



NORDUGRID

*Grid Solution For Wide Area
Computing and Data Handling*

VOs and ARC

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What is a VO?

- Virtual Organization
 - In a broad sense: a group of people working together
 - In practice: Organizations, research groups, experiments
- Examples:
 - Nordugrid
 - ATLAS
 - ALICE
 - CMS

How it is used on the GRID

- **Authorization:** A person belonging to a VO can access several resources.
 - For example in ATLAS a member of the ATLAS VO gets access to ATLAS resources.
- **Information system:**
 - **Resource discovery:** what queues serve ALICE?
 - **Brokering:** which CMS resources are free to be used? How many free job slots allocated for ALICE?
 - **Statistics/job discovery:** How many LHCb jobs are running in cluster X? Which cluster is running ALICE jobs?
- Accounting?

How is this concept implemented?

- A **VOMS server** associates a VO credential (typically in the form of an X.509 attribute certificate) to a member user
- The server can be queried for users belonging to a VO
- The proxy certificate can contain such attribute information (multiple VO attributes)
 - Generation of such credential requires to contact a VOMS server

How does it look like in GLUE1 For the experiments (CREAM)

Program Settings Help

Browser

Choose plugin



Entries

Mds-Vo-name=BUDAPEST

- GlueCESEBindGroupCEUniqueID=grid106.kfki.hu:8443/cream-sge-alice
- GlueCESEBindSEUniqueID=grid143.kfki.hu
- GlueCESEBindGroupCEUniqueID=grid106.kfki.hu:8443/cream-sge-cms
- GlueCESEBindGroupCEUniqueID=grid106.kfki.hu:8443/cream-sge-dteam
- GlueCESEBindGroupCEUniqueID=grid106.kfki.hu:8443/cream-sge-hungrid
- GlueCESEBindGroupCEUniqueID=grid106.kfki.hu:8443/cream-sge-ops
- GlueCESEBindGroupCEUniqueID=grid107.kfki.hu:8443/cream-sge-alice
- GlueCESEBindGroupCEUniqueID=grid107.kfki.hu:8443/cream-sge-cms
- GlueCESEBindGroupCEUniqueID=grid107.kfki.hu:8443/cream-sge-dteam
- GlueCESEBindGroupCEUniqueID=grid107.kfki.hu:8443/cream-sge-hungrid
- GlueCESEBindGroupCEUniqueID=grid107.kfki.hu:8443/cream-sge-ops
- GlueCESEBindGroupCEUniqueID=grid109.kfki.hu:8443/cream-sge-alice
- GlueCESEBindGroupCEUniqueID=grid109.kfki.hu:8443/cream-sge-cms
- GlueCESEBindGroupCEUniqueID=grid109.kfki.hu:8443/cream-sge-dteam
- GlueCESEBindGroupCEUniqueID=grid109.kfki.hu:8443/cream-sge-hungrid
- GlueCESEBindGroupCEUniqueID=grid109.kfki.hu:8443/cream-sge-ops
- GlueCEUniqueID=grid106.kfki.hu:8443/cream-sge-alice
 - GlueVOViewLocalID=alice
- GlueCEUniqueID=grid106.kfki.hu:8443/cream-sge-cms
- GlueCEUniqueID=grid106.kfki.hu:8443/cream-sge-dteam
- GlueCEUniqueID=grid106.kfki.hu:8443/cream-sge-hungrid
- GlueCEUniqueID=grid106.kfki.hu:8443/cream-sge-ops
- GlueCEUniqueID=grid107.kfki.hu:8443/cream-sge-alice
- GlueCEUniqueID=grid107.kfki.hu:8443/cream-sge-cms
- GlueCEUniqueID=grid107.kfki.hu:8443/cream-sge-dteam
- GlueCEUniqueID=grid107.kfki.hu:8443/cream-sge-hungrid
- GlueCEUniqueID=grid107.kfki.hu:8443/cream-sge-ops
- GlueCEUniqueID=grid109.kfki.hu:8443/cream-sge-alice
- GlueCEUniqueID=grid109.kfki.hu:8443/cream-sge-cms
- GlueCEUniqueID=grid109.kfki.hu:8443/cream-sge-dteam
- GlueCEUniqueID=grid109.kfki.hu:8443/cream-sge-hungrid
- GlueCEUniqueID=grid109.kfki.hu:8443/cream-sge-ops

