

iSeries to UNIX:

In this three-part series, Thibault Dambrine describes the basics of the UNIX Operating System and first impressions, from the perspective of an iSeries programmer.

- Part 1 describes the basics of UNIX, how it came to be and how the UNIX architecture differs from that of the iSeries.
- Part 2 deals with some of the basic UNIX commands, directories, security and scheduling system.
- Part 3 is all about shell scripting, the UNIX equivalent of the iSeries' CL language.



Thibault Dambrine

UNIX - First Contact (Part I of III)

By Thibault Dambrine

The first time I heard of UNIX as part of the greater (then AS/400) picture was at a TUG meeting which took place at the Hockey Hall of Fame, on May 17, 1994. The speaker for that memorable occasion was **Eugene Carthra**, of IBM. At that time, it sounded more like fictional techno-spin than anything very concrete.

AS/400 has since evolved into iSeries, and we all know a lot has changed in this landscape. As for many AS/400 professionals with long years invested nearly exclusively in the OS/400 operating system, I have grown curious about UNIX.

Recently, on top of my iSeries duties, I got a chance to work on a UNIX/Oracle client-server project. The primary aim of this article is to share my UNIX discovery experience, from the viewpoint of a

long time iSeries programmer. This will be done in three parts: Part 1 (factual) will describe how the UNIX operating system works, and compare each of its major components with its equivalent in the iSeries. Part 2 (somewhat subjective) will relate my top-10 impressions when first starting to work on UNIX, all along giving some precise examples to convey my points. Finally, Part 3 will provide a list of basic commands that can help one navigate in UNIX.

In the beginning...

In March of 1999, nearly 4 years ago, I became a self-employed contractor, working on Y2K upgrades. Now on my own, I realized or perceived that I was suddenly more exposed to lack of knowledge in other platforms than the AS/400.

Recognizing that UNIX is probably closer to OS/400 than NT, I started a single UNIX course at the Southern Alberta Institute of Technology (SAIT), not knowing quite yet where it would lead me. To my surprise, this course was not taught on UNIX, as I had expected it to be. Rather, it was taught using Linux. Within a few weeks, I was hooked, and eventually took the full set of courses for the UNIX certificate.

UNIX? What is UNIX?

In the late 1960's, **Ken Thompson** at Bell Labs had developed a game named "Space Travel" on an old GE computer that was later ported to run on a spare PDP-7. This project gave **Ken Thompson**, **Dennis Ritchie**, and **Rudd Canaday** the experience needed to develop a new operating system for the PDP-7 based on a new file system they had designed. (See **Figure 1**.)

This new operating system was capable of supporting two simultaneous users and was nicknamed (UNICS) for **UNi**plexed **I**nformation and **C**omputing **S**ystem. Bell Labs granted financial support to this project, and with time the name UNICS evolved into UNIX.

In 1974, UNIX was re-written and became the first operating system written in C, the language created by **Dennis Ritchie**. This enabled the first port of UNIX outside of the DEC PDP world where it was born, to a 32-bit INTERDATA 8/32 minicomputer system. That year, The Computer Science Department at the University of California, Berkeley, began to use UNIX.

By Version 7, UNIX had developed and matured into a relatively stable operating system, which could run on several types of computers. At that time, a Department of Justice injunction forbade AT&T to sell software. AT&T made Unix available to universities as an academic tool for a low cost. It became very popular in university computer science departments.

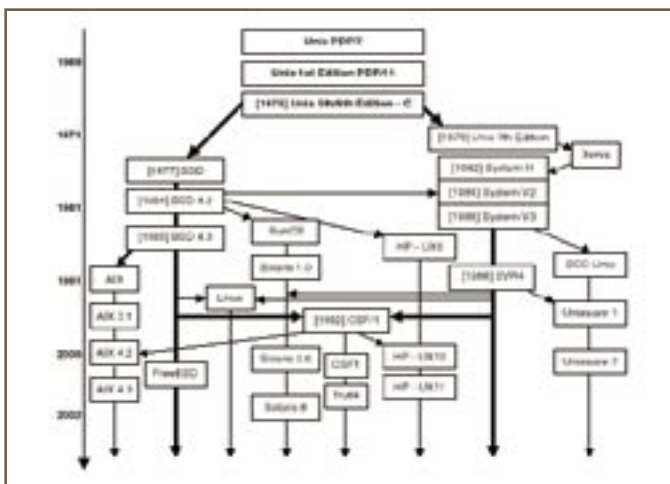


Figure 1

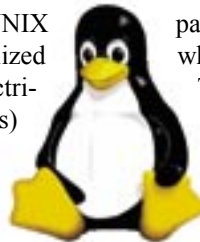
A major developer of the UNIX OS was one of these universities. In 1977 the first Berkeley Software Distribution (BSD) version of UNIX was released. Berkeley added virtual memory support, TCP/IP networking, vi, csh (C Shell), and more.

