

Teaching IP networking fundamentals in resource constrained educational environments

Grenville Armitage
Warren Harrop
(Jason But)

{wazz,garmitage,jbut}@swin.edu.au



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Outline

- Introduction
- Teaching unix - options
- What is "RULE" (Remote Unix Lab Environment)?
 - For students
 - For teachers
- RULE v2
- Conclusion

Introduction – the problem

- Pedagogical goals
 - Expose students to unix
 - Allow self directed access (flexible learning)
 - Allow access from anywhere on the campus network
- Limitations
 - Existing Windows labs
 - Floor space



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Why use unix?

- Important in teaching Telecomms Engineering
 - Ability to modify network code implementation
 - Unix is typically very strong in network centric installations
 - “Hands-on experience” due to many unix-like operating systems being open-source
- Server operating system of choice
 - Unix is the most common OS for Apache web server, the most popular web server in the world
 - Unix is incredibly reliable (netcraft.com)
- Give a range of experiences



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What is RULE?

(Remote Unix Lab Environment)

“Giving student(s) a (group of) PC(s) that can be accessed anywhere/anytime for advanced telecoms and computer science teaching”

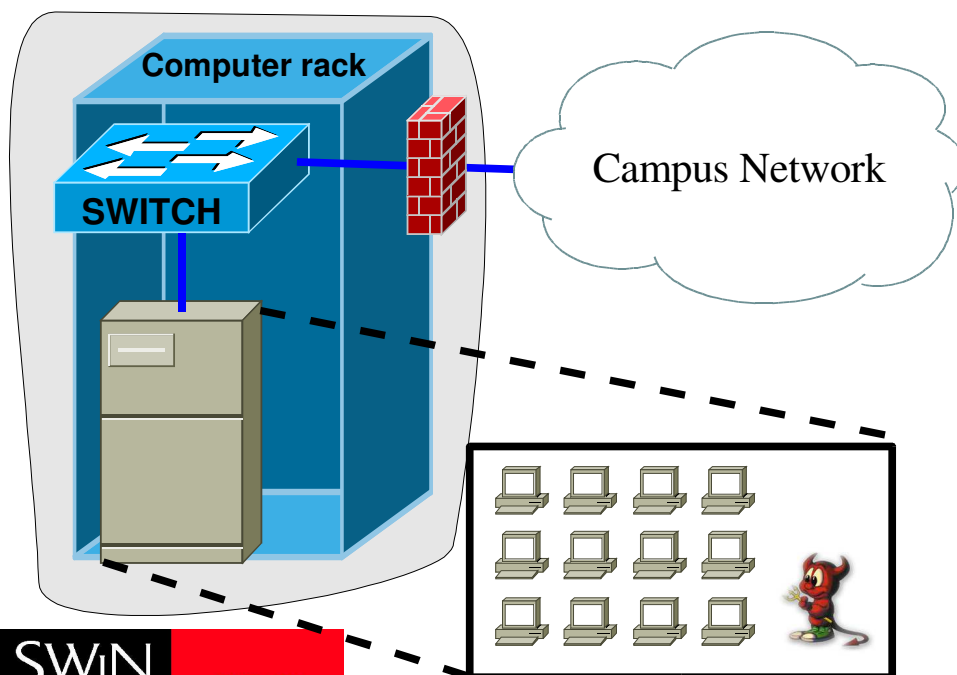


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What is RULE?

Efficient use of space



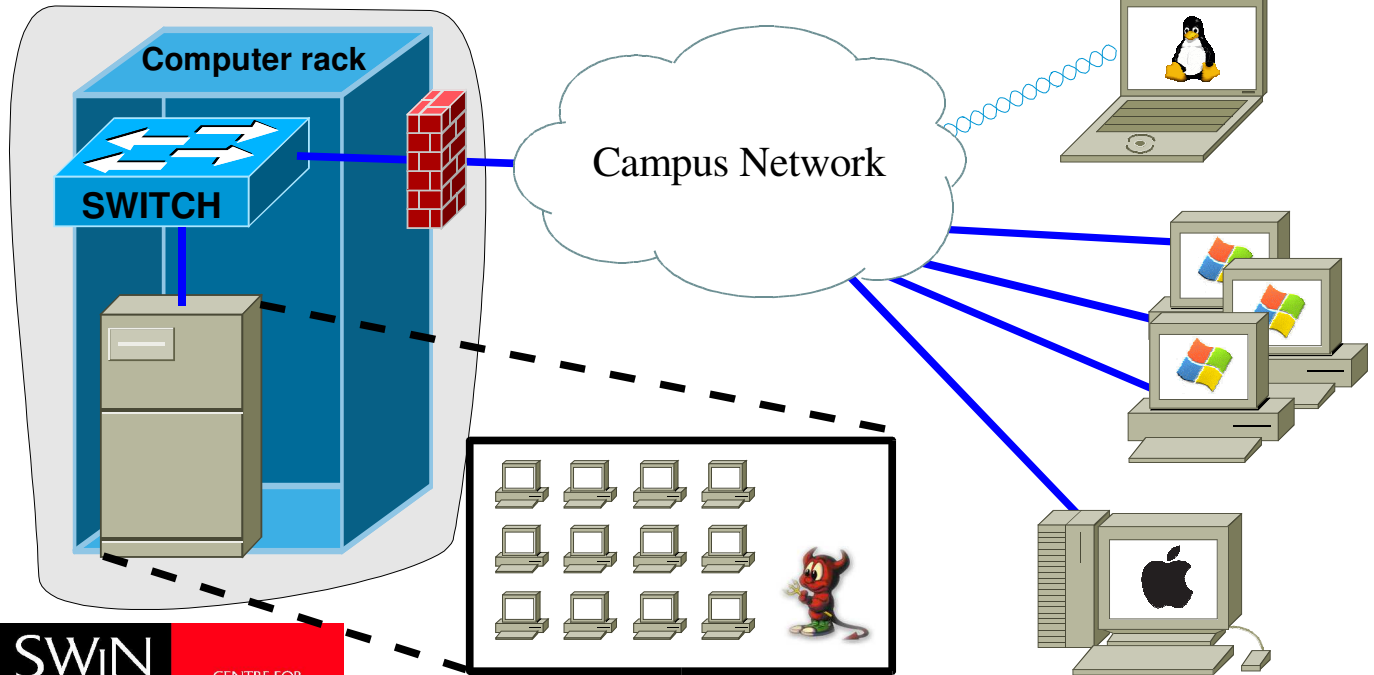
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What is RULE?

