

Porting AliEn to Windows

Harutyunyan A.T.^{1,2,3}, Hayrapetyan A.R.^{1,2,4}

¹ Yerevan Physics Institute (YerPhI) after A.I. Alikhanyan, 2 Br. Alikhanyan St., 375036 Yerevan, Armenia

² Armenian e-Science Foundation (ArmeSFo), 49 Komitas St., 375051 Yerevan, Armenia

³ Student at Department of Computer Science and Informatics, State Engineering University of Armenia (SEUA), 105 Terian St., 375009 Yerevan, Armenia

⁴ Student at Department of Applied Mathematics, Yerevan State University (YSU), 1 Alex Manoogian St., 375049 Yerevan, Armenia

{hartem, ahairape}@mail.yerphi.am

Abstract

AliEn is a Grid infrastructure for large-scale job submission and distributed data management developed and intensively exploited by ALICE, a heavy-ion experiment under construction at CERN. The node hierarchy of AliEn represents central and remote site servers and end-user, client machines. These three parts communicate with each other via XML messages using SOAP protocol and the message generation and exchange is done using portable Perl modules. This makes it possible to run the client, site and server software on different OSs. This paper describes our progress on the port of the AliEn client part software to the Windows OS.

1 Introduction

AliEn (ALICE Environment on the Grid) [1] is a distributed computing environment developed by the off-line team of the ALICE experiment [2], one of the four LHC (Large Hadron Collider) [3] experiments currently being built at CERN, Geneva, Switzerland [4]. Its aim is to offer the ALICE user community a transparent access to the worldwide-distributed computing and storage resources. AliEn was put into exploitation at the end of 2001. Currently ALICE is using AliEn for the distributed production of Monte-Carlo data, detector simulation and reconstruction at more than 30 sites located on four continents. Several other HEP experiments as well as health-care Grid projects (EU MammoGRID, INFN GP-CALMA) are exploiting AliEn or some components of it (see [1] for references).

An important task of the AliEn developers is to port it to systems other than Linux OS, giving access to AliEn to as many users as possible. Besides, the AliEn toolkit has been chosen by the Middleware Re-engineering and Integration team of the European EGEE project [5] for its activity of the integration of the middleware of the leading Grids. The aim of the team is to provide robust middleware components, deployable on several platforms including the Windows one.

In this paper we present our work on the AliEn client part port to Windows OS. The node hierarchy of the Alien software is presented in Section 2. The dependency structure of AliEn, which defines the port strategy, is described in Section 3. The port details are explained in Section 4 and in Section 5 we summarize the current status of our work.

2 Node hierarchy of AliEn

AliEn has been built on top of the latest Internet standards for information exchange and authentication (XML/SOAP, PKI) from a large number of the common Open Source components (such as Globus/GSI, OpenSSL, OpenLDAP, SOAPLite, MySQL). Out of a total of 3M lines of code, only 1 % corresponds to the native AliEn code, written in Perl, while 99 % of the code was imported in the form of external/third party Open Source components (for more details on AliEn see [6-10]).

The node hierarchy of the AliEn is shown in Figure 1. It represents a central server (which provides authentication and monitoring, file transfer and job brokering, optimization and managing), remote site servers (with local monitoring service, computing and storage elements and file transfer daemon) and client part that provides interface for working in AliEn.

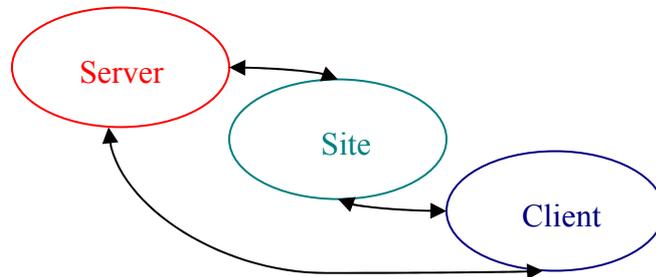


Figure 1. AliEn node hierarchy

The central server software is installed one per Virtual Organization, the site software is installed at least one per site and the third, client part is installed on the user machines. The corresponding software distribution packages are presented in Table 1.

<i>Package Name</i>	<i>Installed by Client</i>	<i>Installed by Site</i>	<i>Installed by Server</i>
AliEn-Admin			✓
AliEn-Base	✓	✓	✓
AliEn-CE		✓	
AliEn-Client	✓		✓
AliEn-GUI	✓		
AliEn-Monitor		✓	
AliEn-Portal			✓
AliEn-SE		✓	
AliEn-Server			✓

Table 1. AliEn distribution packages for Client, Site and Server

The AliEn components are web services and they communicate with each other via XML messages using SOAP protocol. The message generation and exchange is done using portable Perl modules. This makes it possible to port to the non-Linux platforms the client part alone.

