96 - Thin Clients

- Building Thin Clients with PXES(http://pxes.sourceforge.net/)
  This thin client allows the user to connect with many different types of
  Application Servers. The features include:

- **Supported servers and protocols**
  - **Unix/Linux** supporting XDM
  - **Microsoft Terminal Server** using RDP
  - **Citrix** using ICA
  - **VNC** using TightVNC
  - **LOCAL** local graphical session with simple desktop
  - **LTSP** or **K12LTSP**
  - **IBM Host** using 3270 or 5250 emulation (soon)
  - **Telnet** emulating ANSI terminal
  - **SSH**
  - **Tarantella** using proprietary protocol
  - **Nomachine** using NX

Boot methods

- **PXE** network card included in most modern PC hardware
- **Etherboot** to boot from diskette or EPROM
- **CD-ROM**
- **Hard disk**
- **DOC** DiskOnChip and **DOM** DiskOnModule
- **USB Storage**

Hardware requirements

- **Processor:** x86 architecture (i486, i586, i686, VIA C3, etc.)
- **BUS:** PCI recommended (although ISA works)
- **RAM:** 32 Mb recommended (24 Mb minimum)
- **NIC:** see supported card list in Readme
- **Video:** see supported card list in Readme

Local devices

- **Diskette**
- **Hard disk**
- **CD-ROM**
- **Printers** parallel, serial and USB
- **Serial** devices (bar code reader, etc.)
- **Audio**

Supported operating system

- **Linux**
- **Solaris**
- **AIX**
- **SCO**
- **BSD**
- **HP-UX**
- **Microsoft Windows NT4**
- **Microsoft Windows 2000**
- **Microsoft Windows 2003**
- **Microsoft Windows XP**

- ## Principle of operation:
  This Thin Client can be started from a bootable CD (iso image) or booted from an Image server via the network. When booted from the CD it offers multiple choices of type of thin clients to boot. Each Thin Client is adapted to connect to a particular type of Terminal Server.

- The Network booting can use different methods:
  - **Intel-PXE:**Part of the 'Wired for Management' specification from the late 1990's included a specification for a bootrom technology known as the *Pre-boot Execution Environment* commonly abbreviated as **PXE** . A PXE bootrom can load at most a 32 kilo-byte file. A Linux kernel is quite a bit larger than that. Therefore, normally PXE loads a 2nd stage boot-loader which in turns loads the kernel and `initrd`.
  - **Ehterboot:** Etherboot is a software package for creating ROM images that can download code over an Ethernet network to be executed on an x86 computer. Many network adapters have a socket where a ROM chip can be installed. Etherboot is the code that can be put in such a ROM. Etherboot can also be written to a floppy, which works great for testing.
  - **Netboot:** Netboot, like Etherboot, is a free software project that provides free boot ROM images. The difference is that it is a wrapper around the NDIS driver or packet drivers that is shipped with the network cards.

- The any of the network booting methods are using the same principle as far as our application is concerned: The booting mechanism (PXE/Etherboot/Netboot) does a request to the network. A DHCP server responds and provides an IP and all the required network informations, including the address of the TFTP-Server where the Thin Client (Linux-Image) resides.

- After booting the Thin Client attempt to connect to the Terminal Server and ,if successful, is then ready for Login onto the Terminal Server.

- ## Installation of XDM Thin Client and XDM Server on a SuSE 9.x:
  Software to install:
  We need to install the software for the following services:
   - Software for configuring and building the Thin Client System Image .
   - DHCP Server that responds to Intel-XPE requests (fixed IP only).
   - TFTP Server for booting and transferring the Thin Client System Image.
   - XDM/KDM/GDM Server to which the Thin Client connects for login.

  From SuSE Original CDs/DVD:
  - `dhcp-server`   ISC DHCP Server
  - `tftp`   TFTP Server
  - `perl-Gtk-Perl`   Perl module for gtk and gnome

  From Internet:(`http://pxes.sourceforge.net/`)
  - `pxes-base-i586-1.0-15.i386.rpm`   (base system to build Thin Client Image)
  - `pxesconfig-1.0-16.noarch.rpm`   (Configurator/builder of This Client Image)
  - `Glade-Perl-0.60-1.noarch.rpm`   (Libraries needed by `pxesconfig`)
  - `mknbi-1.2-6.noarch.rpm`   (Software for building network boot image)
  - `ldetect-lst-0.1.0-11sls.i586.rpm`   (Hardware auto detect software)
   `ldetect-lst` is not found in the above web site. Its location is:
   http://rpm.pbone.net/index.php3/stat/4/idpl/1034641/com/ldetect-lst-0.1.8-11sls.i586.rpm.html

  Note1: Do not care for dependencies while installing the RPM packages,
           use `--nodeps` rpm option. Once installed the dependencies will be resolved.
  Note2: Make sure that the package `netboot` from SuSE is NOT installed.
           It conflicts with the needed `mknbi-1.2-6.noarch.rpm`