Efficient use of space

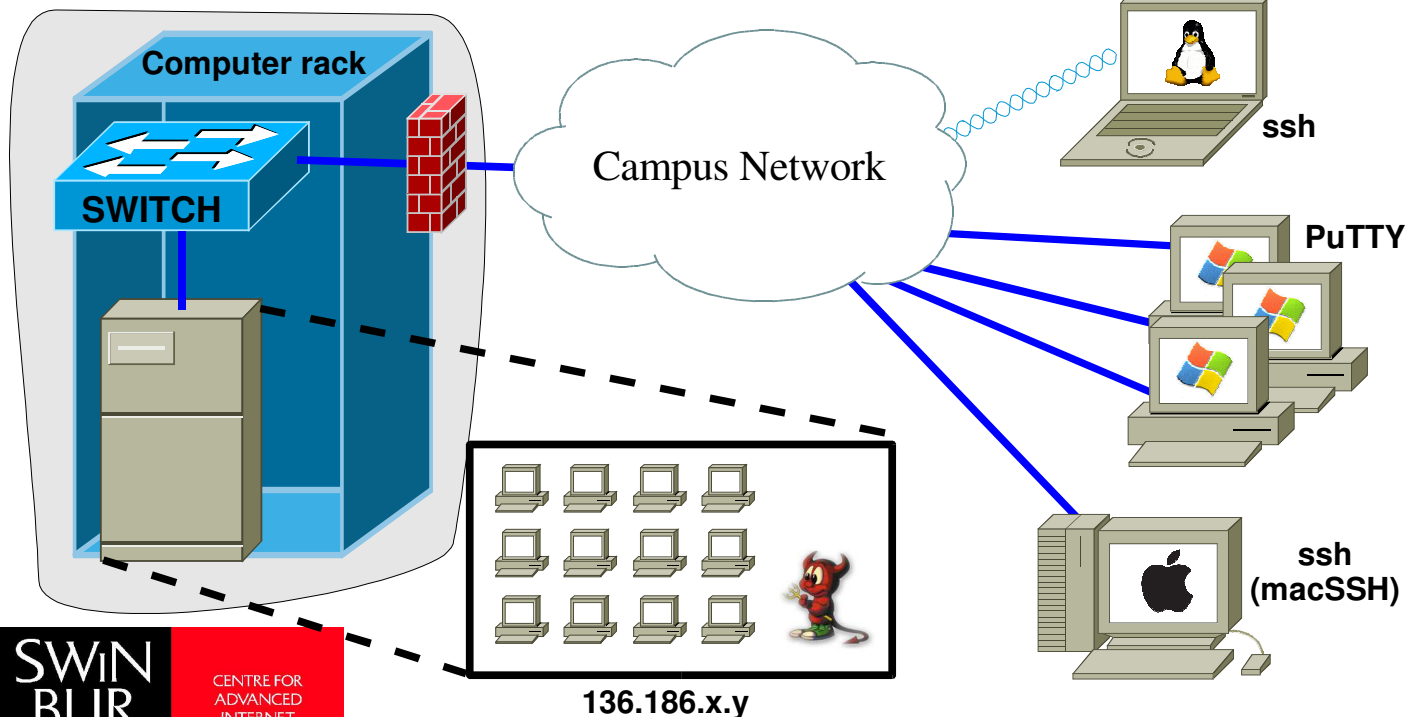
Flexible Learning



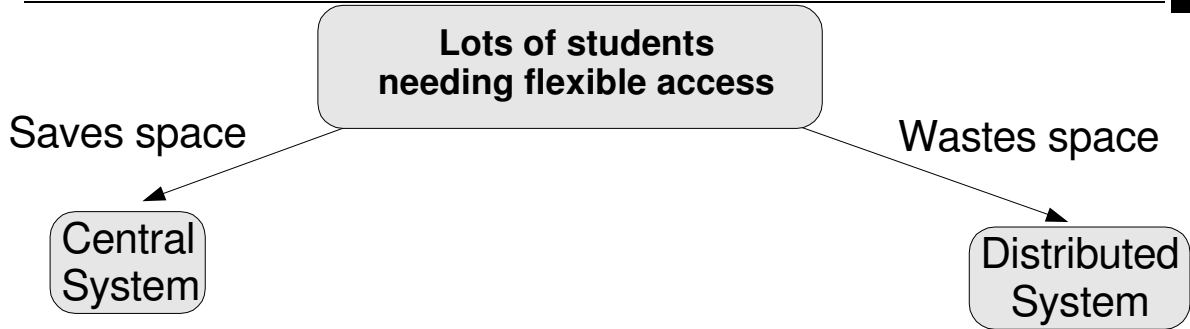
What is RULE?

