



The Legion System

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References

1. Grimshaw, Wulf, and the Legion Team. *The Legion Vision of a Worldwide Virtual Computer*. CACM January, 1997.
2. Grimshaw, Ferrari, Knabe, and Humphrey. *Wide-Area Computing: Resource Sharing on a Large Scale*. IEEE Computer May, 1999.
3. Natrajan, A. and Humphrey, M. "Legion: The Grid OS Architecture and User View" 2nd International Global Grid Forum Meeting, July 15-18, 2001. (Powerpoint)
4. Natrajan, A. "Legion: The Grid Operating System" Lecture at UMBC, April, 2001.
(<http://legion.virginia.edu/presentations/UMBC-Apr2001/>)
5. The Legion Web Site (<http://www.cs.virginia.edu/~legion/>)

Legion Project Background

- ◆ University of Virginia
- ◆ Now commercialized as a business intelligence and data integration framework (<http://www.avaki.com/>)
 - As far as I can tell, you can't download it anymore.

Buzzphrases

- ◆ *World-Wide Virtual Computer*
- ◆ *Metasystem Software*
- ◆ *Wide-Area Operating System*

→ These things just mean “grid” or “grid infrastructure middleware”.

10 Design Objectives

- ◆ Site autonomy
- ◆ Extensible core
- ◆ Scalable architecture
- ◆ Easy-to-use, seamless environment
- ◆ High performance via parallelism
- ◆ Single persistent name space
- ◆ Security for users and resource owners
- ◆ Management and exploitation of resource heterogeneity
- ◆ Multiple language support and interoperability
- ◆ Fault tolerance

3 Design Constraints

- ◆ Must work within host operating systems
- ◆ Must work with existing communication protocols
- ◆ Must run with least privilege

Component-Based System

- ◆ Object-oriented
 - Everything is an object – files, processors, storage devices, networks, users, etc.
- ◆ Core objects are specified as interfaces rather than implementations
 - Has an Interface Description Language (IDL)
 - CORBA for the Grid?
- ◆ Objects are extensible and replaceable
- ◆ Support access control on the function invocation level via the “MayI” method

Some Object Types

- ◆ Host
 - Abstraction of a processing unit
- ◆ Vault
 - Abstraction of persistent storage
- ◆ Class Manager
 - Responsible for object creation, monitoring, and lifetime management

Object Identification

- ◆ Context Name
 - Human-readable
- ◆ Legion Object ID (LOID)
 - Location-independent
- ◆ Object Address
 - Machine-and-communication-specific

Available Tools [3]

- ◆ MPI
- ◆ PVM
- ◆ Remote compilation
- ◆ Postmortem debugger
- ◆ Accounting
- ◆ Licensing

Legion Process (from [3])

- ◆ User initiates "run"
- ◆ User/Legion selects site
- ◆ Legion copies binaries
- ◆ Legion copies input files
- ◆ Legion starts job(s)
- ◆ Legion monitors progress
- ◆ Legion copies output files

