

# Use of Linux & OSS in the EIE Teaching Programme at the University of Sydney

David Peterson

School of Electrical and Information Engineering (EIE)

University of Sydney

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# Agenda

- Preamble
- The EBUS Programme
- EBUS Courses
  - EBUS 3001, EBUS 5002 (in brief)
  - EBUS 3002, EBUS 5001 (in depth)
- Outcomes (so far)
- Observations (and Questions)
- Discussion
- Conclusion

# Preamble

- A little about me ...
- A little about you ... (my audience)
- About the School of EIE
  - Degree Programmes
  - Facilities
  - Students
- Why am I here today?

# I. The EBUS Programme

- Objective/Result
- Structure
- Enrolments
- Key contributors

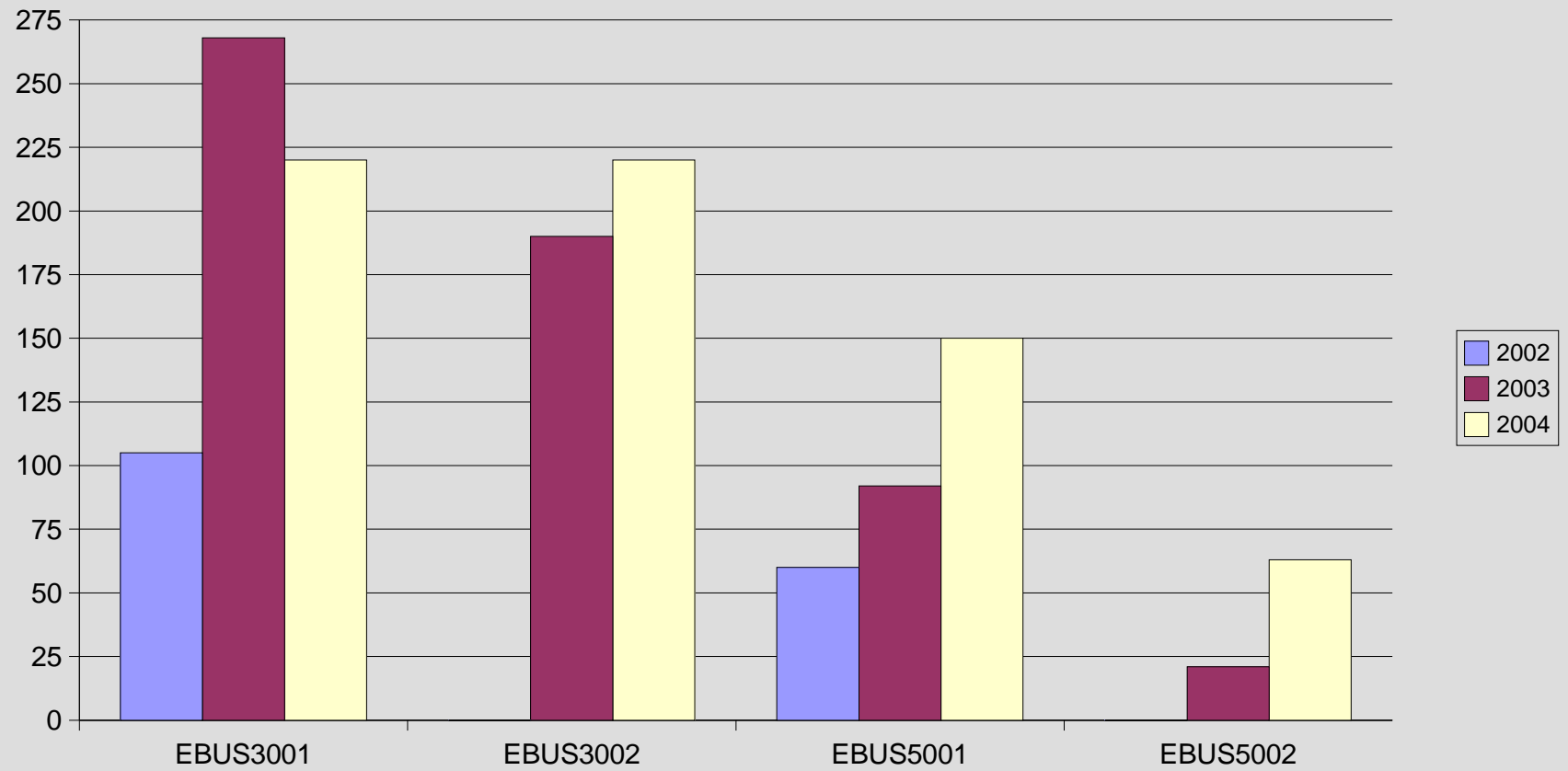
## Objective of the Programme

- **Objective: To develop a leading edge (and world-class) degree programme on E-Commerce technology**
- *Result: Four inter-related courses on E-Commerce (E-C), focusing upon:*
  - E-C business models and processes
  - E-C enabling technologies