Efficient use of space

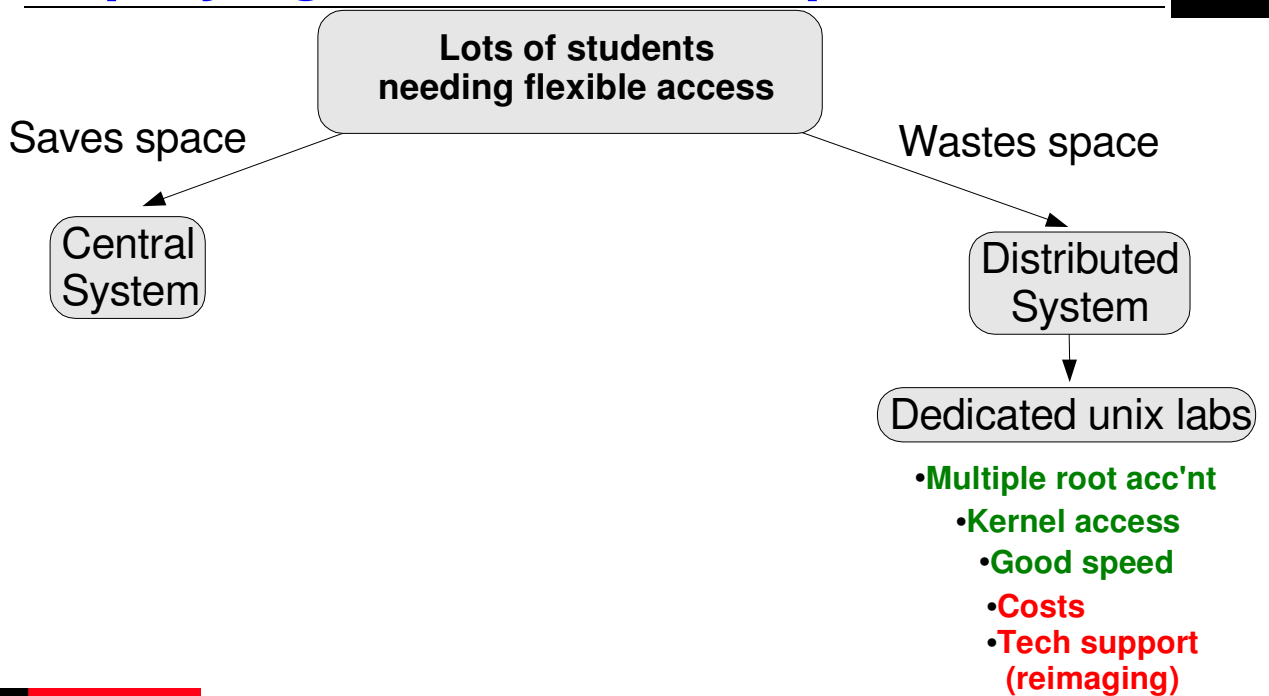
Flexible Learning



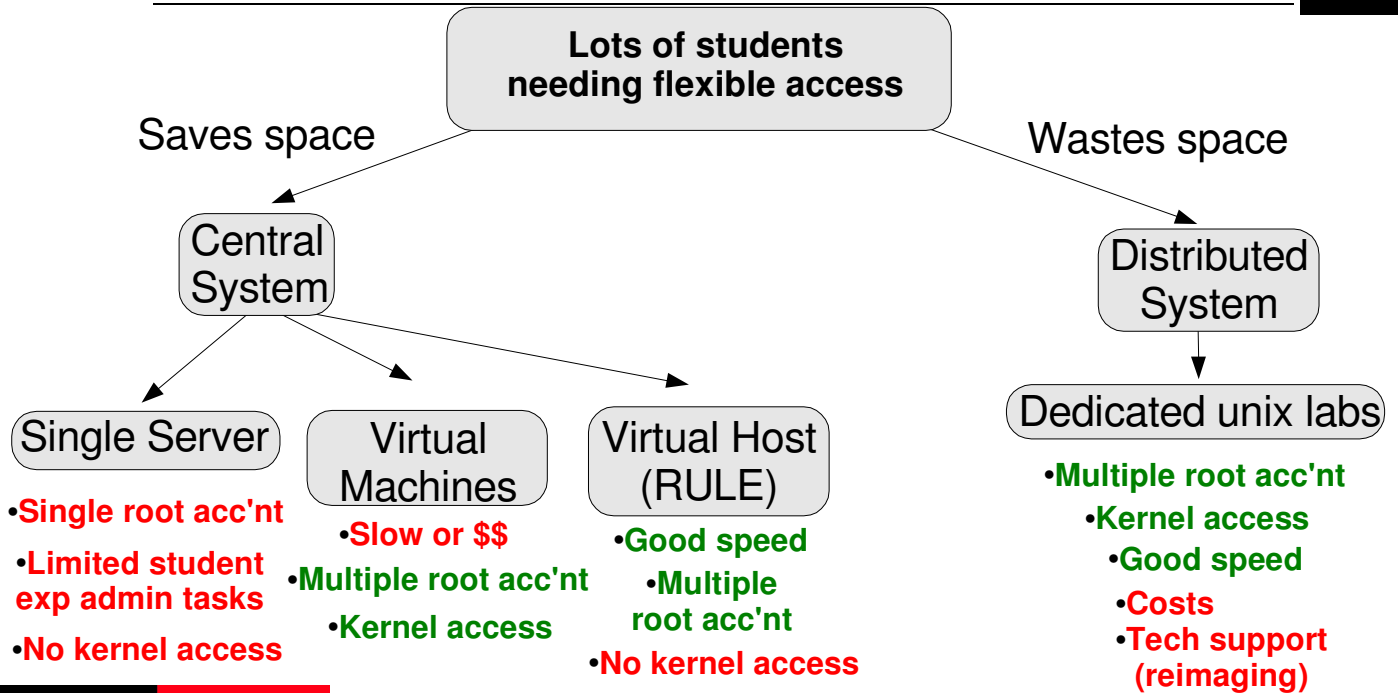
Deploying unix access – options



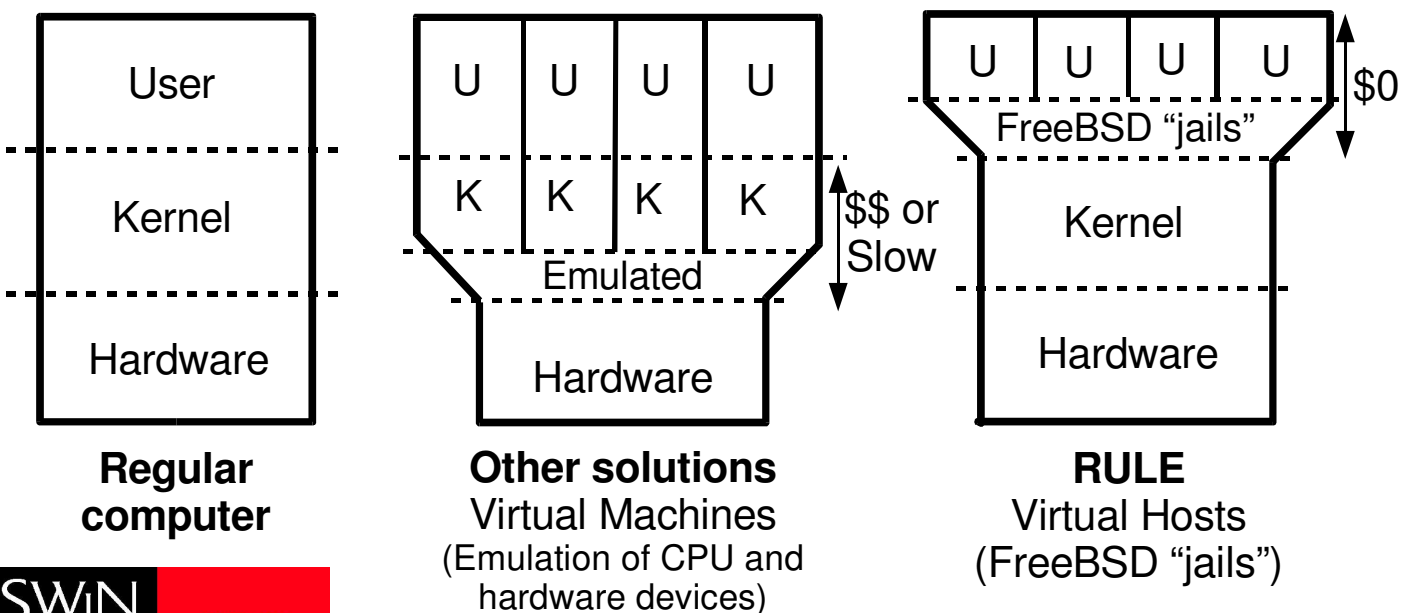
Deploying unix access – options



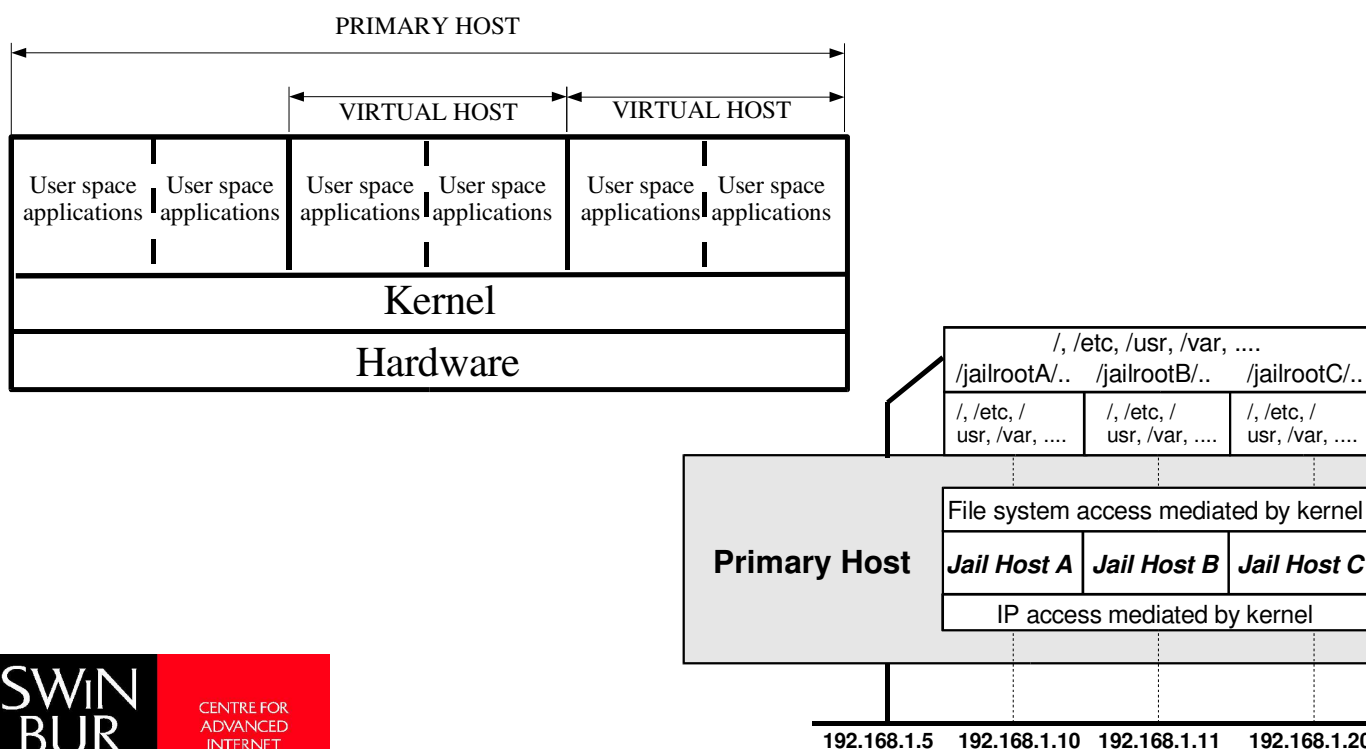
Deploying unix access – options



Using unix – background



Using unix – RULE



For students...

- Unix system access
- Flexible Learning
 - 24hr access
 - Internet-wide access
- Other advantages
 - “Sandbox” environment
 - Allows for experimentation
 - “Drop in” guidance by teaching staff

Teaching experiences

- Deployed within Telecoms Eng at Swinburne
