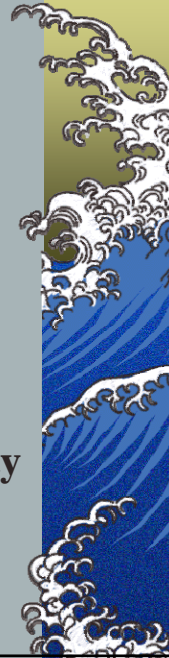


Getting More From Your Virtual Machine

**Kyrre Begnum, Oslo Univ. College,
Norway**

John Sechrest, Oregon State University

**Steven Jenkins, East Tennessee St.
University**



Introduction

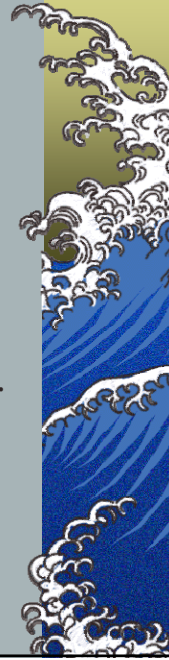
Too many students, Too Few Machines

- => Toy Problems
- => Trivial learning
- => Rigid Support practices
- => Homogeneous Problems
- => High Support Overhead



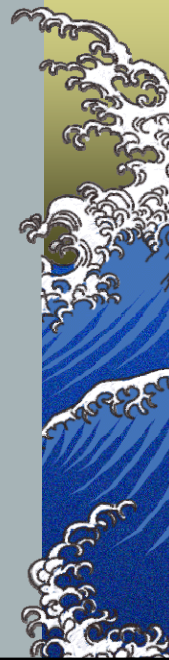
Virtual Machines

- ▶ *Every physical system has multiple virtual instances running on it.*
- ▶ *Each virtual instance has network access*
- ▶ *Each instance is a full linux system*
- ▶ *Virtual services can be provided by either Xen or UML*



Benefits of Virtualization

- ▶ *One computer -> Many Virtual machines
(Kyrre used 1 machine for 84 virtual instances)*
- ▶ *Each student can have several virtual machines*
- ▶ *Restarting a system is easy*
- ▶ *Students get full control of system*



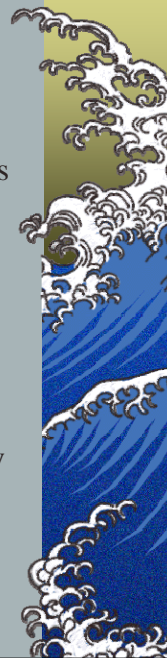
More Benefits of Virtualization

- ▶ *Templates provide preconfigured environments*
- ▶ *You can create networks of virtual machines*
- ▶ *Automation reduces overhead*



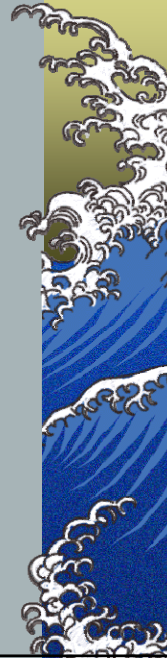
MLN

- ▶ MLN is a wrapper around Xen or UML which automates virtual system management
 - ▶ Configure new Virtual Machines
 - ▶ Configure networks of many machines
 - ▶ Separate Spaces for each student
 - ▶ Configure many virtual machine instances over many different physical machines with one config file
 - ▶ Supports sharing networks between students



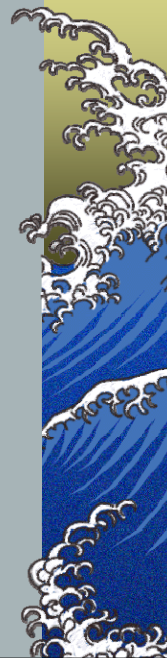
MLN projects

- ▲ *Logical Groups of machines are called Projects*
- ▲ *Individual users can create projects with full administrative rights*
- ▲ *Projects are defined by a text config file*
- ▲ *Virtual machine filesystems are created from filesystem templates*



MLN on Linux

- ▲ *MLN runs on Linux*
- ▲ *It supports several different systems:*
 - ▲ *RedHat*
 - ▲ *Debian*
 - ▲ *Ubuntu*
 - ▲ *BusyBox*



