Virtual Computing Lab (VCL) And Network Isolation

1 May 2012
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
VCL Architecture

• Compute Nodes (cns)
  – Multi-core, multi-GB RAM physical computers that:
    • host VMs (“virtual computers” or VCs) allocated to users, or
    • are allocated to user to install an OS (also a VC)

• Storage Nodes (sns)
  – Simple computers which:
    • provide long-term storage for VMs and disk images
    • are replicated and optimized for moving multi-GB files

• Management Nodes (mns)
  – Computers which:
    • manage the VCL: configuring, provisioning, etc.
    • provide the interface to reservation system
Benefits

• Allows users to have admin privileges
• Provides 24x7 access to computing environment
  – From labs, classrooms, home, conferences, etc.
    • Computer and TCP/IP network are required
• Allows access to software only installable on university-owned equipment
• Provides resources for short-term research/teaching
• Allows for distance learning when labs are required
• Provides network control:
  – Isolate VCs from campus network for security testing
  – Define own network without impacting campus network
    • preconfigured to prevent possible student misconfigurations
Network Isolation

• Physical switch and NICs support VLANs
• Virtual network
  – provided by Virtual Machine Manager (VMM)
  – e.g., VirtualBox
    • allows changing NICs, MAC addresses, promiscuity
    • networking mode: NAT, bridged, host-only, internal
      – DHCP service, NAT port forwarding and PXE booting
• Vyatta network appliance for layer 3
  – router, firewall, DHCP/NAT/ssh services, etc.
• Future: Open vSwitch for layer 2
  – connect VMs across VCLs
  – isolate projects/classes on same VCL
Current Process

• Faculty or students in senior project (i.e., “requester”):
  – Requests VCs
  – Describes desired operating systems, application(s) and network accessibility

• Institute Lab staff:
  – Prepares the virtual computers and network as desired
  – Notifies requester when request is complete
  – Instructs requester on how to use

• 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
    • But it’s much more difficult to use
Future Process

• 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
Limitations

• Defined for short-term use to maximize re-use

• Intensity of resource use
  – CPU time: probably okay with multicore CPUs
  – Disk I/O: can be problem unless multiple real disks used
  – Network traffic: could prevent display access
    • VLANs and prioritizing traffic help
  – Dynamic Graphics (video, 3D software, animations, etc.)
    • problem unless special software purchased

• Limited number of available compute nodes

• Transferring VM and disk images between cns and sns

• Users exchanging massive data
  – between local system and VCs

• Users getting copy of disk image or VM
Status

- Hardware (started in 2009)
  - VCL 1: 10 blades (dual quadcore processors per blade)
  - VCL 2: 20 workstations (single quadcore processor)
  - VCL 3: 30 workstations (single quadcore processor)
- Storage cloud (sns) installed
  - configured once before
- Virtual switch under investigation
- Manual provisioning of VCs
- To-do: adopt and adapt Apache VCL
  - partially configured once before
  - reservation system and automatic provisioning