge volume of geospatial data managed by Grid while shielding the details of Grid infrastructure underneath.





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## Future Work

- ◆ Integration of OGC Web Registry Service (WRS) and Grid catalog systems for providing geospatial-specific OGC-compliant and Grid-enabled catalog services.
- ◆ Enabling the virtual geospatial data services.



# Simple Interface -1/2

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LAITS MCS Demo: Query Logical Files Name at MCS - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address [http://linux.laits.gmu.edu:8080/mcs\\_serv/Geo\\_Query.html](http://linux.laits.gmu.edu:8080/mcs_serv/Geo_Query.html)

### Querying MCS & RLS with Geospatial Metadata:

Logical Object Name	Varchar(250)	<input type="text"/>	The name of the logical object (logical file, collection and view)
Object Creator_Dn	Varchar(250)	<input type="text"/>	Creator's distinguished name
Object Create_Time	Date/Time	>= <input type="text"/> <= <input type="text"/>	eg 2003-04-01 17:02:30
Master_Copy	Varchar(250)	<input type="text"/>	e.g. gridftp://laits.gmu.edu/home/
Last_Modifier_Dn	Varchar(250)	<input type="text"/>	Last creator's distinguished name
Last_Modify_Time	Date/Time	> <input type="text"/> < <input type="text"/>	eg 2003-04-01 17:02:30
Data Granule Name	Varchar(250)	<input type="text"/>	
Production Data Time	Date/Time	>= <input type="text"/>	when production data is completed
Platform Name	Varchar(250)	<input type="text"/>	
Instrument Name	Varchar(250)	<input type="text"/>	

**Spatial Extent:** (Bounding Box Query, unit: degree)

<input type="text"/>	North Latitude	<input type="text"/>
<input type="text"/>	East Longitude	West Latitude
<input type="text"/>	South Latitude	

**Temporal Extent:**

Data Collected Range	Date/Time	> <input type="text"/> < <input type="text"/>	eg 2003-04-01 17:02:30
Data Processing Range	Date/Time	> <input type="text"/> < <input type="text"/>	eg 2003-04-01 17:02:30

**Keywords about Data Contents**

Topic keyword	Varchar(250)	<input type="text"/>
Discipline keyword	Varchar(250)	<input type="text"/>
Variable keyword	Varchar(250)	<input type="text"/>

Done

My Computer

Draw AutoShapes

Page 1 Sec 1 3/10 At 1.1" Ln 5 Col 1 REC TRK EXT OVR English (U.S)



# Simple Interface -2/2

NWGISS-MPGC

File View Functions Tools Project Image Help

Vgroup (Decorrelation)

### Input your request

**Query Parameters**

QuerySRS:

ResponseSRS:

Interpolation:

Elevation:

Time:

byResolution  bySize

ResX:

ResY:

ResZ:

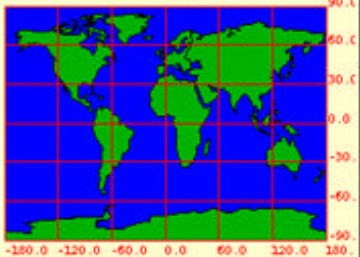
**Spatial Attribute Selection (must be selected):**

NorthBounding Latitude:

WestBounding Longitude:  EastBounding Longitude:

SouthBounding Latitude:

(Longitude,Latitude): **(176.7, -74.25)**



**Temporal Attribute Selection (must be selected):**

1960  2002

1960  2002

StartDate:YYYY 1960 MM 01 DD 01 HH 00 MM 00 SS 00

EndDate :YYYY 2002 MM 12 DD 31 HH 23 MM 59 SS 59

Server Selected:

- <http://207.188.194.35/cgi-bin/NWGISS/junk>
- <http://207.188.194.35/cgi-bin/NWGISS/junk>
- <http://vast.uah.edu:8080/sttserv/serve/Serv>
- <http://dev.polexis.com:8080/wcs/wcs?>
- <http://leoweb.dlr.de:8080/serve/wcs?>
- <http://gws.pcigeomatics.com/CWS/MCSSer>
- <http://ogc.intergraph.com/wcs/request.asp>

**Data Layers:**

- AST\_06S\_003051020021559\_Decorrel
- AST\_06S\_003061820021605\_Decorrel
- AST\_06S\_003100520011609\_Decorrel
- AST\_06T\_002012320010320\_Decorrel
- AUTUMN\_Matthews Autumn Albedo Glol
- CULTIVAT\_Matthews Cultivation Intensit
- ChesapeakeBayLandCoverChange\_Che
- ChesapeakeBayTMlandCover\_Chesape
- DEM\_1 Km Digital Elevation Model - Sou

**BBOX & EPSG:4326**

MinLon:

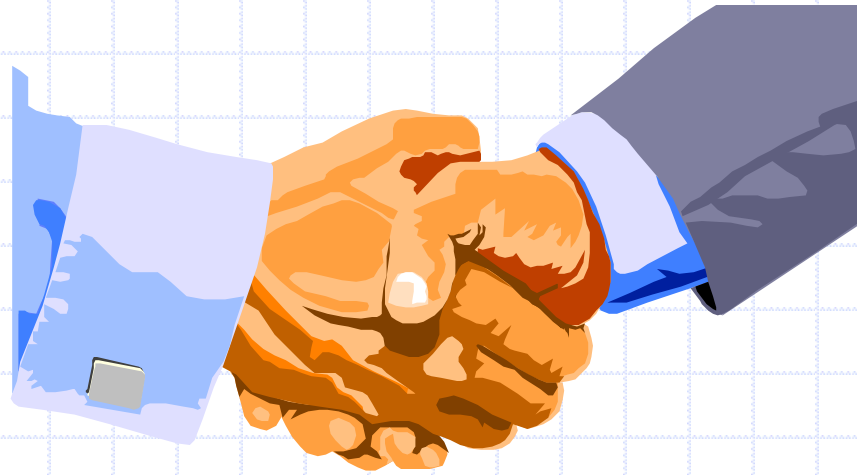
MaxLon:

MinLat:

MaxLat:



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**Thank You for your attention !**

**Any Questions ?** [achen6@gmu.edu](mailto:achen6@gmu.edu)