When deregulation hit and AT&T was split into different companies in 1982, the old regulatory restrictions were lifted and selling UNIX for a profit was allowed. The user community, universities especially, did not welcome this change. University of Berkeley's BSD then became a prominent UNIX player through its affiliation with Sun Microsystems, the leading proponent of the Berkeley UNIX. As a result of commercial pressure AT&T changed their licensing agreement, which enabled many OEM's (e.g. Hewlett Packard's HP-UX) to write UNIX versions of their own without necessarily following all the standards or being obliged to share their innovations. Thus, the fragmentation of UNIX started.

In 1988, the standard for UNIX operating systems was formalized by the IEEE (Institute of Electrical and Electronics Engineers) under the name of "Portable Operating System Interface" (POSIX). POSIX, in particular, describes how to program operating systems so that they can be ported with greater ease to different hardware. The effect is that one can write the source code for an operating system in C and then compile on different compilers designed to work on each hardware model. All major UNIX systems, including Linux, adhere today to the POSIX standard.

The United States government is the largest single organization procuring computer equipment in the world. It was an early adopter of the POSIX standard, giving it a lot of credibility.

In 1993, AT&T sold its UNIX business to Novell, who sold it to the Santa Cruz Operation two years later. In the meantime, the UNIX trademark had been



passed to the X/Open consortium, which eventually merged to form The Open Group, who now owns the UNIX trademark.

This UNIX history perspective would not be complete without a word on Linux. In the early 1990's, **Linus Torvalds**, a Finnish undergraduate student, looked at a small UNIX hybrid called Minix and decided he could do better.

In the fall of 1991, he released the source code for a freeware kernel called "**Linux**". While it is POSIX compatible, it is not technically a "UNIX" operating system, as its kernel was developed independently. Linux does not belong to The Open Group. The evolution of the Linux OS is nothing short of surprising. In a mere ten years the Linux freeware project, with the contribution of thousands of programmers, has grown from undergraduate project to fully configured, professional grade operating system.

UNIX Architecture, compared to the iSeries

Categories	OS/400	UNIX
Control Language Layer	Control Language (CL) and QSHELL	Shell (Bourne Shell, Korn Shell, C Shell other UNIX commands) Similar to the CL language on the iSeries. All programs, on a UNIX system communicate with the hardware via the Kernel. Note 1: UNIX shell script is interpreted, not compiled. Note 2: Other programs, such as databases systems, will also communicate with the hardware via the UNIX Kernel.
Software to hardware Layer	iSeries Micro-code	UNIX Kernel – Sits above the computer's hardware. All programs, including the UNIX shells, interact with the kernel. Programs are insulated from the hardware by the kernel, thus making Unix programs relatively portable from one platform to another.
Hardware	IBM iSeries hardware only	IBM pSeries (formerly RS 6000), Hewlett Packard, Sun Microsystems, Intel PC and more.
Database	DB2/400 only	Oracle, DB2, MySQL, Sybase and more
Programming Languages	RPG, C, C++, Java and more	C, C++, Java and more
Character Code	EBCDIC	ASCII

Figure 2

Any doubts about Linux's ability to handle a heavy load? At time of writing, Google.com, the number one search engine on the World Wide Web, has the Internet's largest index of Web pages (over 2 billion), powered by the world's largest commercial Linux cluster – more than 10,000 servers. With this, it handles over 150 million searches per day.


Unix and iSeries: How Far and How Close?

What I found out when crossing to the UNIX world is that in the end, a computer is a computer, and that in many

ways, even if the methods are different, the goals are mostly the same. On the surface, and also from acquired reputation, one could be tricked into thinking the OS/400 and the UNIX operating systems are at opposite ends of a very large spectrum. Upon closer examination, it appears the overall methods used by UNIX and OS/400 to achieve computing goals are surprisingly similar. In the architecture diagram (Figure 2), you can clearly see how both operating systems use similar layering methods to segregate the hardware from the software.

