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Document “IPv6 guidelines for grid programmers”

*Valentino R. Carcione - GARR
EGEE06 - Geneva, 26.09.2006*

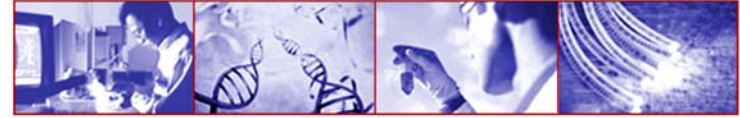




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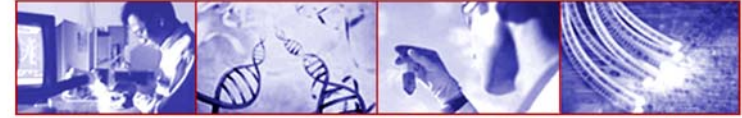
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- ▶ Introduction to EUChinaGRID network activities
- ▶ Motivations & principles informing the document
- ▶ IPv6 guidelines for GRID programmers



EUChinaGRID WP2 Objectives

- ▶ Study the available and foreseen network connectivity promoting new high bandwidth links between Europe and China.
- ▶ Study the available Grid Middleware for an IPv6 network and the interaction between Grid Services and IPv4-IPv6 communication, in order to provide a feedback and propose code enhancements to developers (EGEE, Globus, etc.).



WP2 Activities

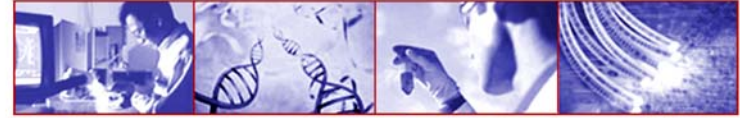
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- ▶ A2.1- Network connectivity plan
 - Study the available connectivity and stimulate the development of the needed connectivity in terms of bandwidth, performance and quality of service
- ▶ A2.2 - Analysis of multi-protocols Grid connectivity
 - Study the interactions between the middleware and the IPv6 networks available in China and in EU, address the problems and feedback to the developers.



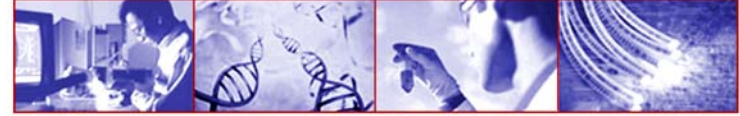
Objective of the activity

- ▶ Promote the integration on the EU-CN grid infrastructures in a multi-protocol environment.
- ▶ Promote the use of the IPv6 protocol in the European grid infrastructure, in collaboration with other EU project (like EGEE).
- ▶ Collaborate to get a fully IPv6-compliant version of the grid middleware.



Why IPv6?

- ▶ IPv6 will run side by side to IPv4. Although a transition date is not foreseen, IPv6 is expected to gradually replace IPv4.
- ▶ Some Grid-related project both in Europe and Asia have already planned to work in IPv6.
- ▶ The EGEE middleware, which can be regarded as the European standard “de facto”, currently does not support the new protocol.



Benefits of IPv6 in a GRID environment

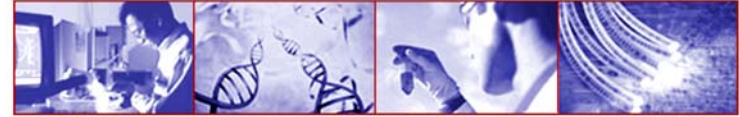
- ▶ A larger address space allows an end-to-end connectivity for all nodes of the grid without NAT.
- ▶ Autoconfiguration mechanisms make the setup of all nodes easier.
- ▶ The intrinsic features of IPv6, such as mobility, the use of multicast instead of broadcast and the extensible header model, generally allow a more efficient use of the network.
- ▶ Integrated authentication methods improve the security over the grid infrastructure.



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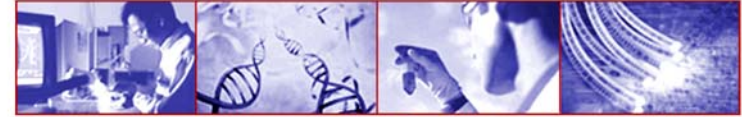
Why IPv6 doesn't work on gLite

- ▶ The new generic interface for IPv6 socket programming is addressed in RFC-3493 “Basic socket interface extension for IPv6”
- ▶ The RFC defines new:
 - Core socket functions
 - Address data structures
 - Name-to-Address translation functions
 - Address conversion functions
- ▶ RFC-3493 aims to make easier the conversion of the existing IPv4 application in IPv6
 - ▶ Using this API, applications should not need to know which type of host they are communicating with.



Why IPv6 doesn't work on gLite (2)

- ▶ Unfortunately programmers have the habit to use old API instead of the RFC-3493 extension
- ▶ Old API can be address the IPv6 protocol family but make difficult the develop process

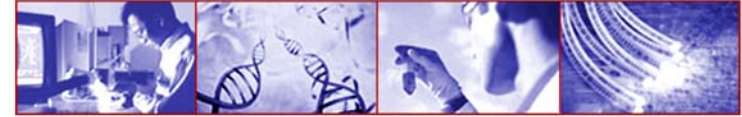


First software survey

- ▶ A first glance on the gLite code highlights that some network routines are not compliant to RFC 3493

```
[~/org.glite.wms-utils.tls] $ grep F_INET
./src/socket++/Socket*.cpp
SocketClient.cpp: agent -> peeraddr_in.sin_family = AF_INET;
SocketClient.cpp: if( (agent -> sck = socket(AAF_INET, SOCK_STREAM,
0)) == -1 ) {
SocketServer.cpp: myaddr_in.sin_family = AF_INET;
SocketServer.cpp: sck = socket (AF_INET, SOCK_STREAM, 0);
```

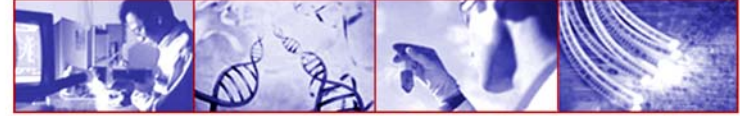
- ▶ IP dependencies can be fixed only by developers.



