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# THE FERMI UNIX ENVIRONMENT - DEALING WITH ADOLESCENCE

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Fermilab's Computing Division started early in the definition implementation and promulgation of a common environment for Users across the Laboratory's UNIX platforms and installations. Based on our experience over nearly five years, we discuss the status of the effort, ongoing developments and needs, some analysis of where we could have done better, and identify future directions to allow us to provide better and more complete service to our customers. In particular, with the power of the new PCs making enthusiastic converts of physicists to the pc world, we are faced with the challenge of expanding the paradigm to non-UNIX platforms in a uniform and consistent way.

## 1 Introduction

The Unix environment infrastructure developed at Fermilab has been reported at various conferences and working meetings [1]. The initial capabilities provided "setup" and "unsetup" scripts providing uniform access methods to software, to support multiple versions of package on a particular computer installation, "ups" to manage the suite of installed software and "upd" for distribution, are now used throughout the Laboratory and by all Experiments.

As the number of UNIX installations and computer platforms have increased, as well as a dramatic increase in the number of users of UNIX at Fermilab, we have extended and expanded the capabilities of the support infrastructure and associated services.

By providing these as extensions of the methodology and already available configuration management tools, we ensure that they are readily accessible and usable by the user community at large. However, adopting an adiabatic expansion rather than allowing a sudden revolution, has constrained us in some areas to implement ideas and needs more slowly than we would have hoped.

## 2 Status of Fermi Unix Environment Support

We detail below some of the areas in which development has occurred over the past year. While these may not seem exciting in their own right, they set the stage for an extension of the supported tools to make our application software development easier, more accessible and available, and for what we plan is an imminent project to address software quality and assurance techniques in a concrete way.

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### 0.1 Core infrastructure

We have defined conformant levels of Unix Environment Standards for our User Installations which allows us to relate the level of conformance to our ability to support it or applications running on it. The levels range from *none*, through *core-FUE* - where at minimum the setup paradigm is available - to *FUE-plus* where we rely on such extra tools as Fermilab image display software, www browsers, standard Fermilab mail handlers to be available[2].

### 0.2 Support for Public Domain Packages

We have entered the arena of packaging and providing many public domain software packages for our user community. Tools have been developed to allow such programs (emacs, tcl, etc etc etc) to be built on all our supported platforms from a single script [3]

Minimal changes are made to the software as it "is taken from the net" - we make those necessary to allow the general Fermilab user community to use the software in a fashion consistent with that developed in house. Given the ever increasing number of these packages and the restricted resources that can be applied to the problem, we attempt to make the massaging needed as small and automated as possible. In the last year the number of packages provided has grown to over a hundred, each one being supported on a minimum of 4 operating systems - and some on 2 versions of an operating system.

### 0.3 Operating System Certification

New releases of UNIX operating systems (such as IRIX V5) can have dramatic effects on whether previously running user code can successfully compile, link and run. To address the number of platforms and operating systems we have to deal with we have introduced a degree of formalism in certifying operating systems and defining the software environment that we will support [4].

This certification process allows us to approach each new vendor or operating system in a consistent fashion, and provides a technical basis for limited competitive acquisitions of new computer hardware.

## 1 VMS Migration Initiative

Fermilab management has announced its official policy to migrate computing activities to UNIX and PC/MAC systems and to phase out VMS, with the stated goal to achieve most of the transition for general users within a year [5]. The Fermilab Computing Division has been charged with leading the program to achieve this goal.

A VMS Migration Task Force has been set up which provides a wide forum for discussion of the related issues. The task force is charged to identify and assist in solving problems associated with migrating users from VMS-based systems to either UNIX systems or personal computers as appropriate.

One aspect of the new environment to the traditional “VMS User” is the range of available choices. Many people do not want to deal with a situation in which there are several operating system shells, several editors, several mail systems, etc. The Fermi Unix Environment Working Group works with the VMS Migration Task Force on technical issues and needed developments to help provide the most complete and consistent environment to meet the needs of the user. New applications which can work consistently across UNIX and the pc world are increasingly attractive.

However, another aspect of the new environment is that of a new generation of users who have “grown up with UNIX” and demand the full range of modern software product availability and support. They live in a world where many individual technical researchers are fluent with “software from the net”, searching for, downloading and using many different tools in various stages of development and robustness, and “cut and pasting” whatever software they need to achieve their goals in a shorter and more “one-of” fashion.

