WLab: Virtual Machines as Learning Objects for ICT Teaching

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Background

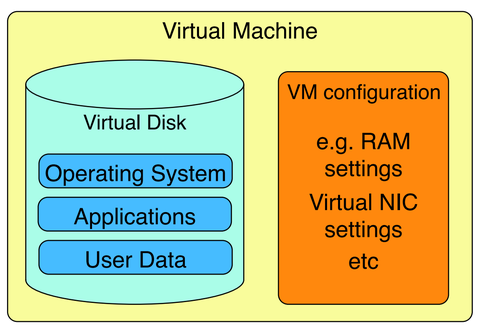
- Providing an e-learning environment for advanced ICT courses (e.g. security, networking) presents certain challenges:

many such courses involve root access to servers

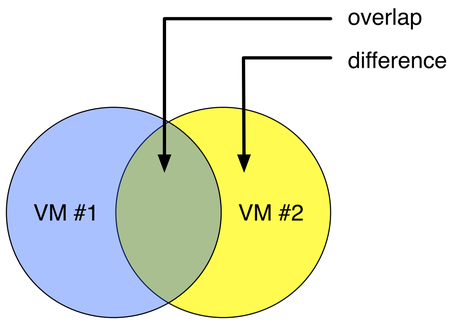
university lab facilities are often outdated

distance learning students must be accommodated!

- Some projects have used virtualisation to overcome these issues for security courses (1)(2)(3), as does the older VLab system currently used in several MSc modules at Kingston University.
- **but...** these existing projects only address infrastructural issues, ignoring the pedagogic potential of virtualisation (4):



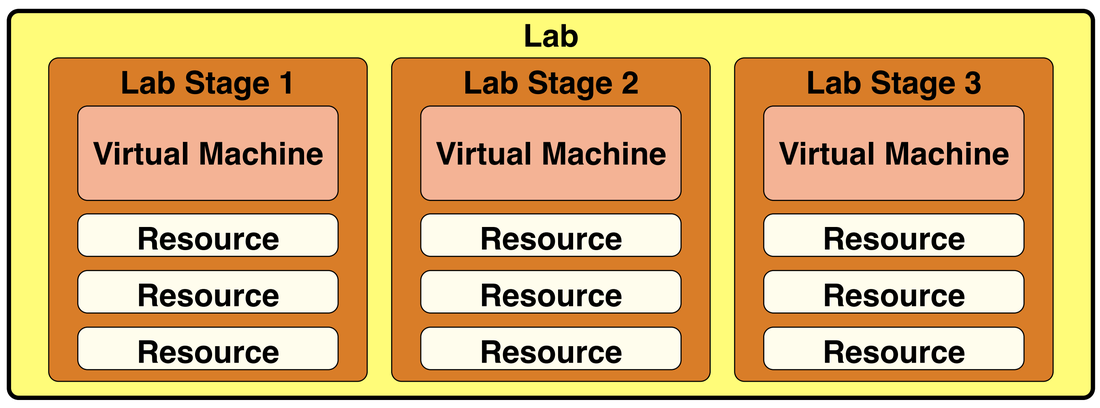
A virtual machine image can be designed with a pedagogic aim in mind, including both software and data for a student to explore that aim.



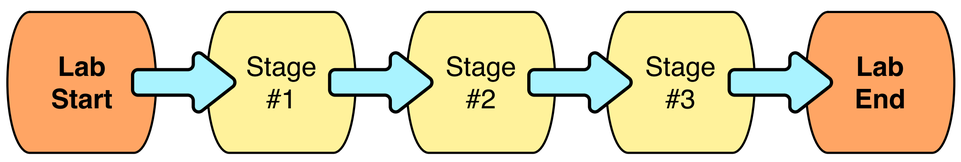
A series of VMs can be designed so that the areas of overlap and difference can convey a pedagogic outcome.