Distinguished Name:

GlueVOViewLocalID=alice,GlueCEUniqueID=grid106.kfki.hu:8443/cream-sge-alice, Mds-Vo-name=BUDAPEST, Mds-Vo-name=local, o=

ObjectClasses

- GlueCETop
- GlueVOView
- GlueCEInfo
- GlueCEState
- GlueCEAccessControlBase
- GlueCEPolicy
- GlueKey
- GlueSchemaVersion

Attributes

GlueCEAccessControlBaseRule	VO:alice
GlueCEInfoApplicationDir	/opt/storage/exp_software
GlueCEInfoDataDir	unset
GlueCEInfoDefaultSE	grid143.kfki.hu
GlueCEStateEstimatedResponseTime	128480
GlueCEStateFreeJobSlots	0
GlueCEStateRunningJobs	733
GlueCEStateTotalJobs	764
GlueCEStateWaitingJobs	31
GlueCEStateWorstResponseTime	289024
GlueChunkKey	GlueCEUniqueID=grid106.kfki.hu:8443/cream-sge-alice
GlueSchemaVersionMajor	1
GlueSchemaVersionMinor	3
GlueVOViewLocalID	alice

How does it look like in GLUE2 For the experiments (CREAM)

Program Settings Help

Browser Choose plugin

Entries
GLUE2DomainID=Australia-ATLAS
GLUE2DomainID=AUVERGRID
GLUE2DomainID=BEgrid-BELNET
GLUE2DomainID=BEgrid-ULB-VUB
GLUE2DomainID=BEIJING-LCG2
GLUE2DomainID=BelGrid-UCL
GLUE2DomainID=BG01-IPP
GLUE2DomainID=BG05-SUGrid
GLUE2DomainID=BIFI
GLUE2DomainID=BIOCOMP
GLUE2DomainID=BMRZ-FRANKFURT
GLUE2DomainID=BUDAPEST
GLUE2ContactID=general.contact.BUDAPEST
GLUE2ContactID=security.contact.BUDAPEST
GLUE2ContactID=sysadmin.contact.BUDAPEST
GLUE2ContactID=usersupport.contact.BUDAPEST
GLUE2GroupID=resource
GLUE2ServiceID=816
GLUE2EndpointID=816_org.glite.ce.ApplicationPublisher_2053530043
GLUE2EndpointID=grid106.kfki.hu_org.glite.ce.CREAM
GLUE2PolicyID=grid106.kfki.hu_org.glite.ce.CREAM_Policy
GLUE2EndpointID=grid107.kfki.hu_org.glite.ce.CREAM
GLUE2EndpointID=grid109.kfki.hu_org.glite.ce.CREAM
GLUE2ManagerID=816_Manager
GLUE2ResourceID=kfki.hu
GLUE2ShareID=alice_alice_816
GLUE2PolicyID=alice_alice_816_policy
GLUE2ShareID=cms_cms_816
GLUE2ShareID=dteam_dteam_816
GLUE2ShareID=hungrid_hungrid_816
GLUE2ShareID=ops_ops_816
GLUE2ToStorageServiceID=816_grid143.kfki.hu
GLUE2ServiceID=grid11.kfki.hu_VOMS_2715298739
GLUE2ServiceID=grid143.kfki.hu

GLUE2ComputingShareMaxSlotsPerJob	999
GLUE2ComputingShareMaxTotalJobs	2147483647
GLUE2ComputingShareMaxVirtualMemory	9223372036854775807
GLUE2ComputingShareMaxWaitingJobs	0
GLUE2ComputingShareMaxWallTime	259200
GLUE2ComputingShareRunningJobs	675
GLUE2ComputingShareServiceState	Production
GLUE2ComputingShareTotalJobs	707
GLUE2ComputingShareUsedSlots	0
GLUE2ComputingShareWaitingJobs	32
GLUE2EntityCreationTime	2015-12-09T17:07:54Z
GLUE2EntityOtherInfo	CREAMCEId=grid106.kfki.hu:8443/cream-sge- ServiceType=org.glite.ce.CREAM InfoProviderName=glite-ce-glue2-share-static InfoProviderVersion=1.1 InfoProviderHost=grid107.kfki.hu
GLUE2ShareDescription	Share of alice for alice
GLUE2ShareEndpointForeignKey	grid106.kfki.hu_org.glite.ce.CREAM
GLUE2ShareID	alice_alice_816
GLUE2ShareResourceForeignKey	kfki.hu
GLUE2ShareServiceForeignKey	816