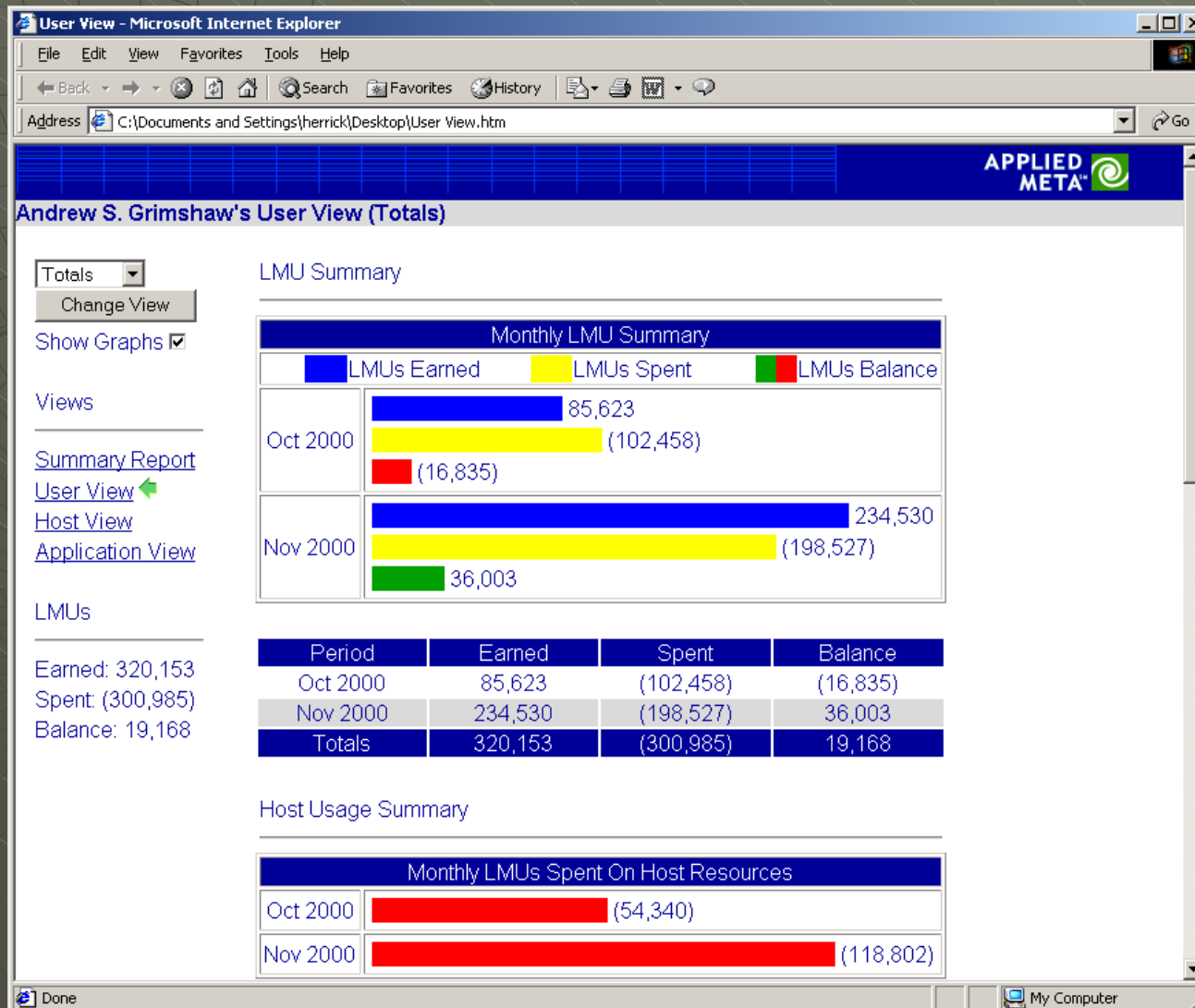
Context Space

- ◆ Where the user works with Legion
- ◆ Grid-wide hierarchical directory service
- ◆ Global namespace
 - All resources can be named and referenced using Unix-like paths
- ◆ Contrast with “local space”, the user’s local machine
 - Can transfer files/directories from context to local and vice versa
 - Can also map a local directory to context space temporarily