- Lab sessions for HET436 – '03, '03, '05
 - Introduction to unix
 - Configure a http (web) server
 - “thttpd” (tiny httpd)
 - Configure a http (web) proxy server
 - “tinyproxy”
 - Configure a Domain name server (DNS) server
 - Berkeley Internet Name Domain (BIND) - “used on the vast majority of name serving machines on the Internet”



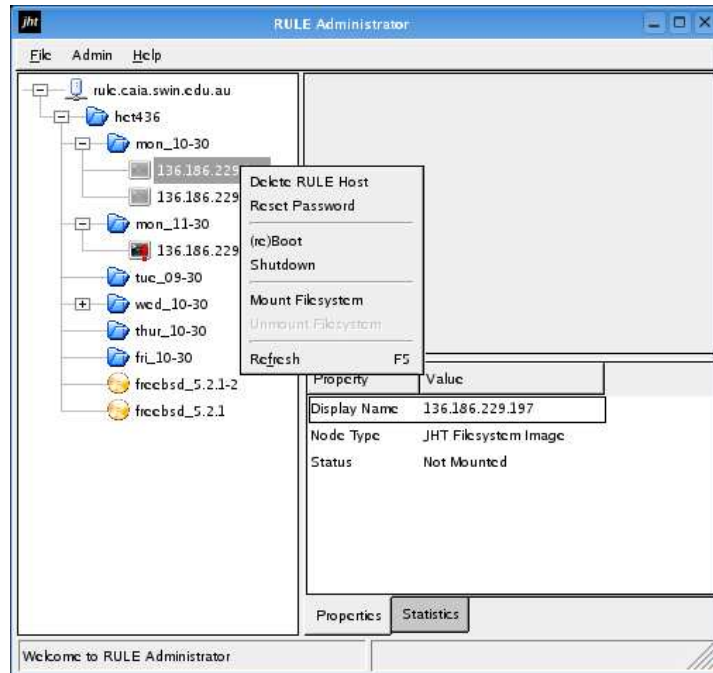
Teaching experiences

- Advantages to having virtual hosts
 - “Drop in” on student's servers – provide help
 - Overwrite files if needed
 - Automated “pickup” of work
 - Plagiarism detection
 - GUI management tool (JHT)...