WLab: a new kind of composite learning object

- A **lab** represents a workshop-style exercise, and contains one or more lab stages.
- **Lab stages** represent an intermediate, "milestone" point of the workshop and contain:
  - A **virtual machine** (VM) state defined by the tutor
  - One or more complementary **resources** in the form of static learning content to direct the activities of the student in the VM..



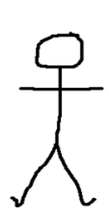
- The order of the lab stages defines a path that the student will take to complete the activity of the lab.



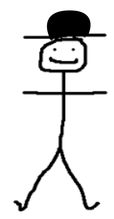
An example lab exercise - drawing a stick figure in Paintbrush

...or "Da Vinci, eat your heart out!

- Each stage includes a VM state designed so the student can immediately start the next activity:

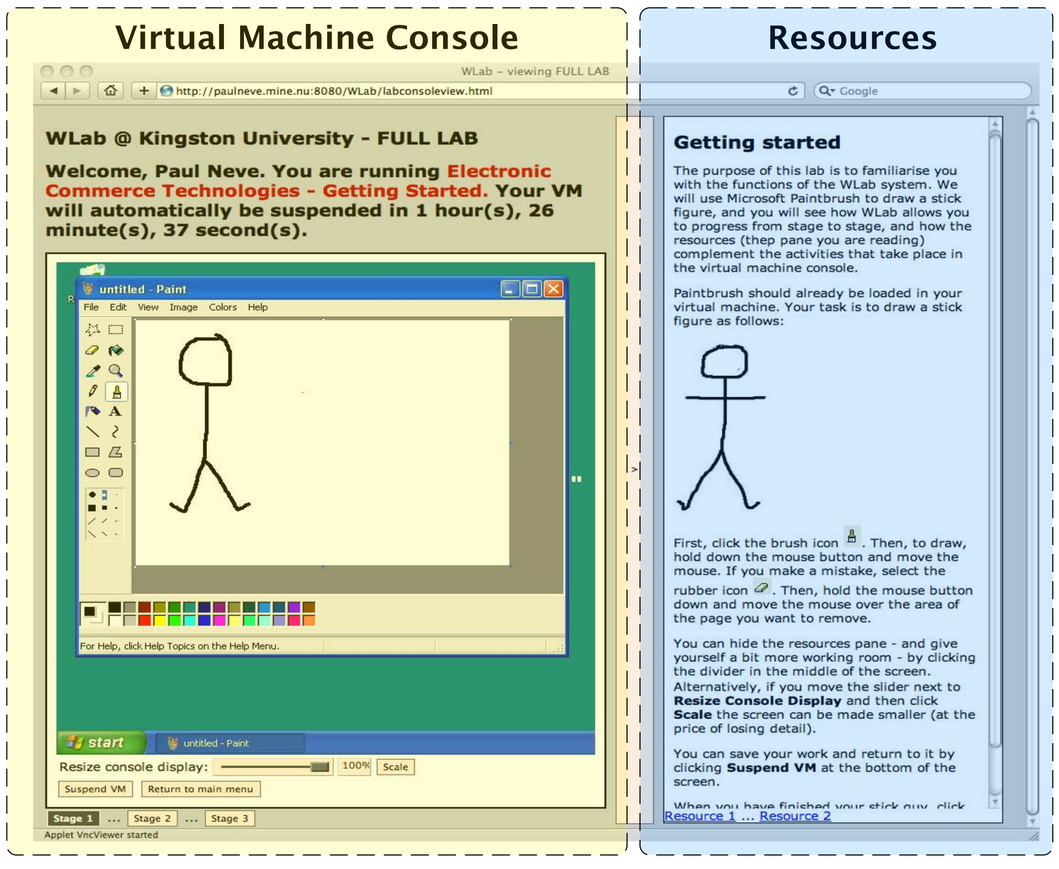


#1: Draw a stick person



#2: Add a hat

#3: ...and a bunch of roses



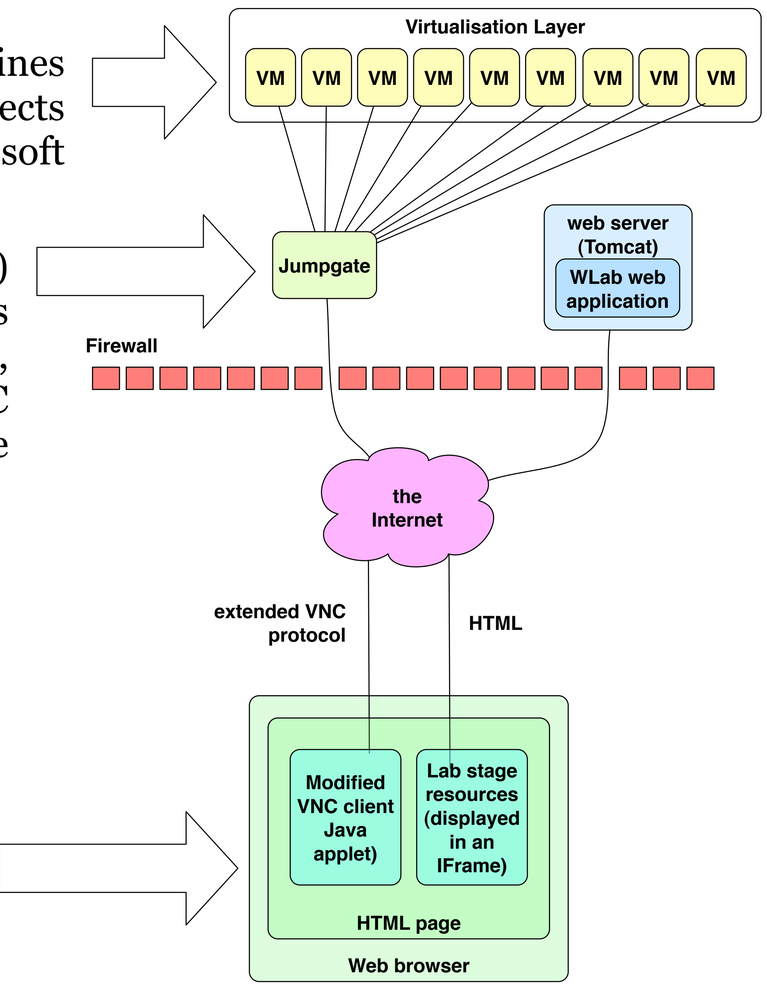
- Each subsequent stage should introduce new concepts and activities that build on what has been learned in previous stages - e.g. stage #2 introduces the fill tool, and stage #3 introduces colour selection and the use of the spray can.
- This approach can be applied anywhere the intermediate stages of a lab exercise can be described with VM states.

System Architecture

