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IBM XL C/C++ and Fortran Compiler for AIX

Utilization Tracking and Reporting with IBM XL C/C++ and Fortran Compiler for AIX

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Contents

IBM XL C/C++ and Fortran Compiler for AIX	1
About this series	4
About this Tutorial	4
Objectives	4
Prerequisites	4
System Requirements.....	4
Glossary	5
Start the Terminal Emulator to AIX System.....	6
<i>Get started with utilization reporting</i>	6
<i>Steps:</i>	7
Conclusion	15
Trademarks.....	15
Resources	15

Before you start

About this series

Walk through this scenario and others online as part of the IBM XL C/C++ and Fortran Compiler for AIX.

About this Tutorial

This tutorial introduces a mechanism to track compiler utilization within your organization and detect if utilization exceeds what is entitled based on the licenses purchased.

Objectives

- Demonstrate how to enable Utilization Tracking and Reporting with XL C/C++ and FORTRAN compilers.
- Introduce the Utilization Reporting Tool (urt)
- Total time: 15 minutes

Prerequisites

- Basic Unix skills
- Basic command line compilation experience

System Requirements

<http://www.ibm.com/software/awdtools/xlcpp/aix/sysreq/>

<http://www.ibm.com/software/awdtools/fortran/xlfortran/aix/sysreq>

Glossary

IBM XL C/C++ Compiler: IBM® XL C and C++ compilers offer advanced compiler and optimization technologies and are built on a common code base for easier porting of your applications between platforms. They comply with the latest C/C++ international standards and industry specifications and support a large array of common language features.

IBM XL Fortran Compiler: The IBM® XL Fortran compiler offers advanced compiler and optimization technologies and is built on a common code base for easier porting of your applications between platforms. It complies with the latest Fortran international standards and industry specifications and supports a large array of common language features.

Getting Started

Start the Terminal Emulator to AIX System

Figure 1 Get Started

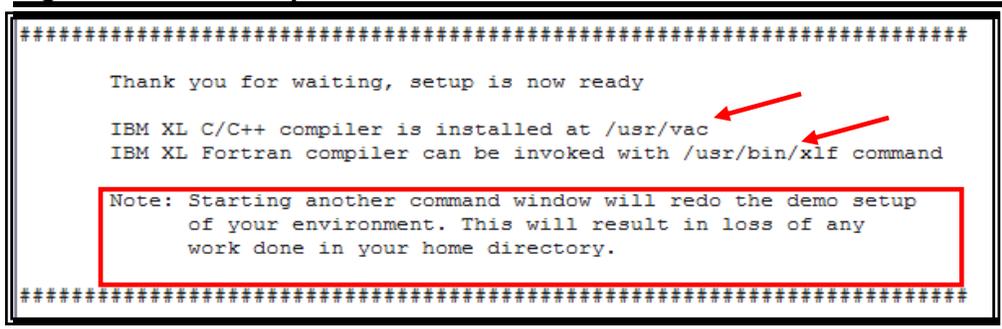


Double click the "Launch AIX" icon on the desktop (See Figure 1) to start the character terminal to AIX system.

Get started with utilization reporting

Successful login will result with user presented with a menu of demo hosted on the server. Type 10 and press the enter key to select "Compiler Utilization report" demo.

Figure 2 Demo Prepared



On the terminal window you will see important information and directory path to compiler install directory (See Figure 2 Demo Prepared).

Note: Starting another command window will start the demonstration setup of your environment. This will result in loss of any work done in your home directory (See Figure 2 Demo Prepared). This will impact any progress you have made on demo steps going forward.

This demo does not require more than one terminal window. However, if you prefer more than one terminal window then you may open them before going forward.

Terminal window is now ready for commands. Your home directory contains necessary source code to perform the tutorial. Type ls command to see the directory content (See Figure 3 Contents).