3 Client software port scheme

The AliEn distribution for Linux contains all the necessary software to run AliEn under a Linux shell. The client part native code consists of shell and Perl scripts. Shell scripts are used for processing user supplied commands (like ‘alien proxy-init’ or ‘alien’) and further invocation of appropriate AliEn Perl script (it may be proxyInit.pl or Prompt.pl) as well as for the initialization of the environment variables (e.g., \$ALIEN_ROOT, X509_CERT_DIR) which are used during the AliEn work.

To run AliEn under Windows, one needs necessary GNU shell utilities (Bash command-line interpreter, compiler, and shell applications like ‘find’, ‘grep’, etc) ported to Windows. Therefore the whole software to port consists of the original AliEn software plus these utilities. For a software port, it is necessary to unravel its dependency structure. The dependencies hierarchy of the AliEn client part software to port is organized in a four-layer structure shown in Figure 2.

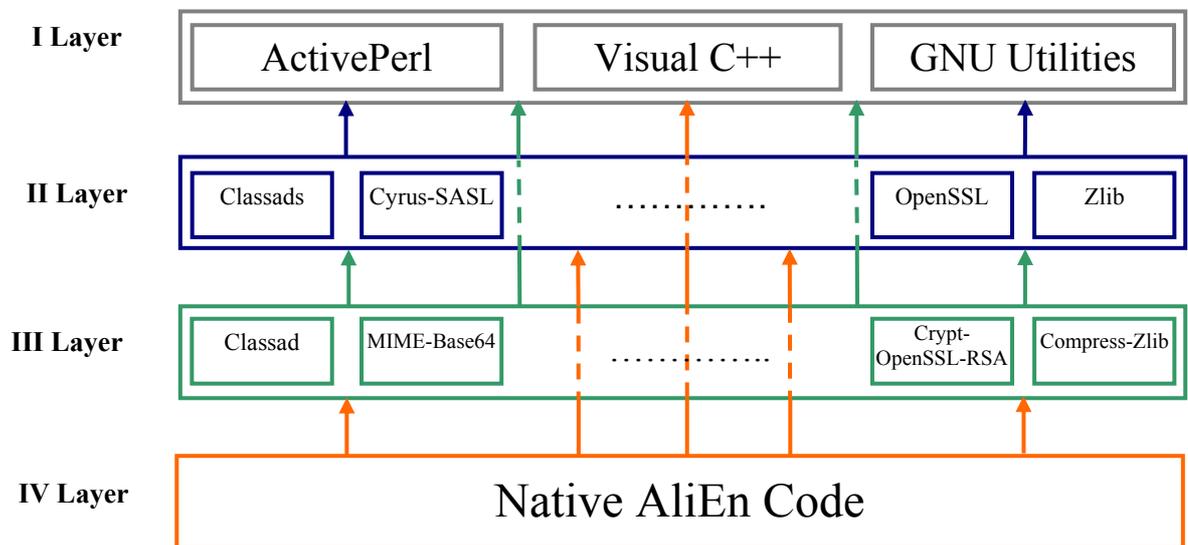


Figure 2. Dependency hierarchy of the AliEn client part software

The first three layers include third-party software packages. They are grouped into blocks which contain Perl modules, tools and libraries and which have no mutual dependencies within a layer. Blocks from the first three layers are given in Tables A1, A2 and A3 of the Appendix, respectively. In the cells of these tables, the content of an individual block is listed.

The first layer provides a building and execution environment for the next layers. It is formed of the Microsoft Visual C++, Active Perl and GNU utilities for Windows. The blocks from the second and third layers represent Perl modules, libraries and various tools. The last, fourth layer is the native AliEn source code which is not divisible into blocks and is ported as a unified whole.

4 Port details

In this section we expose the port steps in accordance with the dependency structure shown in Figure 2. We are porting the AliEn distribution version 1.32.14.

4.1 First layer

The blocks entering first layer are composed of the following packages:

- **Active Perl** [11]. This package provides Perl interpreter for Win32 platform, which is the port of Linux Perl interpreter version 5.8.0 entering the AliEn distribution.
- **Microsoft Visual C++** [12]. This package provides: C/C++ compiler (`cl`), linker (`link`) and Microsoft Program Maintenance Utility (`nmake`). This set of tools provides the same functionality as GNU utilities `gcc`, `ld` and `make` under Linux.
- **GNU utilities for Windows** [13]. This package provides Bash command-line interpreter and other tools used for processing the AliEn shell scripts.

The list of the first layer tools is given in the Table A1.