- - Enter the following new line in the `/etc/fstab`:
    `/tmp/pxes.initrd  /tmp/pxes  ext2  loop,noauto,user,owner  0 0`

- ## Configuring the XDMCP Server (SuSE 9.x/10.x)
  To allow the thin client to get a login screen from the main server's display manager, we
  need to enable the XDMCP protocol in the Display Manager Server.
  To do so we need to edit the file: `/etc/opt/kde3/share/config/kdm/kdmrc`
  to enable XDMCP, the listening to TCP ports and restrict the shutdown to only Root:

```
[Xdmcp]
Enable=true


[X-*-Core]                    (Greeter config for all remote displays)
AllowShutdown=Root


[X-:*-Core]                   (Core config for local displays)
#ServerArgsLocal=-nolisten tcp
                              (Comment it out ('#') to activate the TCP listening)
```

then restart the kdm : `init 3` then `init 5`

- **Configuring the needed services:**
  TFTP Server Configuration (`tftp` Advanced TFTP Server)
  This TFTP server runs as Daemon and is already configured to serve the directory:
  `/tftpboot` and this is how it should stay for serving PXES Thin Client.
  It runs under the super daemon `xinetd`. To activate it, just edit the file:
  `/etc/xinetd.d/tftp` and set the parameter '`disable = no`' then restart `xinetd`.
   Its serving data directory is `/tftpboot"`.

  DHCP Server Configuration(ISC DHCP Server**):**
        The DHCP Server needs to be configured so that it responds to Intel-PXE
        requests as well as to BOOTP and Etherboot Protocols. Here is a sample of the
        `/etc/dhcpd.conf` file which respond to these 3 Protocols:

```
--------------------------------------------------------------------------------
option nbgrub-menu code 150 = text;
#-------- Dynamic DNS Update section -----------------
ddns-update-style interim;
ignore client-updates;
#            zone linux.site { primary 172.16.11.200; key DHCP_UPDATER; }
# zone 16.172.in-addr.arpa. { primary 172.16.11.200; key DHCP_UPDATER; }
#---------------------------------------------
subnet 192.168.100.0 netmask 255.255.255.0 {
      range dynamic-bootp          192.168.100.200 192.168.100.220;
      # --- option routers is the default gateway
      option routers               192.168.100.1;
      option subnet-mask           255.255.255.0;
      option nis-domain            "linux.site";
      option domain-name-servers   192.168.100.133;
      default-lease-time           21600;
      max-lease-time               43200;
      next-server                  192.168.100.70;
      filename                     "pxes/pxes-1.0.nbi";      (for netboot only)

      option tftp-server-name "192.168.100.70";
      log(debug, substring(option vendor-class-identifier, 0, 9));
      if substring (option vendor-class-identifier, 0, 9) = "PXEClient" {
            filename "pxes/grub/pxegrub";
      }
      elsif substring (option vendor-class-identifier, 0, 9) = "Etherboot" {
         filename "pxes/grub/nbgrub";
      }
            option nbgrub-menu "(nd)pxes/grub/menu.lst";
            option root-path "192.168.100.70:/opt/ltsp/i386";
      }

#   host martin {
#      hardware ethernet        00:0C:29:B1:4E:4B;
#      fixed-address            192.168.100.201;
#      option tftp-server-name "192.168.100.70";
#      log(debug, substring(option vendor-class-identifier, 0, 9));
#      if substring (option vendor-class-identifier, 0, 9) = "PXEClient" {
#            filename "pxes/grub/pxegrub";
#      }
#      elsif substring (option vendor-class-identifier, 0, 9) = "Etherboot" {
#         filename "pxes/grub/nbgrub";
#      }
#            option nbgrub-menu "(nd)pxes/grub/menu.lst";
#            option root-path "192.168.100.70:/opt/ltsp/i386";
#      }
```

}

- **Thin Client System Image Configuration and generating:**
  This done by running the graphical program `pxesconfig` .
  This program should be run by root if you need to produce a Bootable ISO CD Image.
  Command : `kdesu pxesconfig`
  This program will produce any or all of the 3 types of Thin Client boot/system Image:
  - Network bootable Image(needed by Etherboot)
    (`/tftpboot/pxes/pxes-1.0.nbi`)
  - ISO 9660 Bootable CD Image   (`/tmp/pxes-1.0.iso`)
  - **Squashfs system Image. Needed by Intel-PXE Boot-up.**
    (`/tftpboot/pxes/pxes-1.0.squash`)

  Options:
  - Screen 1: Kernel and Initial Ram disk selection
    - Select '`Initialize ram disk content`' to produce a new ram disk configuration.
    - Select '`Read saved configuration`' to read an already produced ram disk configuration and make further minor changes.

  - Screen 2: Required Local devices
    - Select the keyboard layout.
      eg. `de` for German Keyboard
    - Set the Mouse sensitivity and acceleration.
    - Leave the Network card as: `autodetect`

  - Screen 3: Optional Local Devices
    - If not needed leave as is.