Command:

ls

Figure 3 Contents

```

$ ls
copyof.xlc.cfg  delta.xlc.cfg  urtxlc.c      urtxif.cfg
copyof.xlf.cfg  delta.xlf.cfg  urtxlc.cfg    urtxlf.f
$
    
```

<i>Source Files</i>	<i>Description</i>
urtxlc.c	A simple Hello World C source file
urtxlf.f	A simple Hello World FORTRAN source file
<i>Compiler Delta Configuration Files</i>	
delta.xlc.cfg	XL C compiler delta configuration file that overrides only the following two entries instead of overriding the compiler's entire configuration: <i>xlurt_cfg_path</i> and <i>xlurt_cfg_name</i>
delta.xlf.cfg	XL FORTRAN compiler delta configuration file that overrides only the following two entries instead of overriding the compiler's entire configuration: <i>xlurt_cfg_path</i> and <i>xlurt_cfg_name</i>
<i>Copy of Compiler Configuration Files</i>	
copyof.xlc.cfg	Copy of the XL C compiler's configuration file (vac.cfg) with the following entries modified: <i>xlurt_cfg_path</i> and <i>xlurt_cfg_name</i>
copyof.xlf.cfg	Copy of the XL FORTRAN compiler's configuration file (xlf.cfg) with the following entries modified: <i>xlurt_cfg_path</i> and <i>xlurt_cfg_name</i>
<i>Compiler Utilization Tracking Configuration Files</i>	
urtxlc.cfg	XL C utilization tracking configuration file
urtxlf.cfg	XL FORTRAN utilization tracking configuration file

Steps:

Each step below will have instructions for C/C++ and Fortran compilers. You may choose to try out one or both of the compilers.

The figures shown below were taken from using Utilization Tracking and Reporting with XL Fortran compiler.

Part 1 will show how to track and report utilization with a delta compiler configuration file.

Part 2 will show how to track and report utilization with a local copy of the compiler configuration file.

You can centrally enable and configure utilization tracking by modifying the installation's configuration files themselves. Due to permission restrictions with your login ID, it is not possible to demonstrate modifying the installation's configuration files in this tutorial. For information on this and more, please refer to the IBM XL C/C++ and Fortran for AIX Compiler Reference documentations.

Part 1: Steps to demonstrate Utilization Tracking and Reporting using a delta compiler configuration file:

1. Define XLC_USR_CONFIG environment variable to make the compiler recognize that you have a user defined delta configuration file

Command:

For C/C++ compiler:

```
export "XLC_USR_CONFIG=$PWD/delta.xlc.cfg"
```

For Fortran compiler:

```
export "XLF_USR_CONFIG=$PWD/delta.xlf.cfg"
```

Figure 4 Define Variable 1



```
$ export "XLF_USR_CONFIG=$PWD/delta.xlf.cfg"
$
```

Highlights:

What is in `delta.xlf.cfg`?

```
DEFLT: use=DEFLT
xlurt_cfg_path:=.
xlurt_cfg_name:=urtxlf.cfg
```

where:

`xlurt_cfg_path` -> This entry tells the compiler where to look for the utilization tracking configuration file. It is set to point to the current working directory. By default, it points to the `urt` sub-directory in the compiler installation location.

`xlurt_cfg_name` -> This entry tells the compiler the name of the utilization tracking configuration file. By default, the file name is `urt_client.cfg`, which is a symbolic link to the configuration file specific to the version of the compiler you're using. For example: With XL FORTRAN V13.1 on AIX, the file name is:

```
urt_client.cfg -> urtxlf1301aix.cfg
```

Note: You'll notice that the only difference in `delta.xlc.cfg` is the 'urt' configuration file name (it is `urtxlc.cfg`).

2. Invoke the compiler to capture utilization data

Command

For C/C++ compiler:

```
xlc urtxlc.c -c
```

For Fortran compiler:

```
xlf urtxlf.f -c
```

Figure 5 Compile 1

```

$ xlf urtxlf.f -c
** urtxlf    === End of Compilation 1 ===
1501-510  Compilation successful for file urtxlf.f.
$

```

Highlights:

Is utilization being tracked and recorded?

For your convenience, utilization tracking is enabled in `urtxlc.cfg` for C and in `urtxlf.cfg` for Fortran. If you look inside the configuration files, you'll see:

```
-qenabletracking
```

By default, it is turned off. If you look in the default compiler configuration file, you'd see:

```
-qnoenabletracking
```

You'll notice that a file ending with ".cuf" was created in your home directory. It should have the machine name followed by your login name as its file name.