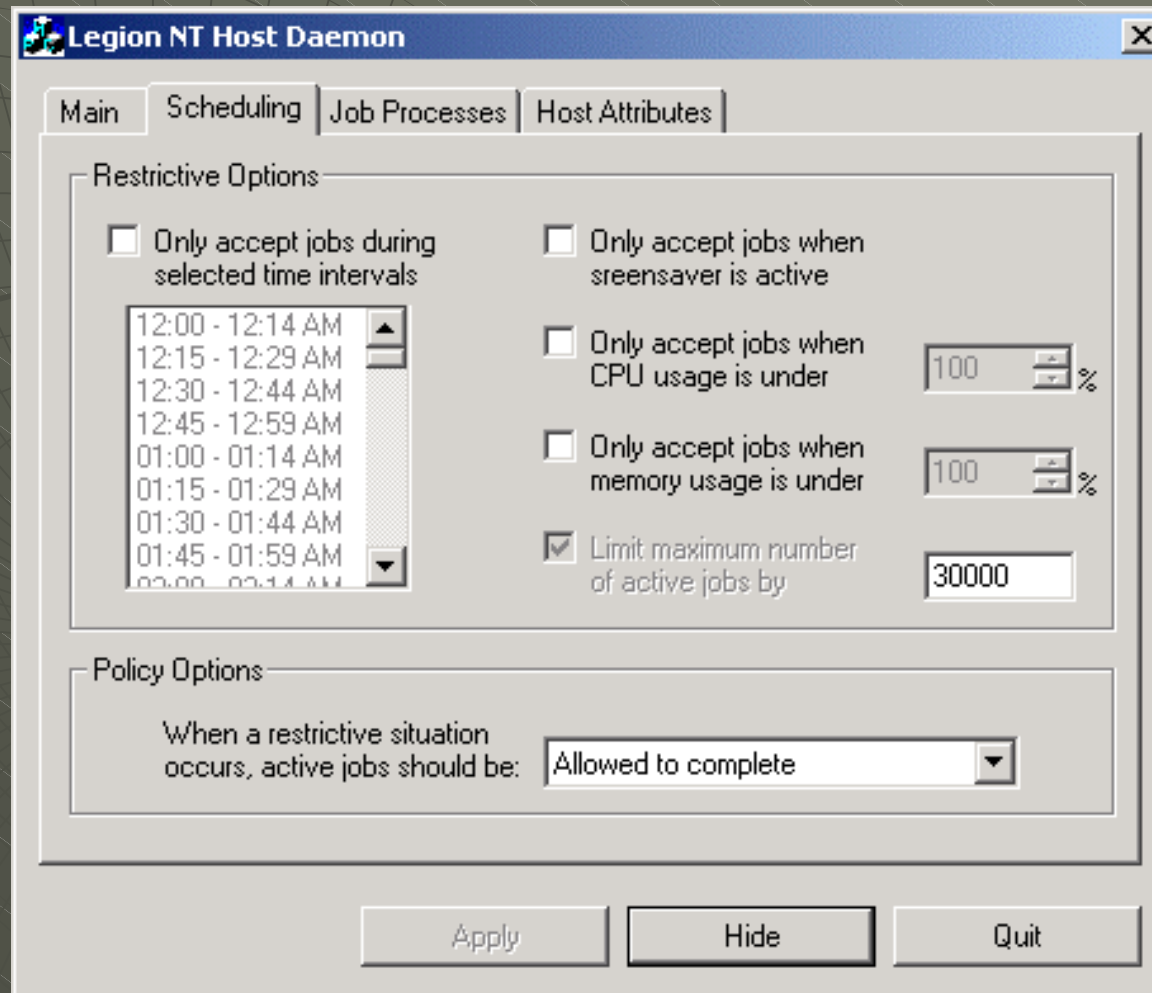
Some Screenshots

- ◆ From [3]:
 - Natrajan, A. and Humphrey, M.
"Legion: The Grid OS Architecture and User View" 2nd International Global Grid Forum Meeting, July 15-18, 2001.
(Powerpoint)

Accounting (from [3])



Job Sandbox (from [3])



[3]

Legion Browser - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address m&SESSION_ID=731.692968402058131.996572483331380.276581272483&command=legion_ls&arg1=/class&curdir=/class Go

Links RealPlayer

LEGION worldwide virtual Computer
e pluribus unum: one out of many

APPLIED META **Work as One™**
vanet

[Home](#) [Whoami](#) [Profile](#) [Man Pages](#) [Clear Cache](#) [Create/Copy](#) [Delete](#) [Register](#) [Run](#) [Instance Information](#) [Status](#) [Logout](#)