Configuration options

- ▲ *MLN configuration supports setting system variables for virtual machines*
 - ▲ *Filesystem Template*
 - ▲ *users + passwd*
 - ▲ *startup commands*
 - ▲ *network parameters*

Project in a Box

- ▲ *Provide a working environment for a team of students.*
- ▲ *Pre-configured with Web server*
- ▲ *Including Media Wiki*
- ▲ *and Blog software*
- ▲ *Student control of system config*

MLN Configuration

```
▲ global { project group1 }  
  #include superclasses.mln  
host cms-server-group1 {  
  superclass projectVM  
  template blimp.ext3  
  root_passwd *somethinghere*1  
  users {joe *apasswd* }  
  network eth0 { address 192.182.19.10 }  
}
```

Student Benefits

- ▲ *Move student attention to task instead of overhead*
- ▲ *Students can choose tools they want to use*
- ▲ *Students have direct control of the working environment*
- ▲ *Students have access to services over network*

Managing Large Scale Networks

- ▲ Used in Firewalls and intrusion course
- ▲ Network + DMZ + firewall
 - ▲ 12 student groups
 - ▲ 6 virtual machines/group
 - ▲ each group reboots separately

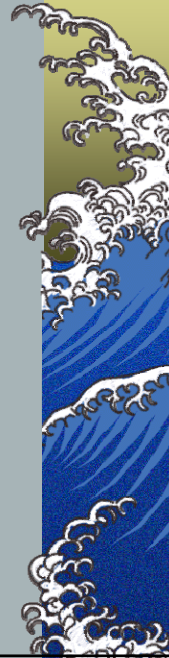
Large Scale Configuration

```
▲ global { project group1  
  $owner = group1  
  address = 128.193.36.17  
  $mount = /home/group1/ms004a  
}  
#include common.mln
```

217 lines of config file produced 84 running systems

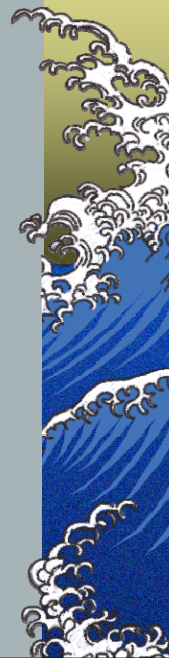
Hardware

- ▲ *Dual Xeon 3.0 Ghz*
- ▲ *6 GB of memory*
- ▲ *SCSI Raid disks*
- ▲ *direct network access*



Class Experiences

- ▲ *Run in classes at OSU and Oslo (and sweden and netherlands)*
- ▲ *Creating lab configurations is easier*
- ▲ *process scales to more groups*
- ▲ *students able to restart systems*
- ▲ *supports diverse scenarios in the same assignment*



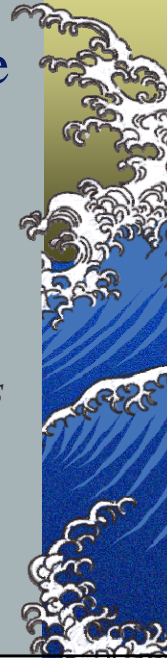
So many machines, so little time

Time: *With physical machines, lab configuration took significant time.*

A lab with 15 machines used to take 2 weeks now it takes 10 minute

Space: *The need for space for special labs is reduced*

Money: *The cost of a new configuration is greatly reduced.*



Benefits

- ▶ *Direct student control -> reduce IT staff overhead*
- ▶ *write once & execute many times -> increases reuse of activities*
- ▶ *Programatic control of systems reduces effort to support different scenarios*
- ▶ *System security can be managed easier*
- ▶ *More services for less effort*



Future Work

- ▶ *MLN is growing plug-ins to support more features*
- ▶ *Automatic configuration and self configuration tools are part of the underlying research.*

MLN Configuration

```
▶ global { project p1 }
  superclass host { size 2500M
    memory 128M }
  network eth0 {
    switch lan
    netmask 255.255.255. } }
host one {
  superclass host
  service_host backend1
  roles { webserver(mysite.com)  } }
```

Resources

- ▲ *Cfengine* - <http://www.cfengine.org>
- ▲ *MLN* - <http://www.sf.net/projects/mln>
- ▲ *Xen* - <http://www.xensource.com>

Sechrest@eecs.oregonstate.edu