The virtual machines within the lab objects run inside Microsoft HyperV.

Jumpgate (6) provides access through firewalls, and routes VNC traffic to the correct VM.

The student views a lab in a standard web browser, and TightVNC (6) is used to embed the VM within the WLab web UI.



References

1. Krishna K, Sun W, Rana P, Li T, Sekar R. V-NetLab: A cost effective platform to support course projects in computer security. In *9th Annual Colloquium for Information Systems Security Education* (CISSE 05). Atlanta; 2005.
2. Gaspar A, Langevin S, Armitage WD. Virtualization Technologies in the Undergraduate IT Curriculum. *IEEE IT Pro.* July/August 2007: p.10-17.
3. Gaspar A, Langevin S, Armitage W, Rideout M. Enabling new pedagogies in operating systems and networking courses with state of the art open source kernel and virtualization technologies. *Journal of Computing Sciences in Colleges*. 2008; 23: p189-198.
4. Neve P. *A General Approach to E-Learning for ICT Students* [online]. Available from http://www.paulneve.com/cgi-bin/wiki.pl/A_General_Approach_to_E-Learning_for_ICT_Students [Accessed 16th August 2010].
5. Argyroudis P. Jumpgate website [online]. Available from http://jumpgate.sourceforge.net [Accessed 20th May 2010].
6. TightVNC Website [online]. Available from http://www.tightvnc.com [Accessed 20th May 2010].