Sysadmin Training

in the

Virtual Unix Lab

An Interactive Course System with a Tutorial Component, User Adaption

and Result Verification via Domain Specific Languages

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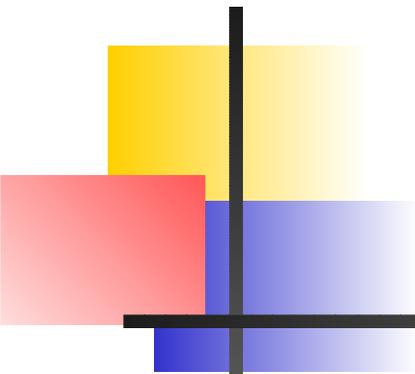
Introduction

- Context: system admin training

- Computer Science + Information Science

- Funded from 2001 to 2003 with 20.000EUR ($24.000) as "Practical Unix Cluster Setup" by the HWP project of the German ministry of education and research (BMBF).

- PhD thesis at the department of Information Science (Informationswissenschaft) at the University of Regensburg, Germany.
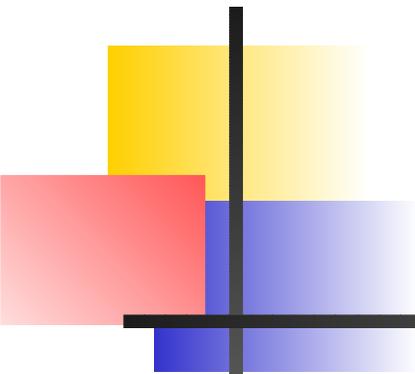
Background

- Problem: root access for users

- No Root - no practicing of many things

- Root - unknown state after exercise
  $\Rightarrow$ Reinstall to be safe

- Reinstall not always an easy option!

- Virtual teaching different from classroom teaching
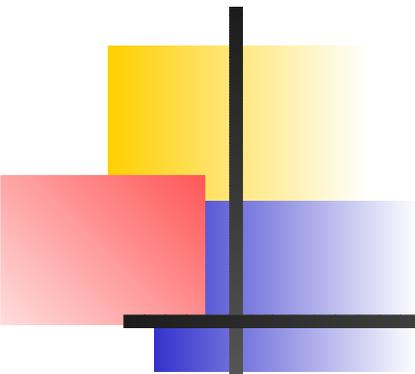
The Virtual Unix Lab

- Installs lab machines on demand

- Users can book exercises for a certain time

- All machines will be setup identically

- Exclusive access during exercises

- Evaluation of exercise results

- Feedback on success of exercise

- Machines are re-installed from scratch for next user
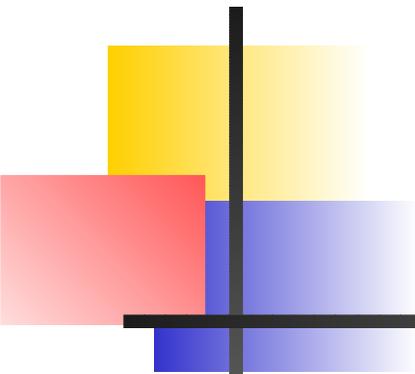
VUlab: User Area

A user's perspective:

- Login and account creation

- List of exercises

- Booking an exercise

- Taking an exercise

- Retrieving feedback afterwards
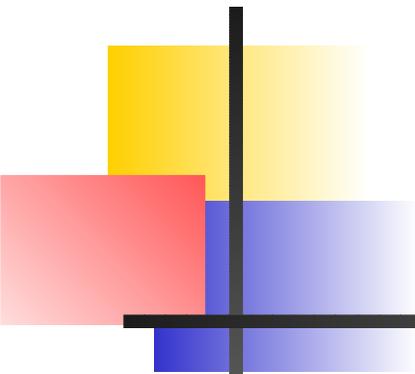
VUlab: Admin Area

An admin's perspective:

- Manage users

- Manage booked exercises

- See group statistics

- Create new exercises

Sceenshots

Sceenshots

Sceenshots

Screenshots

Aufgaben:

Paketverwaltung

1. Installieren Sie die bash und tcsh Binärpaket (Quelle: ftp://ftp.netbsd.org/pub/NetBSD/packages/1.6/sparc/All)

   Pakete installiert? (pkg_info -e)   Nein

Benutzerverwaltung

1. Richten Sie einen neuen Benutzer "test" ein. Home-Verzeichnis soll /home/test sein, Shell "tcsh".

   "test" finger(1)bar?   OK
   Korrektes Home-Verzeichnis? (finger, test -d)   OK
   Shell richtig gesetzt? (finger)   OK
   Eintrag in /etc/master.passwd?   OK

2. Geben Sie das Passwort für den Benutzer "test" auf "vutest"

   Passwort richtig gesetzt? (getpwnam(3), crypt(3))   OK

3. Stellen Sie sicher dass sich der Benutzer via telnet, ssh und ftp einloggen kann!
4. Ändern Sie die Login-Shell des Benutzers "vulab" so daß er künftig die bash verwendet.
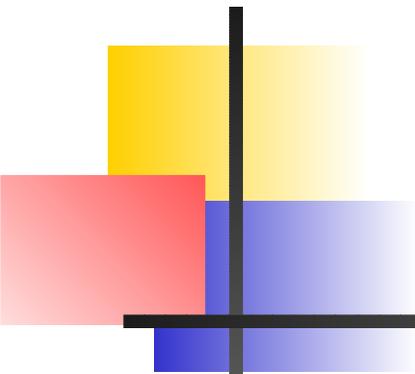
Server Machine

- DELL PC, 1*3.2GHz

- 1024 MB RAM

- mirrored SATA disk

- additional PCI ethernet card

- Runs NetBSD 2.0/i386
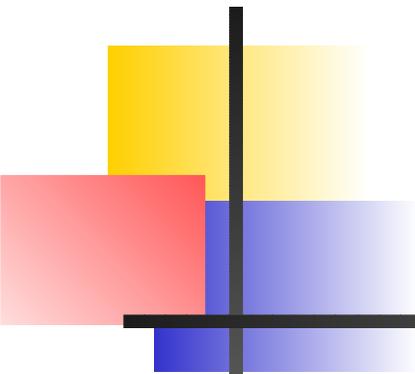
Lab Machines

- 2*

- Sun SPARCstation 4, 110MHz

- 64 MB RAM

- 1 GB internal SCSI disk

- Run NetBSD 1.6.2/sparc or Solaris 9/sparc

Goal: Virtual Machines!

(Xen, qemu, VMware)
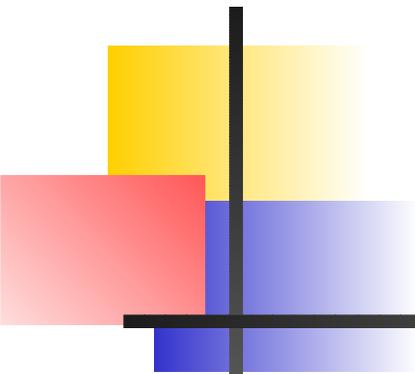
Lab Machine Installation

- Server acts as DHCP, RARP and NFS server to lab network

- Netbooting of lab machines, after end of previous exercise (independent of running OS!)

- Image-deployment to lab machines via NFS (w/ some experiences from the g4u project :-)