JHT (Jail Host Toolkit) - Admin

- GUI app for administering virtual hosts



RULE v2



Why RULE v2 ?

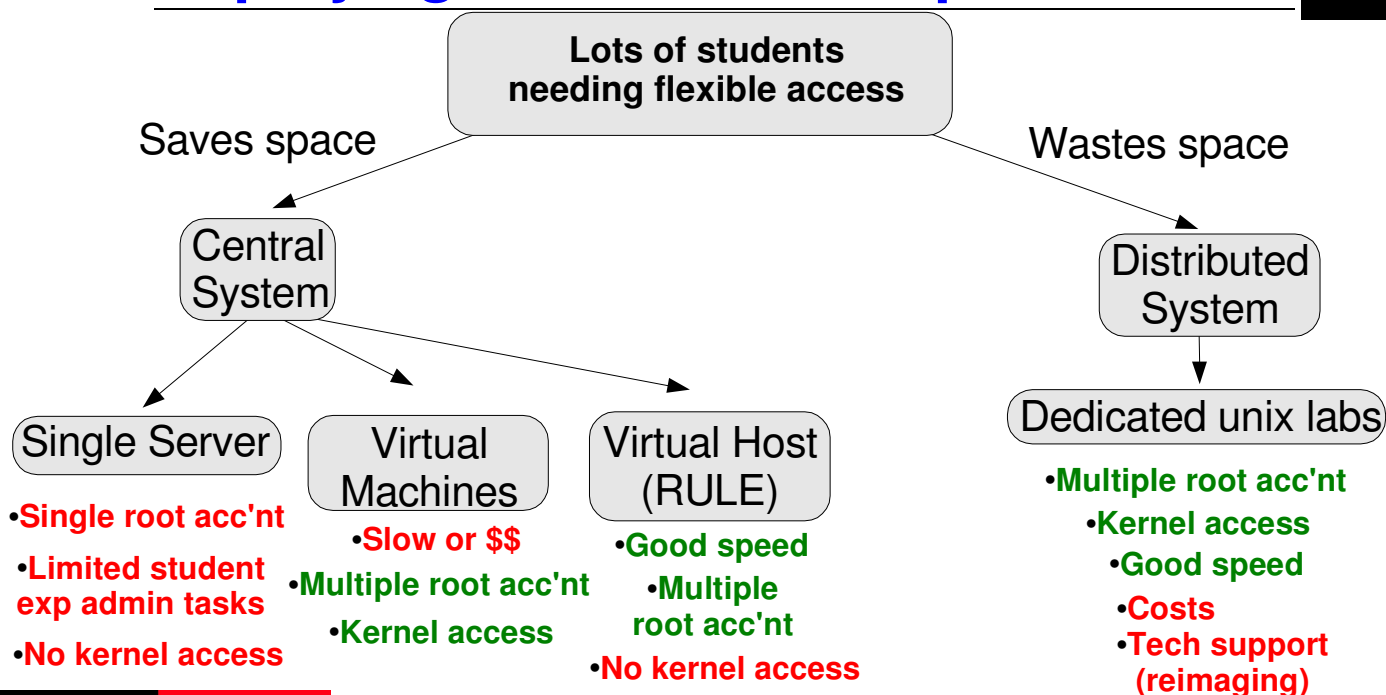
- Returning to our original goals...
“Giving student(s) a (group of) PC(s) that can be accessed anywhere/anytime for advanced telecoms and computer science teaching”
- Virtual host does not provide full functionality
 - As might be required for certain scenarios including telecomms and OS design – cannot modify OS
- If this was made possible
 - Students can now break the OS
 - Potential to create runaway system that generates large amounts of network traffic



