AIX Affinity With Linux
Technology Paper

Summary of AIX Affinity with Linux

IBM is bringing Linux application interoperability to AIX 5L®. Now you can run many Linux® applications on AIX®, a mission critical - highly scalable operating system.

IBM's plans for AIX affinity with Linux are implemented in two phases. The first phase is the release of the *AIX Toolbox for Linux Applications*, available at www.ibm.com/AIX. *The AIX Toolbox for Linux Applications* contains GNU and other commonly used tools helpful for recompiling an application for use on AIX. The second phase is *IBM's* planned inclusion of additional Linux compatible APIs and header files in AIX 5L Version 5.1 (when it releases).

AIX Affinity with Linux uses a Application Programming Interface (API) approach to providing Linux application interoperability. This approach is NOT an environment or an additional layer/wrapper to run Linux applications in or on. It is the integration of Linux compatible APIs and header files into AIX 5L. Thus, recompiled Linux applications are treated as native AIX applications and have access to all the reliability, scalability and availability of AIX. The result is a tighter integration of the application to the operating system than can be achieved with an Application Binary Interface (ABI) approach.

AIX has been developed using UNIX industry standards and as such there is a high degree of compatibility at the API level between AIX and Linux. This degree of similarity is such that many Linux applications can be recompiled and run on AIX 4.3.3 and AIX 5L Version 5.0 today using the *AIX Toolbox for Linux Applications*. *AIX 5L Version 5.1* plans to add even more interoperability between AIX and Linux by including APIs that are presently not similar between AIX and Linux, resulting in an even higher degree of Linux application compatibility. Thus, much of the functionality of *AIX 5L Version 5.1* already is available in AIX 4.3.3 and AIX 5L Version 5.0, with full implementation of *IBM's Linux affinity plans* available in AIX 5L Version 5.1.

For additional information on AIX affinity with Linux, or to download the *AIX Toolbox for Linux Applications* go to www.ibm.com/AIX

Terminology:

AIX Affinity with Linux: *AIX affinity with Linux* is the capability to easily compile and run Linux applications on AIX.

***AIX Toolbox for Linux Applications*:** A group of GNU and open source tools and utilities for building and deploying Linux applications on AIX. Includes a collection of programs that have already been recompiled and tested. *AIX Toolbox for Linux Applications* is available at www.ibm.com/AIX

Linux operating system/kernel: Linux is a Open Source operating system kernel originally created by Linus Torvalds with the assistance of developers from around the world.

GNU Project: GNU is an Open Source software community that has developed a number of very useful application development tools. For more information on the GNU Project go to www.gnu.org

Linux Background:

The Linux operating system has gained popularity through its close connection with Internet computing and e-business. The operating system has gained a large share of this business because of the high number of applications that have been developed.

Linux's initial attraction was that it was a "free" operating system, meaning that the source code was made available without charge. While the lack of a cost was an initial appeal, the real appeal is proving to be the applications that have been either developed or ported to Linux. Examples include Sendmail, Apache web server, and Samba (NT file and Print server emulator).

Every successful operating system has had a breakthrough application, the breakthrough application for Linux was (and still is) the Apache Web Server. Apache is by far the most widely used HTTP server on the Internet.

Further spurring the growth of Linux is the availability of the GNU tools. GNU is an open source project that has developed a series of tools from compilers to text editors. These tools have been ported to Linux and are the tools of choice for many developers of Linux applications.

Why *AIX* Affinity with Linux?

The value is in the data and the applications. Developing applications is a costly and time-consuming process. If a company needed to move from a low end Intel based system to a high performing IBM @server pSeries or IBM RS/6000® system they usually had to develop all new applications.

The first issue became how to assist companies that currently use Linux based application and need a mission critical system easily move to AIX 5L. The answer is to offer a set of integrated API's and header files that will allow a Linux application to be recompiled to run on AIX 5L. AIX version 4.3.3 and AIX 5L version 5.0 today has many of the necessary APIs to run Linux application, with AIX 5L Version 5.1, there will be an even greater degree of compatibility between AIX and Linux.