Restricting Access to Lab Machines

telnet
ssh
ftp

20023
20022
20021
10023
10022
10021

23
22
21

telnet
ssh
ftp

telnet
ssh
ftp
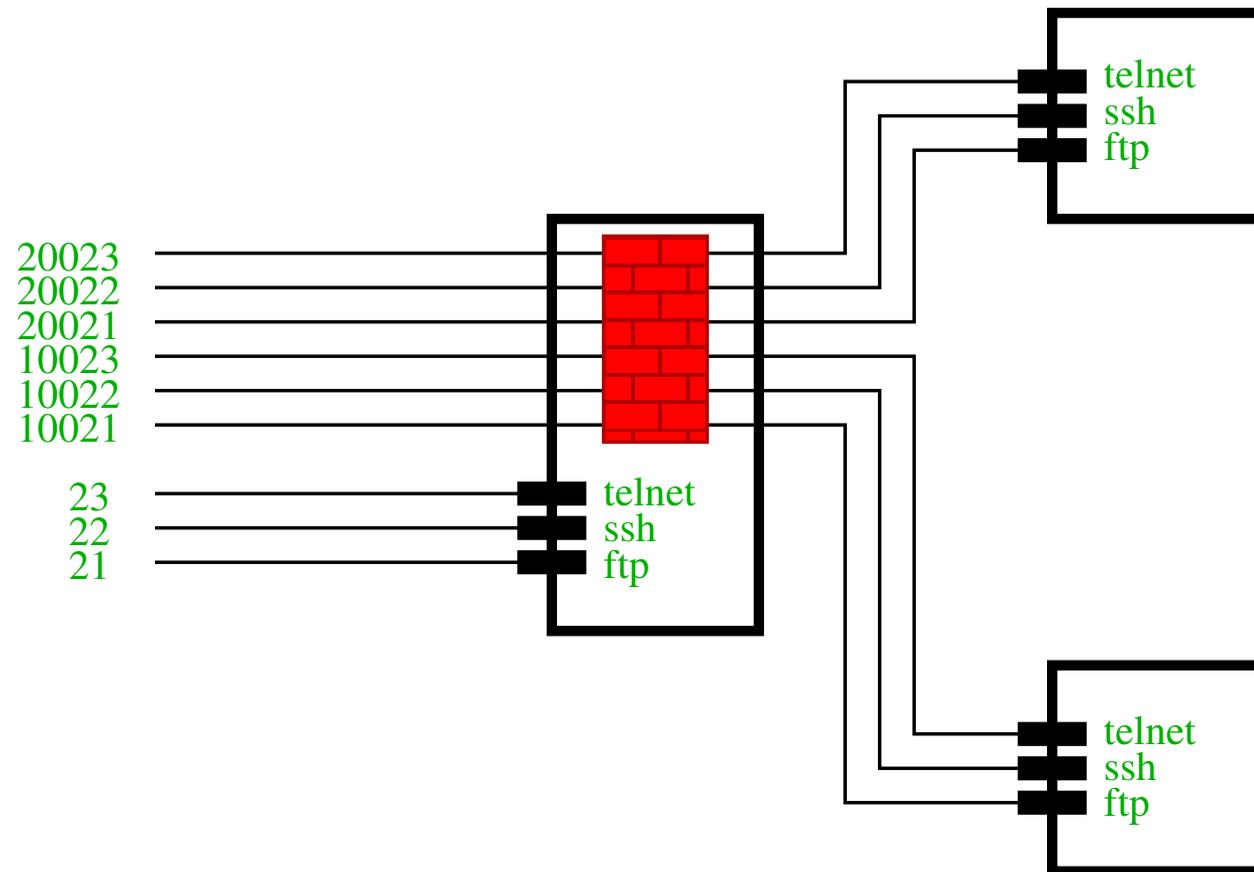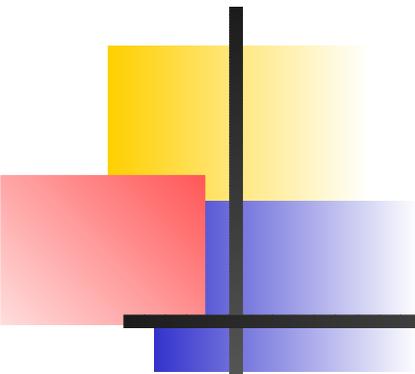
Software

- Apache

- Postgres

- IPfilter

- NetBSD

- Solaris

- PHP

- Perl

- Bourne shell
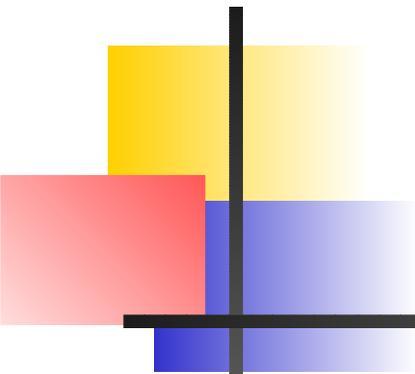
Status: CompSci

- The system works

- Available Exercises:
  - Network Information System (NIS)
  - Network File System (NFS)

- Tested successfully in summer semester 2004 and 2005 w/ 40 students during course "System Administration" at the University of Applied Sciences (Fachhochschule, FH) Regensburg, Germany.
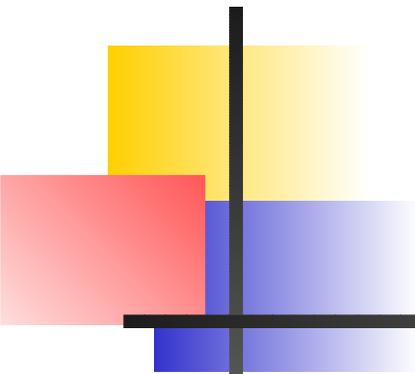
Status: InfoSci