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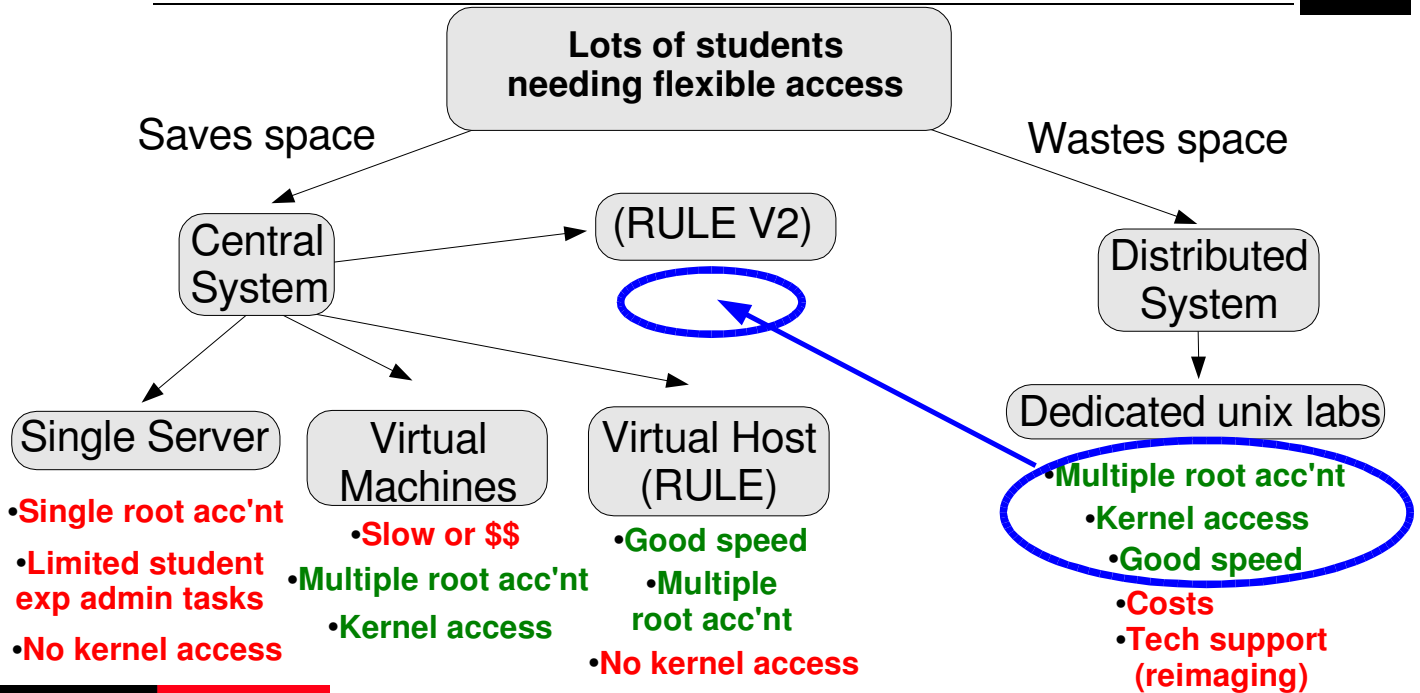
Deploying unix access – options



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Deploying unix access – options