First software survey

- ▶ A more detailed survey was started on a Storage Element (DPM with SRM)
- ▶ System libraries resolve correctly IPv6 addresses, but the software is unable to understand it.

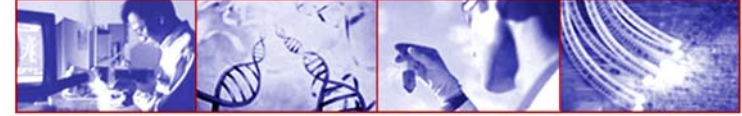
```
[ipv6@roma02 ipv6]$ dpns-ls /
send2nsd: NS009 - fatal configuration error: Host unknown:
roma02.ipv6.euchinagrid.eu
[ipv6@roma02 ipv6]$ strace dpns-ls /
...
recvfrom(3,
"\263\354\201\203\0\1\0\0\0\1\0\0\6roma02\4ipv6\veuchin"...,1024,
0, {sa_family=AF_INET, sin_port=htons(53),
sin_addr=inet_addr("193.206.158.1")}, [16]) = 123
close(3) = 0
```



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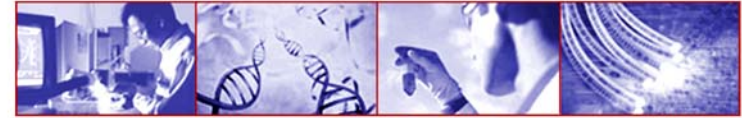
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Following-up the Beijing meeting

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- ▶ In the EUChinaGRID meeting in Beijing two action was defined to help the EGEE developers in the integration process:
 - Draw up an interoperability guideline for developers
 - Check and debug the source code of the gLite middleware in order to identify IP dependencies



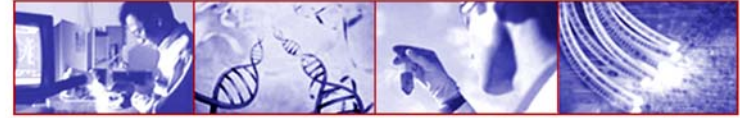
Interoperability guide for developers

▶ The document tackles the basics of the IPv6 programming in 4 different languages:

- C
- Perl
- Python
- Java

▶ It aims to be a first guide for middleware developers

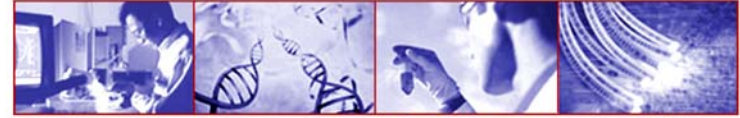
▶ It will be discussed with the EGEE-JRA1 team ASAP



Interoperability guide for developers (2)

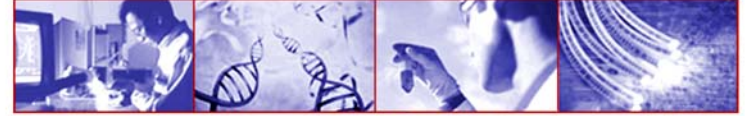
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- ▶ The document is made of two parts:
 - IPv6 Programming guide: describes the basics of IPv6 programming in the most used programming languages and explains how to port IPv4 application on IPV6
 - gLite code survey: (under construction) reports the results of the code survey on the middleware source code and draws up the list of the incompatible modules



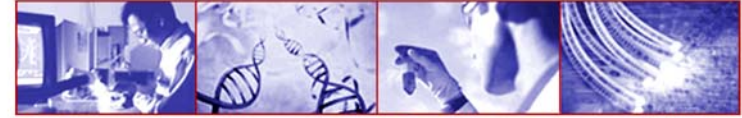
Most frequently programming issues

- ▶ Hard-coded addresses (e.g. 127.0.0.1 instead of the name localhost)
 - ▶ Un-portable APIs
 - ▶ IPv4 specific keywords
 - ▶ Libraries with only IPv4 support
 - ▶ IPv6 un-compliant functions for name resolution
 - ▶ Numerical IPv4 addresses instead of the server names
- ▶ Small data structure (IPv6 addresses are a bit large... 128 bit vs 32 bit of IPv4)



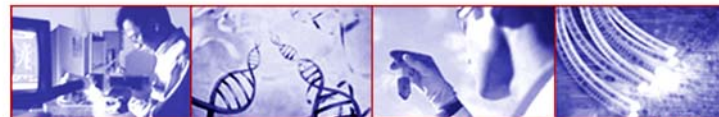
Finding IP dependencies in the MWs

- ▶ Two different actions have been started:
- C Code checker
 - Third-party (non gLite) middleware compatibility report.



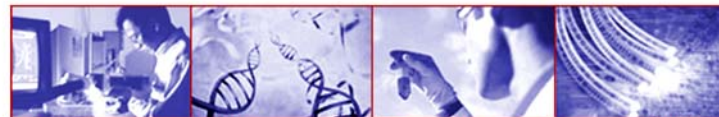
Actions

- ▶ Extend the code survey to other packages of the EGEE MW (this action will be started when the other source repositories will be available).
- ▶ Integrate the code survey results in the migration guidelines document.



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Questions?



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Thank you!