# Structure of the Programme

- Course Timeline:
  - 3<sup>rd</sup> Year:
    - EBUS 3001 (Sem 1)
    - EBUS 3002 (Sem 2)
  - 4<sup>th</sup> Year courses:
    - EBUS 5001 (Sem 1)
    - EBUS 5002 (Sem 2)
  - Thesis work:
    - A large number of EBUS-related theses offered each year
    - Topics: web frameworks, web services, EAI, middleware, etc ... (in conj. with CEL and WEG)

# Course Enrolments



# Industry Support

- EBUS sponsors / collaborators:
  - IBM
    - Guest lecturers and round-tables
    - Equipment and software
  - Microsoft
    - Guest lecturers and round-tables
    - Equipment and software
  - Optus (SingTel)
    - Guest lecturers
  - others ...



# Key Contributors

- Programme Director
  - A/Prof. David C. Levy
- Lecturers / Support staff
  - Dr. Rafael Calvo (EBUS 3001, EBUS 5002)
  - Dr. Eric Mousset (part of EBUS 5001)
  - David Peterson (EBUS 3002, EBUS 5001)
  - Ms. Gosia Mendrela (Online support for EBUS Programme)

## II. EBUS Courses

- Four courses:
  - EBUS 3001 Intro. to E-C Systems
  - EBUS 3002 E-C Website Programming
  - EBUS 5001 E-C Application Programming
  - EBUS 5002 E-C Application Frameworks
- Today's focus: EBUS 3002 and EBUS 5001 in particular

## In-brief: EBUS 3001

- Focus:
  - E-Commerce business models (B2C, B2B, etc)
  - Enabling technologies (TCP, HTTP, SMTP etc)
  - OSS vs. proprietary software
  - Introduction to OSS licence models
  - Website usability (design and testing)
  - Managing the software development process
  - Identifying and documenting requirements
  - Analysis of portal and community websites
  - Basic HTML and web skills

# In-depth: EBUS 3002

- Focus:
  - The development of basic database-driven websites
  - Introduction to database design, SQL and basic DBA
    - PostgreSQL RDBMS
  - Introduction to Perl programming and the Mason templating system
  - Basic Linux system administration
    - Installing and configuring Apache and mod\_perl

# In-depth: EBUS 3002

- Structure of the course:
  - 4 focal areas over 11 weeks:
    - Enabling technologies
    - Basic web programming
    - Database-driven programming
    - Template-driven web programming
  - 1. Enabling technologies
    - HTML, HTTP, TCP/IP, DNS and the internet

# In-depth: EBUS 3002

- 2. Basic web programming
  - Perl programming primer (language syntax, data structures etc)
  - Writing a basic Perl CGI
  - Installing / configuring apache web server
- 3. Database-driven programming
  - Introduction to SQL and PostgreSQL
  - Database design
  - Basic DBA
  - Integrating Perl with DBI

# In-depth: EBUS 3002

- 4. Template-driven programming
  - HTML::Mason
  - The Mason OO heirarchy
- Additional topics:
  - Security in e-commerce systems (ocal and remote root exploits, firewall principles etc)
  - More advanced perl topics (regexp etc)

# In-depth: EBUS 3002

- Environment:
  - The environment for this course was completely “OSS” in nature ...
  - Lab server
    - Redhat 8 server running Apache 2.x
  - Database server
    - PostgreSQL RDBMS on shared Linux server
  - Many students running Linux at home
    - Other struggling with Perl under cygwin!



## In-depth: EBUS 3002

- **Assessment:**
  - Comprised of lab work and examination (80%), with a small group project (20%)
  - Lab work is to extend a web-based document management system
  - Project work is to build a basic database-driven website from student's own proposal
    - Many students choose to implement a website based on the results from their previous work in EBUS 3001

## In-depth: EBUS 3002

- Some past projects (2003)
  - Online car parts store
  - Enhanced online “bookshelf” system (automating the tracking of loans of books/music to friends)
  - Database-backed search engine
  - A web-chat system
  - Online auction website

# In-depth: EBUS 5001

- Focus:
  - The development of fully-fledged, E-C “web applications” (not “websites”)
  - Architecture of web applications, not simply “programming”
  - Complex back-end processing logic
  - Serious persistence layer approaches (JDO etc)
  - Heterogeneous interoperability (using XML and web services)