The second issue is that applications are in a constant state of development, either through enhancements or through fixing of bugs. Thus it is important that these companies be able to work on their applications using familiar tools. The answer was to port key components of the GNU tool set, along with other open source tools, to AIX 5L. GNU tools allows customers to work on existing applications, as well as develop new applications using tools that they are familiar with. GNU tools are also the tools needed to recompile Linux applications to run on AIX 5L and AIX 4.3.3. This issue is addressed by the AIX Toolbox for Linux Applications, with GNU tools that have been recompiled for AIX as well as many other useful open source tools and utilities.

AIX 4.3.3 and AIX 5L Version 5.0 already have affinity with Linux. Thus, you can benefit today from AIX affinity with Linux with additional source compatibility available in AIX 5L Version 5.1.

When to use:

When considering how to best utilize *AIX Affinity with Linux* it is important to consider impacts to performance. *AIX Affinity with Linux* is designed to provide the best performance possible, however there are a couple of issues to consider that are outside the control of *AIX Affinity with Linux* that can influence performance.

The Linux application being deployed on AIX will have full access to all AIX functionality, just like an application natively developed for AIX. AIX currently has a high level of compatibility with Linux, and with *AIX 5L version 5.1, IBM plans to provide an* even greater affinity between AIX and Linux. Thus, for a Linux application to take advantage of AIX it does not need to run through any additional layer or wrapper.

The question of performance is not one of the functionality of the recompiled Linux application to take advantage of AIX and the IBM POWER architecture (and in the future the Intel Itanium architecture) but one of the performance of the compiler used to build the application. Most applications that have been developed natively for AIX use the IBM Visual Age compiler, while applications developed natively for Linux utilize the GNU compilers. Thus, you can expect to see a performance advantage for AIX applications that have been built using the IBM Visual Age compiler. At this time the IBM Visual Age compiler is not available for Linux applications.

The Application Programming Interface (API) method that *AIX* utilizes, provides a higher degree of integration between the application and the operating system than can be achieved using a layered or wrapper approach such as found in an Application Binary Interface (ABI) approach.

When considering where to utilize *AIX Affinity with Linux* it is important to consider what applications you will be using for front-end and back-end. Many back-end applications such as databases are available on AIX. If the back-end application you are using is currently available natively on AIX, you should consider using that application rather than porting the Linux version to AIX. Another consideration is what applications in your portfolio are not performance sensitive, do not have a lot of computational requirements etc... that would benefit from the IBM Visual Age Compiler.

An example of how to utilize *AIX Affinity with Linux* technology is for front-end applications. These are applications that are communicating with a back-end application. Front-end applications typically have little or no areas where a compiler would make a significant performance advantage.

Thus, a company that develops its front-end applications on Linux can deploy them across IBMs range of AIX and Linux enabled servers being it on Native Linux or AIX.

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For back-end applications where performance is key, it is best to deploy an application that was developed for AIX. Most of these applications will have been developed utilizing the high performance IBM Visual Age compilers. However, there is nothing to preclude a back-end application from being developed on Linux and deployed on AIX. The performance difference will depend upon the application, and may be negligible.

AIX Affinity with Linux Detailed Review:

AIX brings Linux application source compatibility to AIX. *AIX affinity with Linux* will be fully implemented on AIX 5L Version 5.1 for both the IBM POWER platforms (IBM @server pSeries and RS/6000) and in the future Intel Itanium platforms (IBM @server xSeries).

Much of the *AIX Affinity with Linux* functionality is available today in AIX 4.3.3 and AIX 5L Version 5.0. Thus, many Linux applications can be recompiled and used on these versions of the AIX operating system, with full functionality being available in AIX 5L Version 5.1.

AIX Toolbox for Linux Applications:

AIX Toolbox for Linux Applications provides the tools to port Linux applications to AIX, as well as the tools to work on those applications. Additionally, the Toolbox contains several applications that have already been recompiled for use with AIX.

The core of *AIX Toolbox for Linux Applications* is the AIX 5L version of GNU tools. These tools are governed by the GPL license agreement and their source code is made available, for free, by IBM. These tools are offered for downloading at www.ibm.com/AIX.

- **Development note:** GNU tools have been ported to AIX 4.3.3, the tools in the *AIX Toolbox for Linux Applications* are more recent version of those tools. As well as some additional tools that were not ported in the past. The GNU tools in AIX Toolbox for Linux Applications will work with AIX 4.3.3 and AIX 5L.