Contexts Contents of/class (31 entries)

	Name	Type	Basics	Permissions	Details
class	AuthenticationObjectClass	class	attrs , class , names	acfs , change	info , whereis , ping
etc	BasicFileClass	class	attrs , class , names	acfs , change	info , whereis , ping
home	BasicSchedulerClass	class	attrs , class , names	acfs , change	info , whereis , ping
hosts	BatchQueueMetaClass	class	attrs , class , names	acfs , change	info , whereis , ping
impls	BindingAgentClass	class	attrs , class , names	acfs , change	info , whereis , ping
mpi	BootstrapMetaClass	class	attrs , class , names	acfs , change	info , whereis , ping
mpi_hosts	CollectionClass	class	attrs , class , names	acfs , change	info , whereis , ping
pvm	CommandLineClass	class	attrs , class , names	acfs , change	info , whereis , ping
tmp	ContextClass	class	attrs , class , names	acfs , change	info , whereis , ping
users	ContextProxyClass	class	attrs , class , names	acfs , change	info , whereis , ping
vaults	EnactorClass	class	attrs , class , names	acfs , change	info , whereis , ping
	FileProxyClass	class	attrs , class , names	acfs , change	info , whereis , ping
	JobProxyClass	class	attrs , class , names	acfs , change	info , whereis , ping
	LegionClass	legion class	attrs , class , names	acfs , change	info , whereis , ping
	PlaybackBootstrapObjectClass	class	attrs , class , names	acfs , change	info , whereis , ping
	ProxyBindingMetaClass	class	attrs , class , names	acfs , change	info , whereis , ping
	ProxyMetaClass	class	attrs , class , names	acfs , change	info , whereis , ping
	ProxyMetaClassObject	does not exist	attrs , class , names	acfs , change	info , whereis , ping
	RecorderObjectClass	class	attrs , class , names	acfs , change	info , whereis , ping
	StatTreeClass	class	attrs , class , names	acfs , change	info , whereis , ping
	StatelessClasses	context	attrs , class , names	acfs , change	info , whereis , ping
	StatelessProxyMetaClass	class	attrs , class , names	acfs , change	info , whereis , ping
	TwoDFileClass	class	attrs , class , names	acfs , change	info , whereis , ping
	UnixHostClass	class	attrs , class , names	acfs , change	info , whereis , ping
	UnixImplementationCacheClass	class	attrs , class , names	acfs , change	info , whereis , ping
	UnixImplementationClass	class	attrs , class , names	acfs , change	info , whereis , ping
	UnixVaultClass	class	attrs , class , names	acfs , change	info , whereis , ping
	VanillaMetaClass	class	attrs , class , names	acfs , change	info , whereis , ping
	legion make backend	runnable class	attrs , class , names	acfs , change	info , whereis , ping
	legion native mpi backend	runnable class	attrs , class , names	acfs , change	info , whereis , ping
	ttyObjectClass	class	attrs , class , names	acfs , change	info , whereis , ping

[Legion Home](#) [AppliedMeta Home](#) [Documentation](#) [Software](#) [Testbeds](#) [Et Cetera](#) [Map/Search](#) [Legion Help](#) [Browser Help](#)

Internet

[3]


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File Edit View Favorites Tools Help

Address [m&SESSION_ID=731.692968402058131.996572483331380.276581272483&command=legion_ls&arg1=/class&curdir=/class](#) Go