  - Screen 4: Session Selection
    - Select the type of sessions needed to be available from this This Client.
    - Select also the one that will be the default type (diamond shape selection)

  - Screen 5: X windows
    - Select the **XFree86. V4.2.x** X-server (especially for VMWare)
    - Select the proper X Windows size and color depth.
    - Select '`No Acceleration`' for running the Thin Client inside VMWare
    - If a **font server** is available on the Intranet, then select it with its address.

  - Screen 6: XDM Configuration
    - Depending on the configuration of XDM/KDM/GDM server, you can select the appropriate mode as '`Direct`' or '`Indirect`' or '`Broadcast`'.
      - **Direct**=The Thin Client starts the X Server with the '`-query`' option which queries the XDM/KDM/GDM directly for a login window. The configuration file (`/etc/X11/xdm/Xaccess`)should have the following active line:
        `*       #any host can get a login window`

      - Indirect=The Thin Client starts the X Server with the '`-indirect`' option which queries the XDM/KDM/GDM to display and offer a menu of possible hosts that offers XDMCP display management. The configuration file (`/etc/X11/xdm/Xaccess`) should have the following active line:
        `*   CHOOSER BROADCAST     #any host can get a chooser`

Broadcast: The Thin Client start the X Server with the '-broadcast'
option which queries all the possible hosts that offers
XDMCP display management on the local network.
The configuration file (/etc/X11/xdm/Xaccess)should
have the following active line (same as with 'direct'):

*   #any host can get a login window

In our case the choice would be 'direct'

- Screen 7: General Configuration
    -Select the desired additional services like SSH or Root access and root
     password for remote administration.

- Screen 8: Finish
    - Click on the 'Finish' button to start generating the Boot and system
     Images of the This Client.
    Note: - The network boot images will be automatically saved in the:
        /tftpboot directory.
        - If the Bootable CD Image had been selected to be generated then
         this image is found as: /tmp/pxes-1.0.iso
         It can then be burned onto a CD.
    Note 2: After the program has finished preparing the system, just click on the
         button under the progress bar window to close the main program.

Disabling the GRUB Menu:
    To bypass the GRUB menu edit the file:
        /tftpboot/pxes/grub/menu.lst
    and:
        - Uncomment the line: hiddenmenu
        - Change the timeout value to 0
    eg.
```
    default=0
    timeout=0
    # Uncomment next line to hide the menu
    hiddenmenu
    #splashimage=(nd)/pxes/grub/pxes2-splash.xpm.gz
    root (nd)
    ........................
```

- **Using a Font Server for fonts consistency**
    To make sure all the applications that run under the X-server look identical on all
    workstations as well as on the X-server of the Main Tin-Server, then a Font server
    is needed. Here are the steps to configure the Font server for the Thin-Clients.

    - Get the same list of fonts Paths (FontPath ....) in the [Files] section of
     /etc/X11/XF86Config or /etc/X11/xorg.conf of the main Display
     Manager Server host, and enter them in the font server' configuration file:
     /etc/X11/fs/config under catalogue = section.

IMPORTANT: In this font server configuration file, the list of font paths does not have the keywords 'FontPath' or quotes("...")around the paths, but each font path must end with a comma ',' except for the last line.

- Redo the steps explained in the above section:
    Configuring and generating a Thin Client System Image:
    except for some changes in two of the screens:
        - Screen 1: Kernel and Initial Ram disk selection
            - Select 'Read saved configuration' to read an already produced ram disk configuration.

        - Screen 5: X windows
            - In the Section Font server:
                Select the 'Enable font server' and enter the IP of the font server. Normally it would be the same IP as the Display Manager Server. The port should stay the standard port: 7100.

    The rest of the settings in all the screens should remain the same.

- Start the font server with the command: rcxfs start (SuSE)

- The fonts should now be available to all X-Servers of the Thin Clients.

Some extra technical understanding:

Sequence of events when starting a PXES Thin Client:
1. PXES Protocol from the network cared of the Thin Client gets an IP from the dhcp server
2. Besides other information he gets the filename to load first from tftp server. Normally this file is the GRUP file /tftpboot/pxes/grub/pxegrub
3. GRUB starts, reads its menu file /tftpboot/pxes/grub/menu.lst
4. GRUB load the kernel and initrd file according to the menu.lst
5. The kernel starts with its full PXES thin client Linux files system
6. PXES System starts an X-Server with a direct XDMCP request to KDM server.
7. The KDM server presents a login window and background.
8. The user can login and start a KDE session.

Linux Terminal Server Project

This system is separate and quite different from the PXES thin client system.

XDM Files automatically configured by the program: **ltspadmin**
```
/etc/opt/kde3/share/config/kdm/kdmrc
/etc/X11/xdm/Xaccess
/opt/kde3/share/config/kdm/kdmrc
/opt/kde3/share/config/SuSE/default/kdmrc
```

Default Configuration file for the LPSP:
```
/opt/ltsp/i386/etc/lts.conf
```