How does it look like in GLUE2 For the experiments (CREAM)

Program Settings Help

Browser Choose plugin

Entries

- + GLUE2DomainID=NCG-INGRID-P1
- + GLUE2DomainID=NCP-LCG2
- + GLUE2DomainID=NDGF-T1
- + GLUE2DomainID=NIHAM
- + GLUE2DomainID=NIKHEF-ELPROD
- + GLUE2DomainID=NO-NORGRID-T2
- + GLUE2DomainID=OBSPM
- + GLUE2DomainID=pic
- + GLUE2DomainID=PK-CIT
- + GLUE2DomainID=prague_cesnet_lcg2
- + GLUE2DomainID=prague_lcg2
- + GLUE2DomainID=PRISMA-INFN-BARI
- + GLUE2DomainID=PSNC
- GLUE2DomainID=RAL-LCG2
 - + GLUE2ContactID=general.contact.RAL-LCG2
 - + GLUE2ContactID=security.contact.RAL-LCG2
 - + GLUE2ContactID=sysadmin.contact.RAL-LCG2
 - + GLUE2ContactID=usersupport.contact.RAL-LCG2
 - + GLUE2GroupID=resource
 - GLUE2GroupID=services
 - GLUE2ServiceID=urn:ogf:ComputingService:arc-ce01.gridpp.rl.ac.uk:arex
 - + GLUE2ContactID=urn:ogf:Contact:arc-ce01.gridpp.rl.ac.uk:ComputingService:arex:con0
 - + GLUE2EndpointID=urn:ogf:ComputingEndpoint:arc-ce01.gridpp.rl.ac.uk:gridftpjob:gsiftp://arc-ce01....
 - + GLUE2EndpointID=urn:ogf:Endpoint:arc-ce01.gridpp.rl.ac.uk:ldapglue1:2135
 - + GLUE2EndpointID=urn:ogf:Endpoint:arc-ce01.gridpp.rl.ac.uk:ldapglue2:2135
 - + GLUE2EndpointID=urn:ogf:Endpoint:arc-ce01.gridpp.rl.ac.uk:ldapng:2135
 - + GLUE2LocationID=urn:ogf:Location:arc-ce01.gridpp.rl.ac.uk:ComputingService:arex
 - + GLUE2ManagerID=urn:ogf:ComputingManager:arc-ce01.gridpp.rl.ac.uk:condor
 - GLUE2ShareID=urn:ogf:ComputingShare:arc-ce01.gridpp.rl.ac.uk:grid3000M
 - + GLUE2PolicyID=urn:ogf:MappingPolicy:arc-ce01.gridpp.rl.ac.uk:basic
 - + GLUE2ServiceID=urn:ogf:ComputingService:arc-ce02.gridpp.rl.ac.uk:arex
 - + GLUE2ServiceID=urn:ogf:ComputingService:arc-ce03.gridpp.rl.ac.uk:arex
 - + GLUE2ServiceID=urn:ogf:ComputingService:arc-ce04.gridpp.rl.ac.uk:arex
 - + GLUE2LocationID=location.RAL-LCG2

GLUE2DomainID=...
GroupID=grid,o=...

