

Computer Science & Software Engineering

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Unix and Undergraduate Teaching

Carlo Kopp, BE(Hons), MSc, PhD, PEng

Monash University, Clayton, Australia

email: carlo@mail.csse.monash.edu.au

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Introduction

- The often and repeatedly predicted demise of Unix is unlikely to happen in the foreseeable future.
- Open Source Linux and *BSD continue to grow across a range of market niches.
- Historically, universities have been a major path through which early Unix skills are acquired.
- Students entering universities usually had few if any computing skills, and could be easily focussed on acquiring new computing skills - such as Unix.
- The 'tabula rasa' model applied - student skill sets could be molded in an arbitrary manner to meet industry needs.
- *What has changed?*



The Impact of Commodification

- High performance desktop systems are now widely available and very cheap by historical standards - several thousand dollars buys a 2 GHz 256 MB system.
- Households from which most students are recruited will have one or more home computers.
- High schools usually have computing labs with multiple desktop systems and internet access.
- New university undergraduates may have several years of experience using Windows or MacOS systems, often this includes trivial sysadmin skills.
- Many such students will be reluctant to abandon the familiar and comfortable, and may actively resist learning new skills.



Why Retain Unix as a Teaching Platform?

- We might wish to ask: why should Unix be retained as a teaching platform?
- Given the enthusiasm of many students for proprietary desktop platforms, is it not a better strategy to teach using such systems?
- Some teaching establishments have refocussed away from Unix, but many continue to use Unix as their primary teaching platform.
- What case can we make for using Unix as a teaching platform?
- Are the obvious arguments for using Unix still valid?



Reasons for Retaining Unix (1)

Cost (1): the advent of Linux and *BSD permits the deployment of large numbers of on campus Unix derivative systems at very low cost using cheap commodity hardware.

Cost (2): the advent of Linux and *BSD provides students with very cheap systems for working at home, with large packages of very competitive GPL tools, especially for software development. Dual booting permits these installations to coexist on home computers which are shared by the student with other family emembers.

Portability: Many proprietary systems exhibit very poor portability of source files between different revisions of the same tool. Unless the on campus systems and students' home systems are of exactly the same configuration, this produces difficulties with moving work between campus and home systems.



Reasons for Retaining Unix (2)

Performance: university lab and students' home machines are frequently 'hand me downs' which are short on memory, CPU clock speed and disk capacity. Unix permits useful work on under-resourced platforms.

Functionality: almost all Linux and *BSD releases are provided with GPL toolsets, especially development tools, on the CD-ROM or web accessible ISO images. Therefore the time overheads and dollar outlay to provide a powerful development environment are minimised.

Source Code: GPL operating systems and tools are provided with source code. This permits student project in which GPL software can be modified, enhanced or indeed developed from scratch. Students see tools as software with lines of code rather than shrink-wrapped entities provided by vendors.



Reasons for Retaining Unix (3)

Depth: Unix permits access below the GUI. This provides students with useful practical administration and debugging skills, which cannot be acquired on binary only proprietary platforms.

Are pragmatic 'value for money' and basic teaching arguments a good enough reason for retaining Unix as the primary teaching platform?



Graduates and Career Paths (1)

- Most university graduates will end up in industry positions, and meeting industry needs will continue to be an important aim of university teaching.
- Graduates lacking Unix literacy, let alone more advanced skills, will be at a long term competitive disadvantage in the job market.
- How many employers will make the necessary investment to provide basic and advanced Unix training to graduates with no prior experience? Recent market trends suggest that very few.
- Not providing students with robust basic Unix skills sets excludes them from job market sectors where Unix is dominant - ISP/W3, large multiuser commercial and RDBMS environments and engineering/scientific number crunching.



Graduates and Career Paths (2)

- *A good case can be made that Unix skills amount to fundamental skills in the computing discipline and should be treated as such.*
- Not providing this skills set amounts to providing graduates with an instant handicap at the entry point in their careers.



Challenges in Teaching Unix

What are the key challenges in dealing with a student population which has been previously indoctrinated to use proprietary desktop operating systems?

1. Overcoming fear of the unknown, and prior indoctrination with the belief that Unix is intractably difficult to use and administer.
2. Overcoming active resistance by a small minority who are convinced that Unix skills are of no value in the workforce.
3. Facilitating students who have an interest in running Linux or *BSD on their home systems.
4. Weaning students away from the exclusive use of point/click and menu interfaces to shell oriented user interfaces.



Dealing with Fear of the Unknown

- Experience suggests that incremental exposure works better than deluging beginners with intensive exposure.
- Students are initially exposed to Unix as a runtime environment for tools in subjects which are not centred on programming. Examples are documentation writing, including the use of RCS, and machine architecture, the latter involving the use of various machine simulators.
- Two semesters of exposure appear to be sufficient to dispel student anxieties about the new environment.
- A 'primer' website with links to FAQs and other introductory material has proven useful.



Dealing with Active Resistance

- Active resistance does arise from time to time with a small minority of students.
- It would appear that the prime motivator is unhappiness about having to compete on a level playing field with peers who are equally inexperienced in the 'new' environment.
- Active resistance is usually manifested in complaints or lobbying directed at heads of dept/schools, associate deans or other senior academics; the complaints typically insist on the syllabus being altered to exclude Unix.
- In practice the only useful measure is patience, since reasoned argument about future job prospects is usually not accepted as valid.



Facilitating Home Unix Installations

- Aiding students in setting up home Unix installations, typically as dual boot systems, is often a non-trivial task.
- Many students are not accustomed to working independently and even have difficulty in locating <http://www.linux.org/>, let alone finding a supplier and buying a CD-ROM!
- Provision of free Linux installation CD-ROMs has proven to be very effective - many students are enthusiastic about anything they can get free of charge.
- Student clubs providing 'Linux installation nights' has been by far the most effective approach to getting beginners equipped with operational Unix systems.



GUIs and Other Problems

- Many students have great difficulty in dealing with command line interfaces as they have only ever been exposed to GUIs. Weaning some students away from GUIs to command lines can be difficult.
- The compulsory use of X11 in concert with *xterm* or similar terminal emulators has proven to be the most effective measure. Compulsory use of *vi* has also proven useful.
- Even so, some students will months later continue to use pulldown menus in *gvim*, or terminate editing sessions by using the desktop window SIGKILL button!
- A major issue has proven to be a propensity for some students to expend laboratory time trying to configure the most esoteric KDE or gnome desktop they can devise!



Conclusions

- While very good pragmatic and graduate career path related reasons exist for teaching in Unix environments, changes in the student population require a systematic effort to get effective results.
- Incremental exposure to Unix, facilitating Linux installations on student home systems, and student club Linux related activities appear to be the most useful means of producing Unix literacy rapidly.
- Industry support to universities, via guest lecturer visits and free Linux CD-ROMs, would be a valuable contribution.



End AUUG 2002 Slides