As part of the *AIX Toolbox for Linux Applications*, Gnome and KDE have been ported. These are two popular desktop environments for Linux. The complexity of these applications highlights the capability of AIX to run sophisticated Linux applications.

- **Development note:** When developing applications it is important to write endian-neutral code. Endian-neutral code does not have dependencies on byte ordering. Using endian-neutral code allows greater portability between systems that use POWER processors and those that use Intel Architecture processors. Not developing in an endian-neutral way will result in an application that will need to be recompiled to adhere to the endian dependencies of the processor type. POWER processors prefer big-endian, while Intel Architecture processors prefer little-endian.

- **Question/Answer:** If I develop an application on AIX can I move it to Linux? If the application was developed using standard APIs then the application should recompile for Linux using the GNU gcc and g++ compilers. It is important to check that there are no API's in the applications that are supported by AIX but not Linux. AIX is POSIX and UNIX98 compliant, while Linux is not currently compliant.

Linux compatible APIs:
IBM plans to enhance AIX 5L version 5.1 with additional Linux compatible APIs and Header files.

Thus, for a Linux application to take advantage of AIX 5L it does NOT need to run through any additional layer or wrapper. After recompilation, it hooks straight in just like an application that was written natively for AIX.

On a pure application level there should be little to no performance difference between an application that was developed natively on AIX versus a Linux application that was recompiled for use on AIX.

- **Question/Answer:** How difficult is it to recompile a Linux application for use on AIX? Take the application source that you are currently using, get the appropriate GNU tools from the *AIX Toolbox for Linux Applications* (make, automake, autoconf, gcc etc...), use these tools to create the binaries for AIX and then run the application on AIX. The applications will connect to AIX using the integrated API's and header files. If you do not have access to the application source code, then contact the developer and ask them to provide a recompiled binary for use on AIX. As you can see it is not a difficult or time consuming process to create an application that can be deployed on AIX.

- **Development Note:** The Linux application being recompiled to run on AIX 5L and/or AIX 4.3.3 must be written using standard Linux APIs, and use the GNU gcc and g++ compilers.

- **Development Note:** Many Linux based applications do not utilize the Linux compatible APIs that are being added to AIX 5L Version 5.1. Thus, it is possible to do a recompile of the application and try it on AIX 5L 5.0 and AIX 4.3.3. *AIX Toolbox for Linux Applications* contains many applications that are compatible with both AIX 5L and AIX 4.3.3.

Several sophisticated applications, such as the Gnome and KDE desktops, have been successfully ported using the tools, APIs and header files that are part of *AIX 4.3.3, AIX 5L* and *AIX Toolbox for Linux Applications.*

- **Question/Answer:** Can I easily recompile a Linux application to run on both the IBM POWER and in the future Intel Itanium versions of AIX 5L Version 5.1? As long as

the application has been written using standard APIs and has been compiled using GNU gcc and g++ compilers there should not be any issues.

- **Question/Answer:** Can I run a recompiled 32-bit Linux application on AIX 5L Version 5.1 for Intel Itanium systems? Yes. As long as the applications were compiled using the GNU tools available in the *AIX Toolbox for Linux Applications* it should run. It will run as a 32-bit application on the 64-bit AIX 5L operating system.

- **Question/Answer:** Is there Binary support for Linux Applications for AIX? AIX is an API approach to Linux application interoperability. There is no Linux Application Binary Interface (ABI) support in either AIX 4.3.3 or AIX 5L.

Conclusions:

As companies that currently use, or those that have chosen to deploy Linux based applications, realize that they need a mission critical operating system that has both reliability and scalability they can deploy numerous Linux applications on AIX. This saves time and money by not having to develop new applications to get the robustness of the AIX operating system, whether it be on a IBM @server pSeries or IBM RS/6000 servers today or in the future on a IBM xSeries servers utilizing the Intel Itanium architecture.

Benefits:

1) Allows companies more flexibility in choosing the applications that are best for their needs.
2) Reduces deployment time of new systems.
3) Allows companies to get the benefits of AIX operating system.
4) Allows companies to utilize familiar Linux development tools.
5) Allows companies to develop applications on low-end systems and deploy them on high performing IBM @server pSeries and IBM RS/6000 based systems.

More information:

AIX: www.ibm.com/AIX
AIX Linux Affinity: www.ibm.com/AIX
GNU: www.gnu.org
Linux: www.ibm.com/Linux

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