ObjectClasses

GLUE2Share

GLUE2ComputingShare

Attributes

GLUE2ComputingShareComputingEndpointForeignKey	urn:ogf:ComputingEndpoint:arc-ce01.gridpp.rl.ac.uk:gridftpjob:gsiftp://arc-ce01....
GLUE2ComputingShareComputingServiceForeignKey	urn:ogf:ComputingService:arc-ce01.gridpp.rl.ac.uk:arex
GLUE2ComputingShareExecutionEnvironmentForeignKey	urn:ogf:ExecutionEnvironment:arc-ce01.gridpp.rl.ac.uk:execen...
GLUE2ComputingShareFreeSlots	460
GLUE2ComputingShareFreeSlotsWithDuration	460
GLUE2ComputingShareLocalRunningJobs	13326
GLUE2ComputingShareLocalSuspendedJobs	0
GLUE2ComputingShareLocalWaitingJobs	0
GLUE2ComputingShareMappingQueue	grid3000M
GLUE2ComputingShareMaxRunningJobs	16968
GLUE2ComputingShareMaxSlotsPerJob	16968
GLUE2ComputingShare...	16968

How does it look like in GLUE2 For the experiments (ARC)

Program Settings Help

Browser Choose plugin

- Entries
- + GLUE2DomainID=NCG-INGRID-P1
 - + GLUE2DomainID=NCP-LCG2
 - + GLUE2DomainID=NDGF-T1
 - + GLUE2DomainID=NIHAM
 - + GLUE2DomainID=NIKHEF-ELPROD
 - + GLUE2DomainID=NO-NORGRID-T2
 - + GLUE2DomainID=OBSPM
 - + GLUE2DomainID=pic
 - + GLUE2DomainID=PK-CIT
 - + GLUE2DomainID=prague_cesnet_lcg2
 - + GLUE2DomainID=prague_lcg2
 - + GLUE2DomainID=PRISMA-INFN-BARI
 - + GLUE2DomainID=PSNC
 - GLUE2DomainID=RAL-LCG2
 - + GLUE2ContactID=general.contact.RAL-LCG2
 - + GLUE2ContactID=security.contact.RAL-LCG2
 - + GLUE2ContactID=sysadmin.contact.RAL-LCG2
 - + GLUE2ContactID=usersupport.contact.RAL-LCG2
 - + GLUE2GroupID=resource
 - GLUE2GroupID=services
 - + GLUE2ServiceID=urn:ogf:ComputingService:arc-ce01.gridpp.rl.ac.uk:arex
 - + GLUE2ContactID=urn:ogf:Contact:arc-ce01.gridpp.rl.ac.uk:ComputingService:arex:con0
 - + GLUE2EndpointID=urn:ogf:ComputingEndpoint:arc-ce01.gridpp.rl.ac.uk:gridftpjob:gsiftp://arc-ce01....
 - + GLUE2EndpointID=urn:ogf:Endpoint:arc-ce01.gridpp.rl.ac.uk:ldapglue1:2135
 - + GLUE2EndpointID=urn:ogf:Endpoint:arc-ce01.gridpp.rl.ac.uk:ldapglue2:2135
 - + GLUE2EndpointID=urn:ogf:Endpoint:arc-ce01.gridpp.rl.ac.uk:ldapng:2135
 - + GLUE2LocationID=urn:ogf:Location:arc-ce01.gridpp.rl.ac.uk:ComputingService:arex
 - + GLUE2ManagerID=urn:ogf:ComputingManager:arc-ce01.gridpp.rl.ac.uk:condor
 - GLUE2ShareID=urn:ogf:ComputingShare:arc-ce01.gridpp.rl.ac.uk:grid3000M
 - + GLUE2PolicyID=urn:ogf:MappingPolicy:arc-ce01.gridpp.rl.ac.uk:basic
 - + GLUE2ServiceID=urn:ogf:ComputingService:arc-ce02.gridpp.rl.ac.uk:arex
 - + GLUE2ServiceID=urn:ogf:ComputingService:arc-ce03.gridpp.rl.ac.uk:arex
 - + GLUE2ServiceID=urn:ogf:ComputingService:arc-ce04.gridpp.rl.ac.uk:arex
 - + GLUE2LocationID=location.RAL-LCG2

Time	
GLUE2EntityValidity	600
GLUE2MappingPolicyShareForeignKey	urn:ogf:ComputingShare:arc- idpp.rl.ac.uk:grid3000M
GLUE2PolicyID	urn:ogf:MappingPolicy:arc- pp.rl.ac.uk:basic
GLUE2PolicyRule	vo:alice vo:atlas vo:cms vo:hone vo:ops vo:dteam vo:ihcb vo:biomed vo:enmr.eu vo:epic.vo.gridpp.ac.uk vo:fusion vo:geant4 vo:glast.org vo:gridpp vo:hyperk.org vo:mice vo:pheno vo:ilc vo:na62.vo.gridpp.ac.uk vo:superbvo.org vo:snoplus.snolab.ca vo:t2k.org
GLUE2PolicyScheme	basic