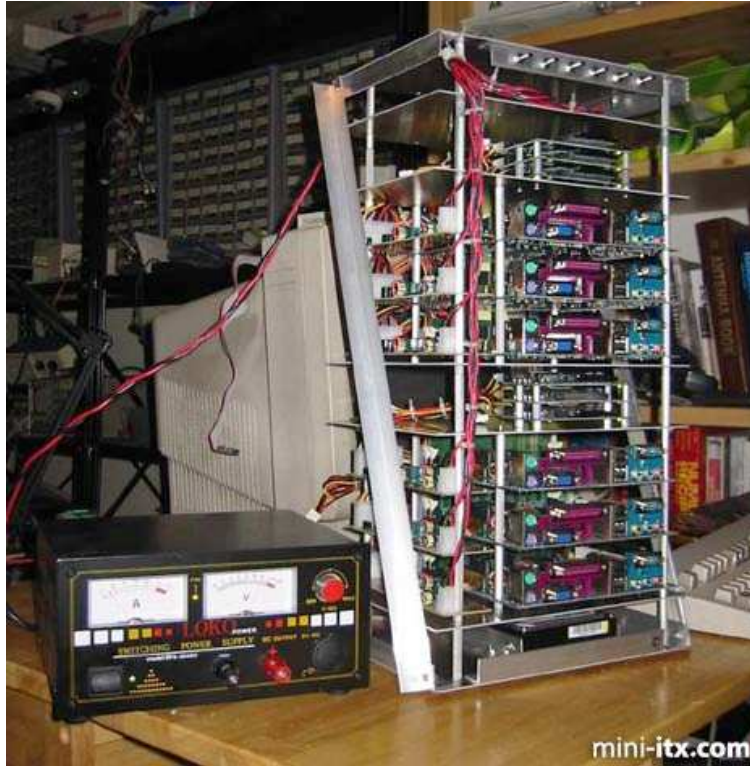


RULE V2

- Use cheap, small footprint motherboards (Mini-ITX) to provide a “real” (not virtual) PCs
- Assign 1 (or more) PC to each (group of) student(s)
- Retain remote access advantages
 - Use existing Windows labs
 - Access anywhere/anytime

Micro-PCs

- 12V DC
- Low power
- Low heat
- HD or Flash Disk



mini-itx.com

<http://www.mini-itx.com/projects/cluster/>

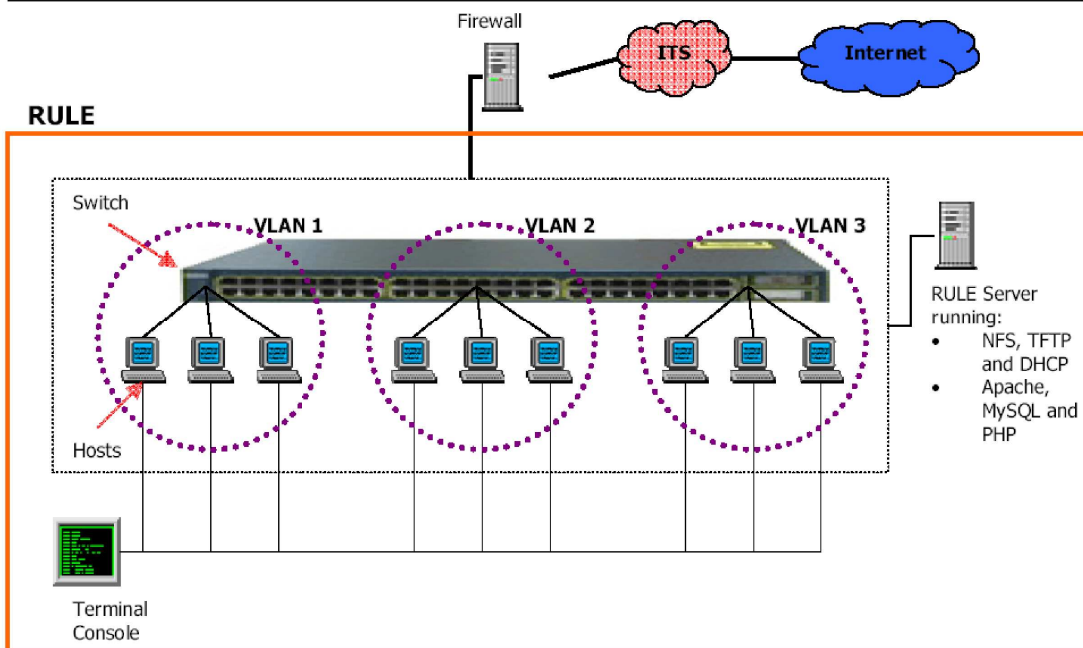
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Multiple “real” Computers