# In-depth: EBUS 5001

- Structure of the course:
  - 3 focal areas over 11 weeks
    - Presentation
    - Persistence
    - Interoperability
  - 1. Presentation: Rendering output
    - Building/deploying a JSP, Java Servlet and ASP.NET web page
    - Comparison / evaluation

# In-depth: EBUS 5001

- 2. Persistence: Data management
  - Accessing data with JDBC
  - Advanced persistence with EJB and JDO
  - Data sources in .NET
  - Comparison / evaluation
- 3. Interoperability: XML and web services
  - Parsing XML in Java and .NET
  - Performing XSLT in Java and .NET
  - Implementing web services in Java (Apache Axis) and .NET (ASP.NET web service)
  - Comparison / evaluation

# In-depth: EBUS 5001

- Environment
  - JSP/Servlet and J2EE component:
    - Apache Tomcat (OSS)
    - JBoss (OSS)
    - IDE: Eclipse & Netbeans (OSS), or text editor!
    - OS: Windows 2000 (in lab), Win/Lin (at home)
  - .NET component:
    - MS Visual Studio .NET 2003
    - OS: Windows 2000 (in lab)
  - Database server:
    - PostgreSQL (OSS) on shared Linux server

# In-depth: EBUS 5001

- **Assessment**
  - Comprised of lab work, major project and examination
    - Lab Work 20%
    - Project 30%
    - Exam 50%
  - A strong emphasis placed on major project for the course. Specification handed out in weeks 2-3, and project due in week 13.

## In-depth: EBUS 5001

- Some past projects (2003)
  - Hospital patient management system
  - Online HR and payroll system
  - Web-based MP3/CD management system
  - Airline reservation system
  - Online banking/broking system
  - Room reservation system



## In-brief: EBUS 5002

- Focus:
  - Web application frameworks
    - e.g. OpenACS (OACS) (OSS)
  - E-learning systems
    - e.g. dotLRN (OSS) – integrates with OACS
  - Extension of OACS and dotLRN
    - Building extension modules for the architecture
    - e.g. calendaring modules, content management modules, etc.
  - Industry speakers
    - e.g. Apple (on MacOS X), Greenpeace (OACS), Optus (“B2E” systems) etc.

### III. Outcomes

- Students found both EBUS 3002 and EBUS 5001 to be “hard courses”
  - The general statement: “Lots of work, little time”
  - Perl syntax (3002) was source of continual confusion for some students! (Python next year?!)
  - Implementing a custom session scheme in Perl (3002) for Mason confused most!
  - Java web app deployment and classpath configuration was a source of challenge for some (5001)
  - Only advanced students fully grasped the web services section of the course (5001)

# Outcomes

- Despite these comments, students found the course rewarding and useful ...
  - Almost all students (>85%) surveyed indicated that they felt the course was worthwhile and useful
  - The vast majority of students mastered the basics of each course: building database-driven websites and managing an SQL database (3002) and presentation, persistence and interoperability (5001)

## IV. Observations

- Our programme
- Our students
- Role of Linux/OSS
- Role of proprietary software

# Observations: Our Programme

- The current situation:
  - A good coverage of the main technical and business process components of E-C engineering
  - A balance between OSS and proprietary technologies
    - more on this later ...
  - Materials receiving iterative refinement (5001 since 2002, 3002 run for first time in 2003)

# Observations: Our Programme

- The future:
  - A gradual move away from pure “E-C” towards a more generic “internet s/w engineering” focus
    - A substantial overhaul planned to coincide with a change from 4 to 6 CP subjects in 2005
  - Steady introduction of new areas to underpin the existing practical components of the course
    - Especially in distributed computing area e.g. web services, more on “internet engineering” issues, etc.
    - More emphasis on P2P (e.g. examining P2P protocols e.g. gnutella, implementing P2P, e.g. JXTA)

# Observations: Our Programme

- Increasing the emphasis on practical, lab-based learning
  - Expensive (labour-wise, and hence financially) but a very useful mode of student learning
  - In process of applying for teaching grant to cover purchase data projectors for all computer laboratories
  - This will enable “live walk-throughs” of tutorial exercises in labs by tutors (not enough time in lectures)
- Maintaining the emphasis on project work within the courses (3002 and 5001 in particular)

## Observations: Our Students

- #1: Many students have had little or no exposure to Linux before commencing our EBUS programme courses (in 3<sup>rd</sup> year!)
- #2: Whilst many (especially “better”) students do have Linux (or other free OS) installed at home, many students do not, and are not comfortable or familiar at all!