Example: `machine1_john.cuf`

What is a ".cuf" file?

Compiler Utilization File – When the compiler is invoked, it will record its start and end time (and other information) in this file. The file can be dedicated to a given user or shared among multiple users. If shared, it is important that all users have access to write to this file, else during compilation, the user will get an informational (I) message informing them of no access.

How was the location and name of ".cuf" file determined?

If you look in `urtxlc.cfg` or `urtxlf.cfg`, you'll notice the following setting:

```
-qusagefileloc=$HOME/$HOSTNAME_$(LOGNAME).cuf
```

It tells the compiler to create the ".cuf" file in the user's home directory with the host name and login name as its file name.

By default, a ".cuf" file is created in the user's home directory and named "`ibmxlcompiler.cuf`". If you look in the default compiler configuration file, you'd see:

```
-qusagefileloc=$HOME/ibmxlcompiler.cuf
```

3. Use urt tool to generate a utilization report

Command:

For C/C++ and Fortran compiler:

```
/opt/ibmurt/1.2/bin/urt
```

Figure 6 URT Report 1

```

$ /opt/ibmurt/1.2/bin/urt
REPORT SUMMARY
-----
Date: 05/22/12      Time: 15:28:47

OPTIONS USED (* indicates that a default value was used):

reporttype=maxconcurrent
maxsubdirs=0
configfile="/opt/ibmurt/1.2/config/ibmurt.cfg"
rptmaxrecords=999999
*adjusttime
usagefileloc=".:$HOME"
*sameuser
timesort=ascend
usagefilemaxsize=999999
usagefilemaxage=999999

FILES USED:

/home/demo/demo999/p770a-x002.demos.ibm.com_demo999.cuf

REPORT DETAILS
-----
USAGE INFORMATION FOR PRODUCT: IBM XL Fortran for AIX 14.1

Max. Concurrent Users Exceeded? : *** YES ***

Max. Concurrent Users Allowed: 0          Max. Concurrent Users Recorded: 1

Exempt Users:

Dates and times where usage exceeded the maximum allowed:

Date           Time           Number of Concurrent Users   Users
-----
05/22/12      15:27:17      1                             demo999 (466) @p770a-x002.demos.ibm.com

$ █

```

Highlights

What is "urt"?

Utilization Reporting Tool – This is a stand-alone tool that is used to generate a report from one or more of the ".cuf" files to get a picture of the overall utilization of the compiler within your organization. In particular, the report will clearly indicate if the number of concurrent users recorded exceeds a specified upper limit (i.e. compiler utilization is not compliant with the licenses purchased). Note that by default, urt looks for ".cuf" files in your current working directory and in your home directory. The ".cuf" file you created above when you ran the compiler was created in your home directory and so was automatically found by urt.

Why does the report say that max. concurrent users has been exceeded?

If you look in urtxlc.cfg or urtxlf.cfg, you'll notice the following setting:

```
-qmaxconcurrentusers=0
```

This sets the maximum number of concurrent users that are allowed to be 0. Thus, even having one user using the product will be reported as exceeding the limit. In practice, you would update this to reflect the actual # number of Concurrent User licenses you have purchased for the product.

How can I see all invocations (not just the ones that exceeded limit)?

If you look in the Utilization Reporting Tool's configuration file (/opt/ibmurt/1.2/config/ibmurt.cfg), you'll notice the following setting:

```
-qreporttype=maxconcurrent
```

This setting tells urt to report only those dates and times when usage of the product exceeds the maximum number of concurrent users allowed.