Beyond the basic architecture similarities and differences of these two operating systems, three more differentiators stand out:

- UNIX operating system builders were early adopters of the TCP/IP networking protocol. Right from the start, TCP/IP was to UNIX what SNA was to IBM 15 years ago. Initially, TCP/IP was considered less secure than SNA (this is still the case!). With the overwhelming popularity of the (TCP/IP based) Internet, TCP/IP has completely replaced SNA as the language of choice for communicating between systems.
- While UNIX sounds like one operating system, it is actually closer to an operating system type. There are several versions of UNIX and they are not 100% compatible with each other. The fastest evolving version of UNIX now is Linux, which has strong backing from all major computer hardware manufacturers. Even our trusty iSeries is now dipping its ladle in the UNIX sauce with its QSHELL, more on this later in the series.
- There are many facilities in the various UNIX shells to read and manipulate flat files. Relational database systems however, have to be purchased separately. This, along with the fact that UNIX can run on many types of hardware, is the biggest difference between these operating systems.

In the next issue, I will explore some of the basic UNIX commands, directories, security and scheduling system. 

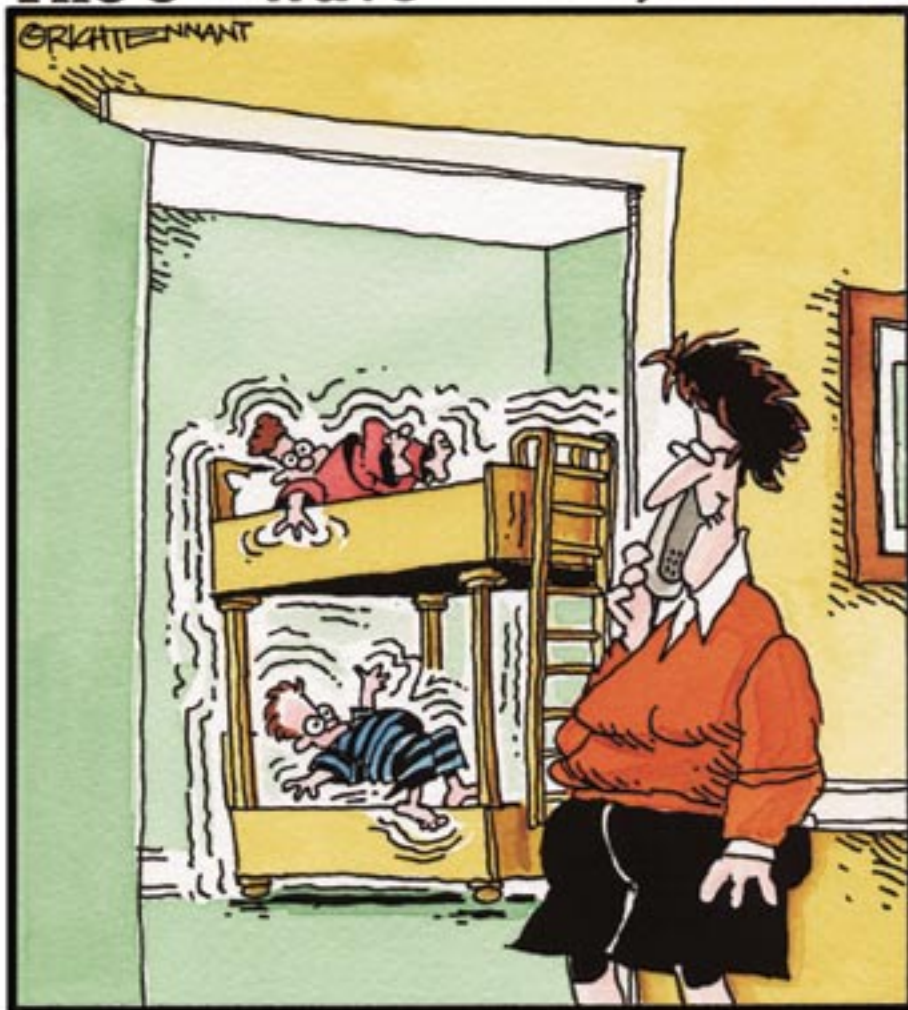
Thibault Dambrine works as an independent contractor in Calgary, Alberta, Canada. You can visit the iSeries & AS/400 related website he manages at <http://www.tylogix.com> or email him directly at: thibault.dambrine@tylogix.com.

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The 5th Wave

By Rich Tennant

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