Additionally, the availability of not only public domain, but commercial software to meet the needs of the scientific analysis community is increasing by leaps and bounds.

The migration initiative is addressing a broad range of areas including user relations and input; documentation and tools to aid migration; editors and associated tools; application tools; physics applications and analysis environment; distributed file systems; code management; the desktop environment (including PC/Mac); databases; resource management; mail and batch systems.

## **2 Wishes, Dreams, and Regrets**

With a long term, multi-faceted project such as FUE there are always areas where one wishes more could have been done, mistakes are made in requirements, design and implementation, and, of course, specifics where the “eyes are bigger than the stomach” and the plans outgrow the ability of the resources to implement them. We identify here, for interest, several such specific areas.

### *2.1 Operating System Installation and Verification*

With the increase in the number of platforms supported at Fermilab as well as the explosion in the number of nodes, some formalism, process, and tools for the consistent installation and verification of operating systems, patches, and layered products is a must. We are currently threatened with being swamped by the needs in these areas. We need to develop the methods and tools to distribute the knowledge and load, to allow monitoring of the systems involved - to discover if users have modified, upgraded, etc., the system without notifying the support staff. As physics experiments rely more on UNIX computers as critical components of their apparatus the need to be on top of this aspect of the environment has increased in priority.

## *2.2 Emphasis on User Friendliness of Installation and Configuration*

The FUE tools were developed by and for system managers and “computer professionals” (whatever they are). As the number of UNIX installations has increased more and more local system managers are merely users, conscripted into service. We did not spend the resources up front to address this issue, and have suffered in the support load and user dissatisfaction ever since. It is a lesson we have learned and will address up front in future projects, however it is not clear that with restricted resources it is an exercise that can be done correctly even in the future.

## *2.3 Definition of and Tools for “sets of products” and “product dependencies”*

The basis of the Fermi Unix Environment paradigm is the definition of a software product entity with associated versions for different releases, operating systems etc. Our paradigm was incomplete, (flawed?) in two major areas - that of the interdependencies between the products, and that of the parameters and attributes of the computer environment that affect the ability of a particular piece of software to run.

Our ideas and regrets in this area could fill a whole paper. Suffice it to say that we have had to develop various barnacles as extensions to FUE, where we really wanted to and should have re-architected and designed.

Thus over the past year we have: developed scripts to list product dependencies from the database (PUPS); scripts to replicate dependencies (CUPS); used multiple UPS databases to handle bundles of software (DART V3 etc.); extended the definition of “flavor” of a product to include operating system version and differences in compiler environment (emacs IRIX+5+GCC vs IRIX+5); scripts to extract fields from ups databases to www configuration files to make available a consistent set of documentation; a method of determining what and which versions of software are included in an executable or binary (see paper on SDSS methodology in this conference); and others not sufficiently well thought out to merit inclusion here!

## **3 Plans for The future**

With the increase in the complexity of the software environment, and with the knowledge and interest of the clients, several projects within the Fermilab Computing Division are independently developing methodologies and tools for increased automation of software testing, configuration management, quality assurance and control. Based on individual project experience we plan to address this issue in the large in the next year. The common infrastructure implemented throughout Fermilab by FUE will allow us to design and implement tools of wide applicability to aid in the speed and quality of the software development, deployment and commissioning process.

Clearly the use of “pc”s (as small letters) and the “PC” (in large letters) for scientific application software development and use will expand exponentially at Fermilab and its collaborating institutions in the next few years. This world where one needs access to

huge amounts of shared information, but needs it easily, fast, and accurate - needs to integrate with the existing world of UNIX and migration from VMS. As identified at CHEP in the last several years, the network already is a critical component of everyones existence.

The Fermi Unix Environment infrastructure must metamorphise to include the paradigm of the pc world, and support interoperability and consistency between all types of computer platform. We recognise that this may lead not only to a significant change in the infrastructure, but to a significant reduction.

Our future challenge is to transform the Fermi Unix Environment into a technically innovative, system engineered, user friendly Fermi **User** Environment across the whole range of computing involved to meet the needs of the Scientific Community to do excellent science with the most advanced software tools available.

#### **4 Acknowledgments**

Such an initiative as FUE [6] benefits from the creative thinking of many people, and the ability of many to work collaboratively, to build consensus, to allow decisions to occur and to do the needed implementation and support. In particular we would like to acknowledge the contributions of Chuck DeBaun, Marc Mengel, Gene Oleynik, Don Petravick, and Margaret Votava to the overall FUE effort.

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