This setting may be overridden on the command-line (or within the urt configuration file, if you have access) to report all invocations of the product, including ones where the limit was not exceeded. This is done by specifying the following setting:

```
-qreporttype=detail
```

Example:

```
/opt/ibmurt/1.2/bin/urt -qreporttype=detail
```

Figure 7 URT -qreporttype=detail output 1

```
$ /opt/ibmurt/1.2/bin/urt -qreporttype=detail
REPORT SUMMARY
-----

Date: 05/22/12      Time: 15:31:08

OPTIONS USED (* indicates that a default value was used):

reporttype=detail
maxsubdirs=0
configfile="/opt/ibmurt/1.2/config/ibmurt.cfg"
rptmaxrecords=999999
*adjusttime
usagefileloc=".:$HOME"
*sameuser
timesort=ascend
usagefilemaxsize=999999
usagefilemaxage=999999

FILES USED:

/home/demo/demo999/p770a-x002.demos.ibm.com_demo999.cuf

REPORT DETAILS
-----

USAGE INFORMATION FOR PRODUCT: IBM XL Fortran for AIX 14.1

Max. Concurrent Users Exceeded? : *** YES ***

Max. Concurrent Users Allowed: 0      Max. Concurrent Users Recorded: 1

Exempt Users:

Product invocations:

Start Time          End Time          Users          Number of Concurrent Users
-----
05/22/12 15:27:17  05/22/12 15:27:17  demo999(466)@p770a-x002.demos.ibm.com  1 (exceeds max. allowed)

$
```

If you are interested, you may try setting `-qmaxconcurrentusers=1` in `urtxlc.cfg` or `urtxlf.cfg` (depending on which product you're trying out), invoke the compiler, and try the following commands to see the differences in report:

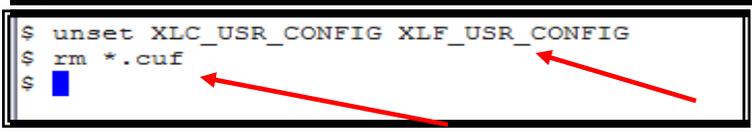
- I) `urt -qreporttype=maxconcurrent`
- II) `urt -qreporttype=detail`

Since there is only one user, you'd see a blank report with I) and all invocations reported with II)

Note: Please do the following clean-up, before starting Part 2 of the demo:

Command:
`unset XLC_USR_CONFIG XLF_USR_CONFIG`
`rm *.cuf`

Figure 8 Clean up



```
$ unset XLC_USR_CONFIG XLF_USR_CONFIG
$ rm *.cuf
$
```

Part 2: Steps to demonstrate Utilization Tracking and Reporting using a local copy of the compiler configuration file:

1. Compile source using a copy of the compiler configuration file

Command

For C/C++ compiler:

```
xlc urtxlc.c -c -F ./copyof.xlc.cfg
```

For Fortran compiler:

```
xl f urtxlf.f -c -F ./copyof.xlf.cfg
```

Figure 9 Compile 2

```
$ xlf urtxlf.f -c -f ./copyof.xlf.cfg
** urtxlf      === End of Compilation 1 ===
1501-510  Compilation successful for file urtxlf.f.
$
```

Highlights

What is in `copyof.xlc.cfg` and `copyof.xlf.cfg`?

These are exact copies of the installed compiler configuration files from `/etc` with only the following entries modified: `xlurt_cfg_path` and `xlurt_cfg_name`, to point to the location of the utilization tracking configuration file (which is the current working directory).

2. Repeat Step 3) [Use `urt` tool to generate a utilization report] from Part 1 of this tutorial

What you have learned

In this exercise you learnt how to:

- Use utilization report tracking tool to track compiler usage for IBM XL C/C++ and Fortran compiler on AIX.

Conclusion

This tutorial demonstrated how to enable Utilization Tracking and Reporting with XL C/C++ and Fortran compilers using a delta compiler configuration file or a copy of the compiler configuration file. It also showed very basic usage of the Utilization Reporting Tool.

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Resources

XL C/C++ for AIX library:

<http://www.ibm.com/software/awdtools/xlcpp/aix/library/>

XL Fortran for AIX library:

<http://www.ibm.com/software/awdtools/fortran/xlfortran/aix/library/>

C/C++ Café: Best Practices for the Utilization Tracking and Reporting Feature in the IBM® XL C, XL C/C++, and XL Fortran Compilers

<http://www.ibm.com/support/docview.wss?uid=swg27022104>