## Observations: Our Students

- #3: Many students become familiar with Linux during the course, but it seems “uphill battle” for a few, and can quite demanding upon tutor time and resources
  - Tutors forced to multiplex between teaching course concepts (web and application development) and demonstrating Linux fundamentals!

## Observations: Linux and OSS

- We believe that Linux/OSS has an important place in our teaching programme
  - e.g. exposure to Linux OS, Java/J2EE using Apache Tomcat / JBoss, Perl + mod\_perl on Apache httpd, etc.

## Observations: Proprietary Software

- We believe that proprietary software also has an important place in the programme
  - e.g. Exposure to MS .NET within 5001
- Position: A proprietary software focus can be **very useful** from an OSS perspective!
  - Show students a wide range of software
  - Present the pro's/con's of different systems
  - Help students reach own conclusions about cost/benefit of specific software products

## Observations: Proprietary Software

- What happens when we present both OSS and proprietary software (side-by-side)?
  - Many students quickly reach the conclusion (on their own) that they can achieve many tasks using OSS. (Note: we don't indoctrinate!)
  - Students become more sophisticated and discerning about the use of proprietary / non-OSS
  - Students take a deeper understanding of the issue with them into the workplace

## V. Discussion

- Discussion questions
  - Factors affecting uptake of Linux
  - Factors affecting uptake of OSS

# Factors affecting the uptake of Linux

- Q: What are the main impediments to further uptake of Linux in undergraduate EIE teaching?
  - Lack of student familiarity with Linux / Un\*x
  - Linux/Un\*x is often not explicitly taught in preparatory curriculum
  - Many different origins of students – cannot assume a baseline
  - Limited time to teach Linux/Un\*x principles during the course

# Factors affecting the uptake of Linux

## – Meeting the challenge ...

- Engage the Linux/OSS community on-campus (e.g. SU-FSUG at Sydney Uni)
- “Lunchtime lecture” demonstrations on Linux basics (e.g. installation of Redhat/Fedora)
- Use of course discussion forums to answer Linux-questions and provide FAQ support
- Tutors willing to answer student's Linux questions (this often wears thin!)
- Distro-on-CD Linux demos e.g. Knoppix

# Factors affecting the uptake of OSS

- Q: What are the main factors affecting the further uptake of OSS in undergraduate EIE teaching?
  - Widespread availability and use of Windows-based productivity software (e.g. MS Office) and specialised applications (e.g. Matlab)
    - Limited reason to move to OSS alternatives e.g. OpenOffice, Octave, etc.
    - Decision to move would have to be taken at School or university level, probably not at a specific course-level
  - MSDNAA agreement with Microsoft to provide MS OS and dev tools to students possibly a factor ...



# Factors affecting the uptake of OSS

## – Meeting the challenge ...

- Make students aware of OSS alternatives (e.g. OpenOffice, Octave, gnuplot, LaTeX, etc)
- Encourage assignment submissions in platform-neutral formats e.g. PDF (which can be easily produced from OO)
- Introduce students to the GNU compiler and toolchain early in the piece – create early adopters!

## VI. Conclusion

- We believe we are succeeding in our objective to create a leading-edge, world-class E-C degree programme
- We believe we are turning out “industry-ready” graduates whose skills are underpinned by a deep knowledge of E-Commerce and internet systems, protocols and technologies
- We believe that our graduates have a strong appreciation for the role of Linux and other OSS technologies in commercial settings

# Industry Feedback

- Feedback from industry very encouraging.  
For example:
  - “One of the most advanced course programs I have seen anywhere ...”  
Kelvin Lawrence, Technology Evangelist  
IBM Thomas J. Watson Research Center
  - Good feedback from Optus and other partners (even ones you might not expect!)

# Student Feedback

- Feedback from students:
  - EBUS programme is perceived as useful and relevant by almost all graduates
    - Source: Feedback surveys for 3001, 5001 (2003)
  - EBUS programme “helped me to get a job”
  - Skills learned are readily translated to other environments (e.g. Python/Zope)
  - Many students become enthusiastic adopters of Linux and OSS in their subsequent units/jobs
    - And champion Linux/OSS adoption within their companies!

# Your Feedback

- I would welcome your comments and feedback on the programme ...
  - Specifically, any comparisons with other E-Commerce and software engineering course programmes with which you may be familiar?
  - Happy to “compare notes” and share information about our programme with others ...

# Audience Discussion

- Any questions you might have ?