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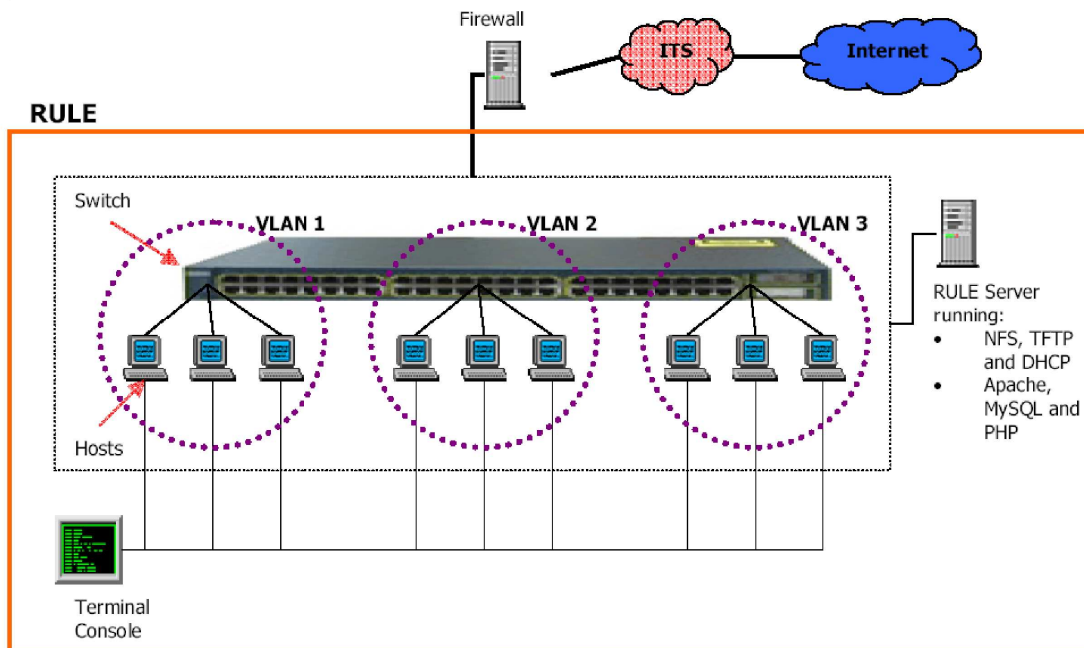
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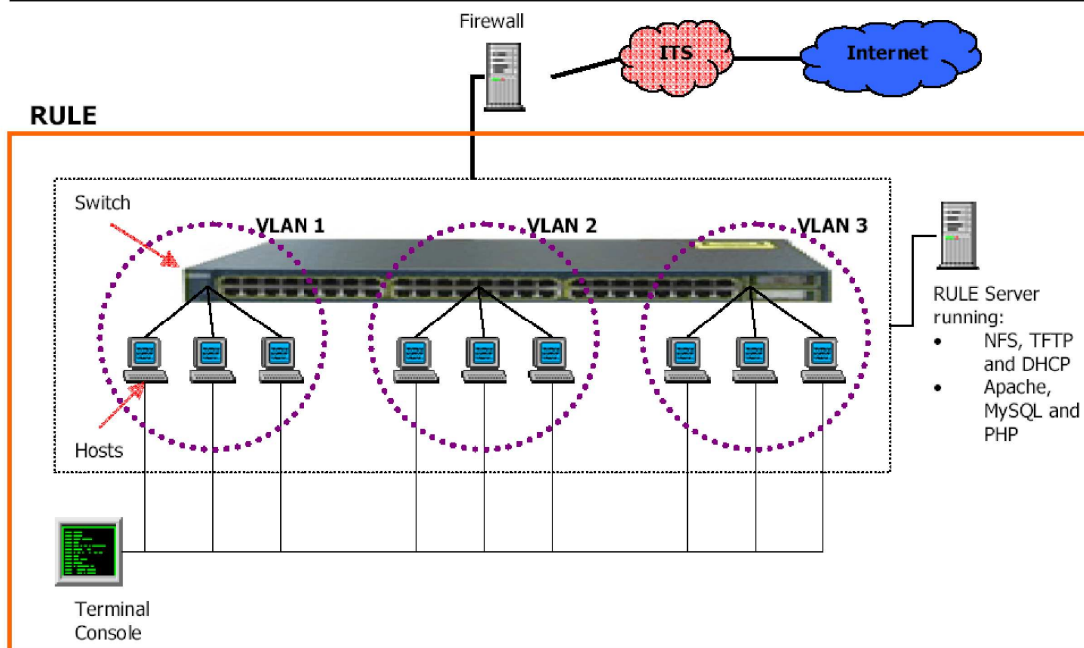
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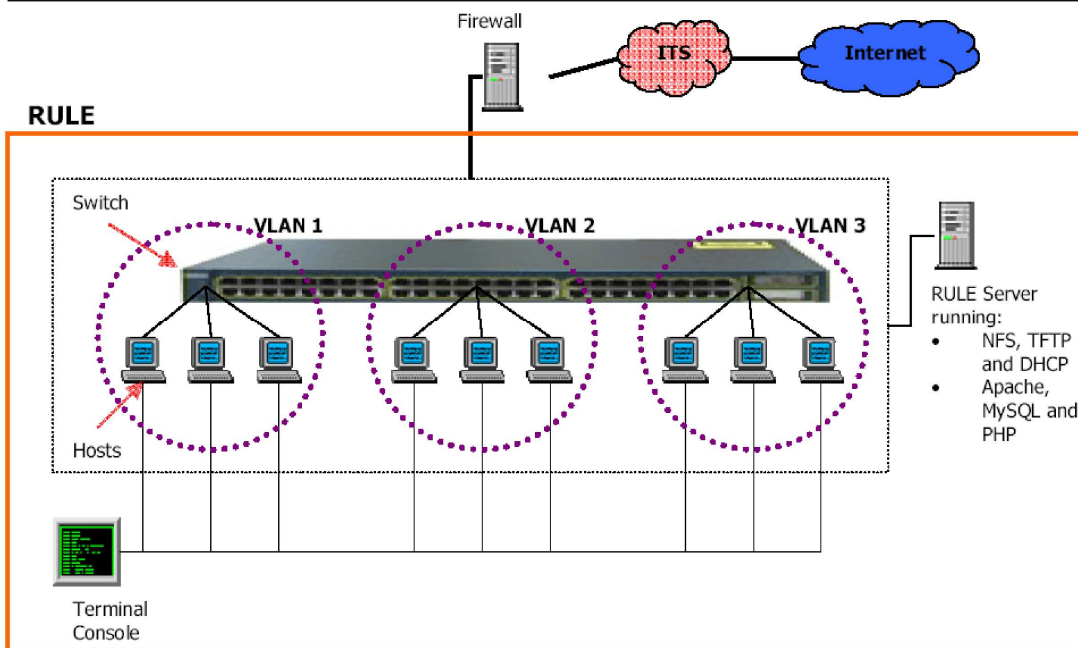
Terminal Server



Network Booting



Firewall Protection



Conclusion

- Teach IP networking fundamentals in unix context
 - Flexible learning & remote access
- Developed & Deployed RULE
 - Richer student experience than a central unix box
 - Easier to deploy & manage than dedicated unix labs
- RULE v2 under development
 - Improved flexibility, requires limited floor space, cheaper than dedicated labs
- Leverage investment in existing Win laboratories

<http://www.caia.swin.edu.au/rule/>

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