4.2 Second layer

The blocks from the 2nd layer are listed in Table A2 of the Appendix. They represent third party libraries and tools from AliEn distribution. These libraries and tools were installed without modification.

4.3 Third layer

The third layer contains third party Perl modules from AliEn distribution listed in the Table A3 of Appendix. They are divided into 2 categories: modules, which do not depend on C/C++ libraries and modules which link to the dynamically loaded C/C++ libraries. The first ones are OS (and architecture) independent, so they do not need port. More than a half of the modules from AliEn distribution is OS independent and is used under Windows without installation.

The list of modules that are OS dependent is given in Tables A4a and A4b of the Appendix. As AliEn distribution does not contain source codes, we built Perl modules from sources available at CPAN [14] and AliEn cache [15]. Table A4a of the Appendix contains modules that did not require modifications for building them under Windows. Table A4b of the Appendix shows modules that needed modifications. Before building and installing them under Windows we had to modify or add options to C/C++ compiler and linker in the appropriate Makefile.PL files.

4.4 Fourth layer

This layer represents the AliEn native code which consists of Perl and shell scripts. In general, these scripts do not require modifications, but in several files there are parts of code that cause errors under Windows. An example is the Linux specific Perl function `getpwuid()` in `$ALIEN_ROOT/site/lib/AliEn/Config.pm` file, which is used to retrieve the username. It is not implemented in the **ActivePerl** and the call of this function was substituted by getting the username from environment variable `$USERNAME`.

5 Port results: AliEn package for Windows users

AliEn client part port has been tested under both Windows 2000 and XP. The bulk of the AliEn commands is currently functioning under Windows. One is able to authenticate, browse the file

catalogue as well as submit jobs. As compared to the AliEn tutorial [16], we have presently the following functionality of the AliEn under Windows:

Authentication (Section 3 of the tutorial): works both with SSH keys and X509 certificates.

Basic commands (Section 4 of the tutorial): all basic commands listed in the AliEn tutorial are working, except `< tab >` and `< tab >> tab >`.

Submitting Jobs (Section 5 of the tutorial): all job submission and monitoring commands are working.

AliEn GUI/xfiles (Section 6 of the tutorial): the port of the AliEn graphics part was not yet considered.

Finally, using the Nullsoft Scriptable Install System (NSIS) tool [17], the Windows AliEn distribution was packaged to `setup.exe` file. This allows installing/uninstalling the AliEn under Windows via a few clicks of the mouse.

Acknowledgments

The achievement of our goal was not possible without the continuous professional guidance and encouragement of Predrag Buncic and Ara Grigoryan. We are thankful to the Swiss Fonds “Kidagan” and Calouste Gulbenkian Foundation for a continuous financial support of our work. The help of the Organizing Committee for our participation in this Conference is deeply acknowledged.

Appendix: AliEn client part software

Table A1. First layer software

	Type	URL
ActivePerl-5.8.0.806: <i>perl.exe</i>	Application	www.activestate.com
Microsoft Visual C++ 6, .Net: <i>cl.exe</i> <i>link.exe</i> <i>nmake.exe</i>	Application	www.microsoft.com/visualc
Gnu utilities for Win9x/NT: <i>bash</i> <i>basename</i> <i>dirname</i> <i>printenv</i> <i>grep</i> <i>mkdir</i> <i>rm</i> <i>find</i> <i>diff</i>	Application	folk.uio.no/andreass/unix_tools.html

Table A2. Second layer: Tools and libraries

Blocks	Type	URL
classads_0.9.5	Library	www.cs.wisc.edu
STLPort-4.6.2	Library	www.stlport.org
Swig-13.19	Application	www.swig.org
cyrus-sasl-1.5.28	Library	asg.web.cmu.edu
GTK+-1.2.10	Library	www.gtk.org
Glib-1.2.10		
expat-1.95.5	Condor Library	expat.sourceforge.net
freetype-1.3.1	Application	www.freetype.org
openssl-0.9.6g	Application	www.openssl.org
WinGlobus2.0 Alpha3	Library/Toolkit	www.globus.org
Zlib-1.1.4	Library	www.zlib.org