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	ProxyMetaClass	class	attrs , class , names	acfs , change	info , whereis , ping
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	RecorderObjectClass	class	attrs , class , names	acfs , change	info , whereis , ping
	StatTreeClass	class	attrs , class , names	acfs , change	info , whereis , ping
	StatelessClasses	context	attrs , class , names	acfs , change	info , whereis , ping
	StatelessProxyMetaClass	class	attrs , class , names	acfs , change	info , whereis , ping
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	UnixHostClass	class	attrs , class , names	acfs , change	info , whereis , ping
	UnixImplementationCacheClass	class	attrs , class , names	acfs , change	info , whereis , ping
	UnixImplementationClass	class	attrs , class , names	acfs , change	info , whereis , ping
	UnixVaultClass	class	attrs , class , names	acfs , change	info , whereis , ping
	VanillaMetaClass	class	attrs , class , names	acfs , change	info , whereis , ping
	legion_make_backend	runnable class	attrs , class , names	acfs , change	info , whereis , ping
	legion_native_mpi_backend	runnable class	attrs , class , names	acfs , change	info , whereis , ping
	tvObjectClass	class	attrs , class , names	acfs , change	info , whereis , ping

[\[Legion Home\]](#) [\[AppliedMeta Home\]](#) [\[Documentation\]](#) [\[Software\]](#) [\[Testbeds\]](#) [\[EtCetera\]](#) [\[Map/Search\]](#) [\[Legion Help\]](#) [\[Browser Help\]](#)

Internet

[3]

Legion Browser - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address 402058131.996572483331380.2765812724833.command=legion_list_attributes&arg1=/hosts/tflegion.sdsc.edu&curdir=/hosts Go

Links RealPlayer

Attributes for /hosts/tflegion.sdsc.edu (35)

Contexts	Action	Name	Value
class	Drop/Edit	atime	'964101816', '808361'
ctime	Drop/Edit	ctime	'964101816', '808361'
mtime	Drop/Edit	mtime	'964101816', '808361'
hosts	Drop/Edit	createtime	'964101816', '808361'
impls	Drop/Edit	implements	'host'
mpi	Drop/Edit	host_legion_architecture	7
mpi_hosts	Drop/Edit	host_os_name	'AIX'
name	Drop/Edit	host_node_name	'tf176i.sdsc.edu'
release	Drop/Edit	host_os_release	'3'
version	Drop/Edit	host_os_version	'4'
vaults	Drop/Edit	host_machine_type	'unknown'
	Drop/Edit	host_architecture_type	'unknown'
	Drop/Edit	host_speed	100.000000
	Drop/Edit	host_max_objects	30000
	Drop/Edit	host_throttle_policy	'drain'
	Drop/Edit	host_luid	'1.3933cb3f.07.b9000000.000001fc0e1a6a8ffc0b6ecd5796f702387a5879d8127057422291c'
	Drop/Edit	host_property	'queue'
	Drop/Edit	context_link	'1.3933cb3f.05.01000000.000001fc0bb404d0efc674a3e2043f3a989052801303df1be4609dff@tflegion.sdsc.edu'
	Drop/Edit	host_compatible_vault	'1.3933cb3f.03.c8000000.000001fc0a7a6e0447d18785d3b16126d3065c6c1d0288423a6a9f'
	Drop/Edit	host_queue_type	'Maui'
	Drop/Edit	schedule_level1	'loadleveler'
	Drop/Edit	schedule_level2	'tflegion'
	Drop/Edit	schedule_level3	'sdsc'
	Drop/Edit	schedule_level4	'usa'
	Drop/Edit	host_property	'native-MPI'
	Drop/Edit	native_mpi_run	'/usr/local/apps/legion/Legion/bin/rs6000/legion_native_mpiibm_wrapper'
	Drop/Edit	context_link	'1.3933cb3f.05.01000000.000001fc0bb404d0efc674a3e2043f3a989052801303df1be4609dff@tflegion'
	Drop/Edit	host_num_processors	1152
	Drop/Edit	context_link	'1.3933cb3f.72000000.62562ea5.000001fc0cfbb0c55f533ceb1fd0660813c75d20033069fac@tflegion'
	Drop/Edit	host_num_processors	2
	Drop/Edit	host_uptime	2383200
	Drop/Edit	host_one_minute_proc_load	0.140000
	Drop/Edit	host_five_minute_proc_load	0.160000
	Drop/Edit	host_fifteen_minute_proc_load	0.170000
	Drop/Edit	host_num_objects	18

Add Attribute

Done Internet



Questions