

Chapter 2

Technical Details

2.1 Xen-based Virtualization

We include important Xen virtual machine installation techniques in this section.

2.1.1 Hardware Compatibility Test

To support virtualization, the CPU in a machine must, at a minimum, supports Physical Address Extension (PAE). To verify if a CPU supports PAE, run

```
grep pae /proc/cpuinfo
```

To implement full virtualization, the CPU must include intel-VT (vmx) or AMD-V (svm) support, to be verified as follow

```
grep vmx /proc/cpuinfo
```

```
grep svm /proc/cpuinfo
```

Since our machines do not meet this requirement, we implement para-virtualization.

2.1.2 OS Modification

Among the free operating systems, Fedora and CentOS both support Xen well (but not for higher versions of Xen). However, Xen can not be launched directly on a standard kernel, since it does not support well enough various hardware configurations, especially new hardwares. We have created a modified kernel based on Fedora 8. As stated earlier, the kernel image for cloud-reversed nodes is stored on the FYP server, and bit-by-bit copied to install on the cloud-reserved working nodes. One thing to note is that, after kernel installation via the network, the IP address and host name should be modified from the default ones in the image, to avoid naming conflict.

We use CentOS with a modified kernel as the guest OS running on top of Xen.

2.1.3 Xen Bridging

It will be helpful to gain a deeper understanding on Xen's underlying mechanism of virtualization.

Xen virtualization mechanism

When xend starts up, it runs the network-bridge script, which:

1. Creates a new bridge named xenbr0
2. "Real" ethernet interface eth0 is brought down
3. The IP and MAC addresses of eth0 are copied to virtual network interface veth0
4. Real interface eth0 is renamed to peth0
5. Virtual interface veth0 is renamed eth0
6. peth0 and vif0.0 are attached to bridge xenbr0.
7. The bridge, peth0, eth0 and vif0.0 are brought up.

When a domU starts up, xend (running in dom0) runs the vif-bridge script, which:

1. Attaches vif<id#>.0 to xenbr0
2. vif<id#>.0 is brought up.

Xen-bridging configuration

Xen sets default bridge as "eth0", which we should change to bridge to other devices when needed in future by modifying the file `/etc/xen/xend-config.sxp`: uncomment "**network script 'network-bridge netdev=eth1'**" and restart xend. After that, verification can be done by "ifconfig peth1"

VM's configuration

In our case, we only deal with the "pygrub.cfg" file, which includes

```
vif = ['bridge=eth1, mac = xx:xx:xx:xx:xx:xx']  
  
disk = ['file /root/centos...]
```

Besides, before launching VMs, make sure SELinux is disabled. To temporarily disable SELinux, run

```
setenforce 0
```

2.1.4 Some Tips

How to install Xen on Fedora8

1. yum groupinstall Virtualization
2. Edit `/boot/grub/grub.conf` and choose xen as the default boot option
3. Reboot

How to install paravirtualized DomU via text mode

1. mount -t iso 9660 fedora-XXX.iso /var/www/html/fedora -o loop, ro
2. Disable SELinux temporarily by **setenforce 0**
3. Start up Apache by **service httpd start**
4. Disable firewall by **service iptables stop**
5. Check the IP address of virbr0, which by default is 192.168.122.1
6. Install the paravirtualized domU by **virt-install -n fedora -w network:default -p -f /var/lib/xen/images/fedora.img --nographics -r 512 -s 16 -l http://192.168.122.1/fedora/**
7. Enable SELinux by **setenforce 1**
8. Enable firewall by **service iptables start**
9. Disable Apache by **service httpd stop**

For GUI installation, run: **virt-manager**.

How to start the Xserver after installing Xen

A problem was resolved with “xorg.conf”. The original file of “xorg.conf” is:

```
Section ''Device''
    Identifier  ''Videocard0''
    Driver      ''Intel''
EndSection
Section ''Screen''
    Identifier  ''Screen0''
    Device      ''Videocard0''
    DefaultDepth 24
    subsection ''Display''
        Viewport 0 0
        Depth 24
    EndSection
EndSection
```

which should be modified to

```
Section ''Device''
    Identifier ''Generic Video Card''
    Driver      ''vesa''
EndSection
Section ''Screen''
    Identifier ''Screen0''
    Device ''Generic Video Card''
    DefaultDepth 24
    subsection ''Display''
        Viewport 0 0
        Depth 24
    EndSection
EndSection
```

About CentOS

1. When trying yum, remember add “**http://**” when setting up a proxy.
2. When installing an editor like vi or vim, use **yum -y install vi***.