How does it look like in GLUE2 For the experiments (ARC)

Program Settings Help

Browser Choose plugin

Entries

- + GLUE2DomainID=NCG-INGRID-P1
- + GLUE2DomainID=NCP-LCG2
- + GLUE2DomainID=NDGF-T1
- + GLUE2DomainID=NIHAM
- + GLUE2DomainID=NIKHEF-ELPROD
- + GLUE2DomainID=NO-NORGRID-T2
- + GLUE2DomainID=OBSPM
- + GLUE2DomainID=pic
- + GLUE2DomainID=PK-CIT
- + GLUE2DomainID=prague_cesnet_lcg2
- + GLUE2DomainID=praguelcg2
- + GLUE2DomainID=PRISMA-INFN-BARI
- + GLUE2DomainID=PSNC
- GLUE2DomainID=RAL-LCG2
 - + GLUE2ContactID=general.contact.RAL-LCG2
 - + GLUE2ContactID=security.contact.RAL-LCG2
 - + GLUE2ContactID=sysadmin.contact.RAL-LCG2
 - + GLUE2ContactID=usersupport.contact.RAL-LCG2
 - + GLUE2GroupID=resource
 - GLUE2GroupID=services
 - GLUE2ServiceID=urn:ogf:ComputingService:arc-ce01.gridpp.rl.ac.uk:arex
 - + GLUE2ContactID=urn:ogf:Contact:arc-ce01.gridpp.rl.ac.uk:ComputingService:arex:con0
 - + GLUE2EndpointID=urn:ogf:ComputingEndpoint:arc-ce01.gridpp.rl.ac.uk:gridftpjob:gsiftp://arc-ce01....
 - + GLUE2EndpointID=urn:ogf:Endpoint:arc-ce01.gridpp.rl.ac.uk:ldapglue1:2135
 - + GLUE2EndpointID=urn:ogf:Endpoint:arc-ce01.gridpp.rl.ac.uk:ldapglue2:2135
 - + GLUE2EndpointID=urn:ogf:Endpoint:arc-ce01.gridpp.rl.ac.uk:ldapng:2135
 - + GLUE2LocationID=urn:ogf:Location:arc-ce01.gridpp.rl.ac.uk:ComputingService:arex
 - + GLUE2ManagerID=urn:ogf:ComputingManager:arc-ce01.gridpp.rl.ac.uk:condor
 - GLUE2ShareID=urn:ogf:ComputingShare:arc-ce01.gridpp.rl.ac.uk:grid3000M
 - + GLUE2PolicyID=urn:ogf:MappingPolicy:arc-ce01.gridpp.rl.ac.uk:basic
 - + GLUE2ServiceID=urn:ogf:ComputingService:arc-ce02.gridpp.rl.ac.uk:arex
 - + GLUE2ServiceID=urn:ogf:ComputingService:arc-ce03.gridpp.rl.ac.uk:arex
 - + GLUE2ServiceID=urn:ogf:ComputingService:arc-ce04.gridpp.rl.ac.uk:arex
 - + GLUE2LocationID=location.RAL-LCG2

GLUE2DomainID=...
GroupID=grid,o=...

ObjectClasses

GLUE2Share

GLUE2ComputingShare X

Attributes

GLUE2ComputingShareComputingEndpointForeignKey	urn:ogf:ComputingEndpoint:1.gridpp.rl.ac.uk:gridftpjob:arc-ce01.gridpp.rl.ac.uk:281
GLUE2ComputingShareComputingServiceForeignKey	urn:ogf:ComputingService:gridpp.rl.ac.uk:arex
GLUE2ComputingShareExecutionEnvironmentForeignKey	urn:ogf:ExecutionEnvironment:e01.gridpp.rl.ac.uk:execen
GLUE2ComputingShareFreeSlots	460
GLUE2ComputingShareFreeSlotsWithDuration	460
GLUE2ComputingShareLocalRunningJobs	13326
GLUE2ComputingShareLocalSuspendedJobs	0
GLUE2ComputingShareLocalWaitingJobs	0
GLUE2ComputingShareMappingQueue	grid3000M
GLUE2ComputingShareMaxRunningJobs	16968
GLUE2ComputingShareMaxSlotsPerJob	16968
GLUE2ComputingShare...	16968

