

# Virtual Computing Lab (VCL) Concepts and Use

8 Dec 2014

(Informational)

# Agenda

- What is a VCL?
- How could a VCL be used?
- What problems does a VCL address?
- How does the VCL work now?
- How will the VCL work?
- What are the capabilities of a VCL?
- What are limitations of VCLs?
- When can one use our VCLs?

# What is a VCL?

- Pool of computers
  - Remotely accessible (screen, keyboard, mouse)
  - Reusable
  - Real or virtual
  - Provisionable (ideally)
- NCSU and IBM popularized concept
  - Software is being open-sourced
- Applies mainly to CSS/ITS programs
  - Use in CES program would require more thought

# How Could a VCL Be Used?

- Reserve computers for classroom exercise
  - E.g., every Tuesday from 2-4pm, need 30 computers with Windows XP and SQL Server installed
- Reserve computer for assignments/projects
  - E.g., student would reserve at a time convenient to them, and might request admin privileges
- Reserve several computers for demonstration/class use
  - E.g., Map-Reduce running on 10 computers
- Make expensive/complex software available remotely
  - Predefined OS and application that students can request to reserve (e.g., Clementine, Enterprise Architect)
- Network needs to be isolated
  - E.g., students studying malware attacks and defenses in a safe environment

# What Problems Does a VCL Address?

- Lab computers are expensive to upgrade
  - Often underused and overpowered
  - Admin privileges sometimes not possible
- Students prefer using laptops
  - Inconsistent or inadequate computing environments
  - Varying skill levels for installing/configuring
- Classroom computers are largely inadequate
  - Inadequate and inconsistent capabilities
  - Installations must be scheduled weeks in advance
  - Admin privileges not possible

# What Problems Does a VCL Address?

- Software licensing is restricted
  - Only installable on university-owned equip
  - Number of licenses is limited
  - Licenses limited to department-only use
- No short-term research/teaching computers
- Distance learning not possible if labs required
- Vulnerable computers for security classes
- Safely configuring network services

# How Does the VCL Work Now?

- Faculty or students in senior project (i.e., “requester”):
  - Requests virtual computers (VCs)
  - Describes desired operating systems, application(s) and networks
- Institute Lab staff:
  - Creates the virtual computers and network as desired
  - Optionally installs/configures operating system, applications, and network
  - Notifies requester when request is complete
- Requester:
  - Uses manage\_vc app on Windows to:
    - Retrieve specific information for her VC(s)
    - Start VC(s)
    - Connect to VC (which opens display)
    - Use VC as a real computer, logging in, entering commands and information via the keyboard, and possibly moving/clicking mouse
    - Ultimately logs off or indicates that the VC(s) are no longer needed
    - Stop VC(s) if desired
  - Could also use rdesktop on Mac OS X or Linux -- it’s much more difficult

# How Will the VCL Work?

- Using web
  - Person reserves computer at a time for a duration
    - Individual or Class
    - Ultimately, also requests what software is installed, etc.
  - Remote computer is prepared or restored by system
  - Person receives IP address and port
- Using remote display software
  - Person connects to remote computer via IP and port
  - Uses remote computer until:
    - Quits session
    - Session duration time expires
  - System saves copy of remote computer



# What Are Capabilities of a VCL?

- One or more VMs per student or team
  - configurable amount of RAM, disk space, attached CD/DVD images, etc.
  - take and restore snapshots
- One or more VMs not under student/team control; e.g.:
  - target VMs for penetration testing from student/team client VMs
  - domain controller
  - database and/or web server
  - firewall and/or router
  - hadoop/spark nodes
  - distributed computing nodes
  - network traffic replayer
- Configurable network
  - under control of student, instructor or lab staff
  - internet or LAN-only access
  - one isolated network per student/team, or all on isolated network
  - IPv4 or IPv6, with network services such as DHCP (isolated-only) and DNS
  - openflow
- Variety of guest operations systems
  - usually, various Windows or Linux client or server editions
- Variety of applications

# What Are Limitations of VCLs?

- Short-term use
  - Want to exploit reusability to minimize costs
- Resource intensity
  - CPU: probably okay with multicore CPUs
  - Disk: problem unless multiple real disks installed
  - Network: problem unless virtual network used
  - Dynamic Graphics
    - problem unless special software purchased
- Number of available computers
- Disk image load/store performance
- Users exchanging massive data with remote system

# When Can One Use Our VCLs?

- Status
  - Hardware (started in 2009)
    - VCL 1: 10 blades (dual 4-core processors per blade)
    - VCL 3\*: 30 workstations (single 4-core processor/workstation)
    - VCL 4: 7 servers (quad 16-core processors/server)
    - VCL 5\*: 15 workstations (single 4-core processor/workstation)
    - VCL 7\*: 10 workstations (single 4-core processor/workstation)
    - VCL 8: 17 servers (dual 4-core or dual 6-core processors/workstation)
    - \* -- shared with Window 7 VM in lab
  - Storage system installed but not configured
  - Virtual switch possible (Virtual Distributed Ethernet – VDE)
  - Manual provisioning of VCs
- Reservation system was tested but not used
- Automatic provisioning still not done