- Didactic analysis of the existing System Administration lecture done

- Analysis of systems after exercises works

- Feedback for user about success of exercise

- Definition of exercises via Web frontend or a Domain Specific Language (DSL)

- DSL defines test primitives (activators) and generalized parameters
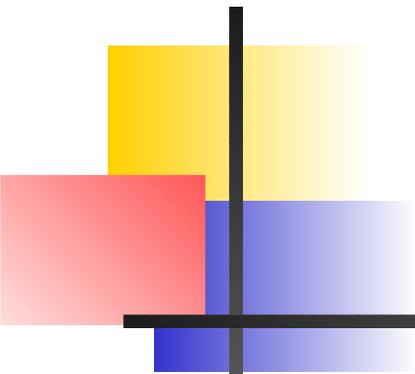
Status: InfoSci

- DSL processor prepares data for result verification and feedback

- Data structure representation pattern allows easy maintenance due to all relevant data being in one place

- Language specialisation pattern allows complex evaluation by using (parts of) PHP

- Easy sequencing, selection and even iteration possible that way
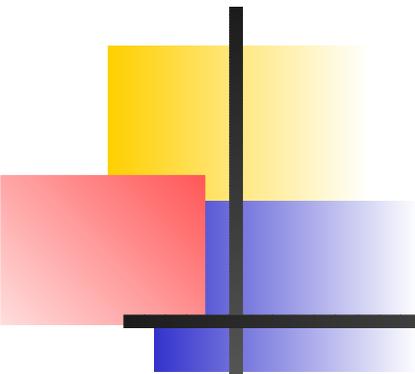
Status: InfoSci

- Application of System frontend pattern allowed easier updating of exercise machines

- Existing infrastructure allows further research for tutoring systems and user adaption in both classroom and pure virtual learning environments
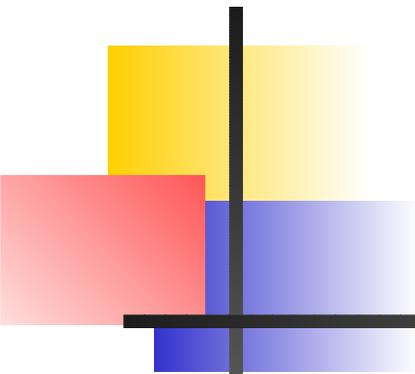
Future: CompSci

- Define more exercises:
  - Web- and Mail server
  - DNS, DHCP, LDAP, Samba, ...
  - Troubleshooting
  - Security analysis
  - System hardening
  - ...
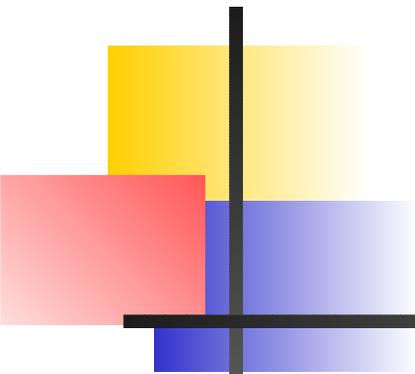
Future: CompSci

- Add more options for lab machines:
    - Real hardware
    - Emulated (virtual) hardware
    - More operating systems: Linux, Windows
- Internationalisation
- Funding!
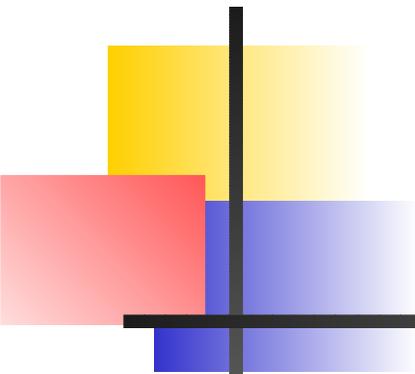
Future: InfoSci

- Using existing infrastructure for verification of exercise results

- Research support for a tutoring system to aid in pure virtual learning environments

- Research user modeling and adjusting the system to various types of learners WRT assistance and system setup

- Finish writing PhD thesis :-)

Thank you!

http://www.feyrer.de/vulab/

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