How does ARC use it

- ARC can be configured to get a list of users depending on their VO using the [group] [vo] blocks in `arc.conf`
- The list is retrieved from VOMS servers defined in the above blocks
- The list entries are added to grid-mapfile by the **nordugridmap** utility (runs independently from A-REX)
- A-REX just reads the grid-mapfile. It has no idea of VOs. Only users

How does ARC use it

- The only source of this information is either the [group] [vo] blocks or the proxies
- The above stuff is generally free-form strings defined on a best effort community based practice.
- i.e. ATLAS or atlas or AtLaS – in most cases are the same. Not to mention ATLAS_VO or the like.
- Moreover, a sysadmin is free to put in the [vo] blocks the names he/she wants. (VOATLAS, atlasvirtualorg...)

How does ARC use it

- Before ARC 5, it was not possible to assign different VOs to a queue (maybe it was in ARC 0.8). All queues had the same Vos.
- Now it is possible, though there is no authorization enforcement on such queues, i.e. the users can submit even if they don't belong (A-REX does not consider certificate attributes per queue afaik)
- The number of jobs is calculated per queue, not per VO.

– Got a GGUS ticket about it!

https://ggus.eu/index.php?mode=ticket_info&ticket_id=112543

Why ARC uses it like that

- The VO concept was never well defined
- VO Strings may vary from one VOMS server to another
- A user can belong to multiple VOs
- The batch system has no idea of VOs. The jobs themselves do not have knowledge of what VO they belong.
Only the user belongs to some, but A-REX does not check for VO itself.

Main VO issues

- Experiments want job statistics per VO.
- A-REX used to discard such information.
- BUG 3495 has a patch for A-REX, contains a discussion with a plan how to fix it.
 - There is a patch by Aleksandr that saves the most important VO name in the proxy certificate into .local file for a job, but it doesn't work for me!
 - Andrii thinks that limiting to the first VO is not sufficient
 - The experiments claim that in the end only one VO per user is actually used
- Our GLUE1 implementation is not flexible wrt to this

How was it solved for CREAM?

- In the CREAM world, sites used to write their own infocollector to target a specific VO
- My attempts to suggest ways to configure ARC to get the same behavior were rejected (see GGUS ticket)
- Implementation for GLUE1 was native, infocollector architecture more flexible than ours (but they only work with BDII/LDAP)

How we plan to solve it

- Make A-REX aware of what VO does a job (or rather, its user) belong to (partially done, need to interact with Aleksandr to understand why it doesn't work for me)
- Make arc.conf configurable wrt which VO is served by each queue (done!)
- Create a PERL module that can work both for GLUE1 and GLUE2 to calculate jobs statistics
- Generate GLUE1/2 objects in a totally different way
 - ! Might create a new bottleneck: additional two GLUE1 and GLUE2 objects for each VO, each object needs the logic to calculate jobs per VO

How to assign a VO to a job?

- Chosen:
 - Read the user proxy
 - Configure authorization in arc.conf using [group]
 - Have an arc.conf configuration where VOMS credentials are checked and enforced first
 - The VO information with which the user was authorized is written in the job.id.local

Rejected solutions

- Add an option to xrsl to specify the VO
- Add an option to xrsl to specify a VOMS server
- Add an external service that tells what VO the job belongs to
- Use the infosys rendering to assign VO to a job, i.e. the selected queue/share determines the VO, A-REX must authorize only if the user is allowed to run on that VO

Reference Bugs and GGUS tickets

- https://ggus.eu/index.php?mode=ticket_info&ticket_id=112543
- https://bugzilla.nordugrid.org/show_bug.cgi?id=3495
- https://bugzilla.nordugrid.org/show_bug.cgi?id=3433
- https://bugzilla.nordugrid.org/show_bug.cgi?id=3464
-