How to access the Internet from a VM

1. Set up the IP address and the netmask by running:
ifconfig eth0 147.8.177.* netmask 255.255.252.0
2. Set up the DNS server by running:
echo nameserver 147.8.176.15 > /etc/resolv.conf
3. Set up the proxy by running:
export http_proxy=http://proxy.cs.hku.hk:8282

After cloning the image

After copying the OS image from the FTP server, the cloned machine will show 2 NICs. What we need to do first is to remove the old one which contains the NIC info of the source machine from which the image is made (If needed, remove all the registered NICs). The file is located at **/etc/udev/rules.d/70-net_persistent**.

2.2 NFS Service

NFS server is deployed on the Dell file server (192.168.1.253) with OpenSUSE 11. Data files of all users are stored on it and can only be modified by their owners. For users' convenience and security, NFS directories belonging to a specific user will be mounted automatically to every single working node allocated to the user. Although cache is enabled on the local machines, any updates to the data files will be written back to the NFS

server. Users' authentication configuration files are also stored on NFS server, which is used for authentication together with the LDAP server.

To enable the NFS server:

1. Edit `/etc/exports`, adding `/export/home` (rw)
2. `chkconfig --level 35 rpcbind on; chkconfig --level 35 nfslock on; chkconfig --level 35 nfs on`

To enable a NFS client:

1. Create the directory `/export/home` (`mkdir -p /export/home`)
2. Add NFS server (Edit file `/etc/fstab`, add one line: `192.168.1.253:/home /export/home nfs defaults 1 1`)
3. Disable selinux by modifying `/etc/selinux`
4. Configure the startup service (`chkconfig --level 35 nsd on; chkconfig --level 35 rpcbind; chkconfig --level 35 netfs on`)

2.3 User management based on LDAP

We manage user accounts and implement authentication with *openLDAP*.

2.3.1 Configuring LDAP Server

To enable the LDAP server on OpenSUSE 11:

1. disable TLS.
2. Base DN is set as “dc=intgroup, dc=net”.
3. Administrator DN is set as “cn=admin”.
4. Database Directory is by default “/var/lib/ldap”, whose type is “hdb”.

When adding or deleting a user:

1. Create the home directory for the user, “`mkdir -p /export/home/xxx`”
2. Enter the user account panel, filter “LDAP user”
3. Home directory is set to the newly created “/export/home/xxx” with permission “755”

2.3.2 Configuring a LDAP Client

1. Configure LDAP client via `authorize-gtk`, or `authorize-cui`
2. Choose the option “Use LDAP”
3. Specify the LDAP server, “192.168.1.253”
4. Fill in the LDAP base DN “`dc=intgroup,dc=net`”
5. Disable TLS/SSL

2.4 Installing OS via PXE

Since not all the machines support booting from USB devices, booting via the network is necessary for OS installation from time to time, for which PXE (Preboot eXecution Environment) service is a nice choice.

2.4.1 Configuring PXE Server

To enable PXE server, There are four steps.

1. modify `dhcpd.conf`, add the following lines:

```
subnet 192.168.1.0 netmask 255.255.255.0 {  
  range 192.168.1.55 192.168.1.199;  
  option subnet-mask 255.255.255.0;  
  option domain-name “intgroup.net”;  
  next-server 192.168.1.2;  
  filename “/pxelinux.0”;  
}
```
2. configure TFTP server, edit `/etc/xinetd.d/tftp` as follows:

```
service tftp{  
  socket_type = dgram  
  protocol = udp  
  wait = yes  
  user = root  
  server = /usr/sbin/in.tftpd  
  server_args = -s /tftpboot  
  disable = no  
  per_source = 11  
  cps = 1002  
  flags = IPv4  
}
```
3. Extract the PXE Boot loader archive to folder `/tftpboot`

4. Setup vsFTP server, put Fedora8.iso to /var/ftp/pub/, so that other machines can access the install files via ftp

2.4.2 Configuring a PXE Client

1. Restart the PC;
2. When the Dell's logo shows up, press F12;
3. Choose booting up via NIC;
4. Then the installer will setup Fedora 8 OS automatically.