Table A3. Third layer blocks

Attribute-Handlers-0.78	Class-MakeMethods-1.005
Params-Validate-0.58	Class-MakeMethods-Template-1.004
Authen-SASL-2.02	DBD-CSV-0.2001
Cache-Cache-1.01	DBI -1.37
Digest-MD5-2.20	DBIx-SQLEngine-0.007
Digest-SHA1-2.01	SQL-Statement-0.1020
Error-0.15	Text-CSV_XS-0.23
File-Cache-0.16	Class-Singleton-1.03
File-Spec-0.83	Convert-ASN1-0.17
HTML::HeadParser-2.17	Dir-Purge-1.0
LWP-5.68	File-CacheDir-0.17
MIME-Base64-2.16	Filesys-DiskFree-0.06
Net::FTP-2.65	Filesys-DiskSpace-0.05
Net-Jabber-1.28	HTML-FromText-1.005
SOAP-Lite-0.55	Log-TraceMessages-1.1
Storable-2.04	HTML-Tree-3.16
Unicode-String-2.06	HTML-Parser-3.28
URI-1.22	HTML-Tagset-3.03
XML-Stream-1.16	HTML-TreeBuilder-3.13
XML-Simple-1.08	HTTP-Request-Form-0.7
XML-Parser-2.31	HTTP-Request-Common-1.19
CGI-FastTemplate-1.09	LWP-UserAgent
Class-Base-0.03	URI-URL-5.03
Class-Facade-0.01	IO-Stringy-2.108
Class-Factory-0.03	Log-Dispatch-1.80
Test-More-0.47	Net-Daemon-0.37
Class-Hook-0.01	Net-LDAP-0.29
Test-Harness-2.26	Parse-RecDescent-1.80
Time-HiRes-1.43	SOAP-Transport-HTTP-0.55
Test-Simple-0.47	Term-Cap-1.08
WSDL-Generator-0.01	Test-1.23
Class-Loader-2.02	Tie-DBI-0.86

Table A3 (continued)

XML-Generator-0.93
XML-Parser-EasyTree-0.01
XML-Writer-0.4
Alias-2.32
Compress-Zlib-1.16
Term-ReadKey-2.21
Term-ReadLine-Perl-0.99
GTK-Perl-0.7009
Glade-Perl-0.61

Authen-AliEnSASL-1.00
Crypt-OpenSSL-Random-0.03
Crypt-OpenSSL-RSA-0.19
Crypt-SSLeay-0.51
Classad-1.00
GSS-1.0
IO-Socket-SSL-0.94
Net-SSLeay-1.23

Table A4a. Third layer: OS dependent modules that do not require modification

Modules	Type	Source code URL
Alias-2.32		
Compress-Zlib-1.16		
DBI-1.37		
Digest-SHA1-2.01		
HTML-Parser-3.28		
MIME-Base64-2.16		
Params-Validate-0.58		
SQL-Statement-0.1020		
Storable-2.04		
Term-ReadKey-2.21		
Term-ReadLine-Perl-0.99		
Text-CSV_XS-0.23		
Time-HiRes-1.43		
Unicode-String-2.06		
XML-Parser-2.31		

Table A4b. Third Layer: OS dependent modules that require modification

Modules	Type	Source code URL
Authen		
Classad-1.02		
GSS-1.0		
Crypt-OpenSSL-Random-0.03		
Crypt-OpenSSL-RSA-0.19		
Crypt-SSLeay-0.51		
IO-Socket-SSL-0.94		
Net-SSLeay-1.23		

References

1. <http://alien.cern.ch>
2. <http://alice.web.cern.ch/Alice/AliceNew/>
3. <http://lhc-new-homepage.web.cern.ch/lhc-new-homepage/>
4. <http://www.cern.ch>
5. <http://egee-jra1.web.cern.ch/egee-jra1/>
6. P. Saiz et al, AliEn – ALICE environment on the GRID, Nucl. Instr. and Meth. A 502 (2003) 437-440, <http://alien.cern.ch>
7. P. Buncic, A.J. Peters and P. Saiz, The AliEn systems, status and perspectives, Proc. of Int. Conf 2003 Computing in High Energy and Nuclear Physics (CHEP03) PSN MOAT004
8. P. Saiz, P. Buncic and A.J. Peters, AliEn Resource Brokers, Proc. of Int. Conf 2003 Computing in High Energy and Nuclear Physics (CHEP03) PSN TUAP002
9. S. Bagnasco et al, AliEn – EDG Interoperability in ALICE, Proc. of Int. Conf 2003 Computing in High Energy and Nuclear Physics (CHEP03) PSN TUCP005
10. P. Buncic et al, Grid-based Simulation Computing in ALICE, Proc. of Int. Conf 2003 Computing in High Energy and Nuclear Physics (CHEP03) PSN TUCP005
11. <http://www.activestate.com>
12. <http://www.microsoft.com/vstudio>
13. <http://folk.uio.no/andreass/downloads/user.exe>
14. <http://www.cpan.org>
15. <http://alien.cern.ch/cache>
16. <http://alien.cern.ch/Alien/main?task=doc§ion=Tutorial>
17. <http://nsis.sourceforge.net>