



Network boot with PXE

REMOTE BOOT

PXE lets you start your computer by downloading a boot image from the network. We'll show you how to use PXE to install Linux.

BY KRISTIAN KISSLING

Some people call it “Pixie,” but PXE is actually an acronym for “Preboot Execution Environment.” This Intel [1] specification dates back to the 1990s.

PXE lets a client computer connect to a server and download a boot image over the network. This technology was designed for terminal-based computing environments, where a thin client device without on-board storage must find and download a boot image. Since then, admins have found other uses for PXE – for instance, as a tool for network installation of normal PCs.

A PXE server can save an admin mileage when installing a large number of computers – connect to the network, boot, and install. The best thing is that setting up this whole constellation just involves a couple of simple steps.

Santa's Little Helper

Consider two computers: Santa (a client) and LittleHelper (a server). Santa will retrieve data from LittleHelper via the network. Santa doesn't need you to do much; just change the boot sequence in the BIOS and move PXE boot up to the top. The BIOS on Santa's NIC will look

for a DHCP server (LittleHelper, in this case), and Santa will then obtain a boot image. LittleHelper assumes the role of a proxy DHCP server and tells Santa where to find the boot image.

The boot image doesn't need to be on LittleHelper's own hard disk – LittleHelper can simply supply a path to the boot image on another computer. Santa picks up the boot image from the specified location and uses **TFTP** to down-

GLOSSARY

TFTP: Trivial File Transport Protocol (RFC 1350). A simple file transfer protocol that only supports reading or writing of files. TFTP does not support features like privilege management or user authentication. In contrast to FTP, TFTP will run on a connectionless protocol such as UDP.

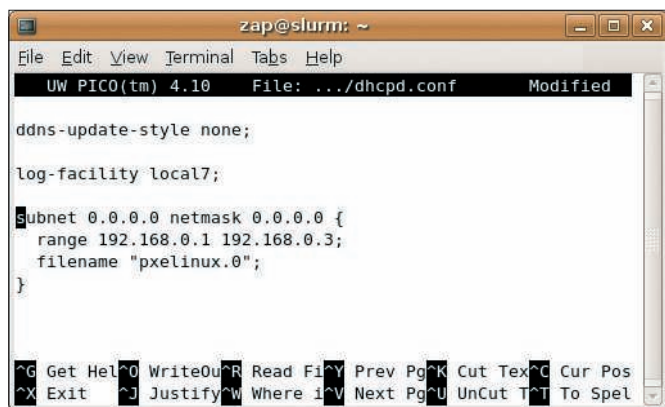


Figure 1: For Ubuntu, add these lines to your `dhcpd.conf` file; you need root privileges to do so.

load it into RAM. Before it can do so, LittleHelper gives Santa a valid IP address, which Santa needs in order to access the PXE boot image.

Although other DHCP servers don't faze the PXE protocol, it is a good idea to make sure your boot image is not loaded by unauthorized machines on the network. You can easily tell LittleHelper not to serve the image to clients unless it knows their MAC addresses.

Help Santa Boot

In this scenario, the critical components that must be present on the server are a DHCP server, a TFTP daemon, and PXE images for the network install. On Ubuntu "Feisty Fawn," you can use the package manager to install the packages `dhcp3-server`, `tftpd-hpa`, and `netkit-inetd` if they are not already installed. OpenSUSE users need `yast2-dhcp-server`, `dhcp-server`, `yast2-tftp-server`, and `tftp`.

LittleHelper (the server) also needs a static IP address.

DHCP Up and Running

To start, set up the DHCP server. On Ubuntu, the DHCP server wants to run out of the box, but it fails for lack of a meaningful configuration. To set this up, you need to edit `/etc/dhcp3/dhcpd.conf` with root privileges until you get something like the configuration shown in Figure 1. Before you start, make sure you

create a safe backup of the original configuration file. Then restart the DHCP server by entering `sudo /etc/init.d/dhcp3-server force-reload`. The `netstat -tulpe` command tells you whether the DHCP server is running.

In Figure 1, the `filename` line specifies the file

that the clients will use as their boot image.

In openSUSE, you'll need to specify the IP address of the the LittleHelper machine (on which the DHCP and TFTP servers will be running) in `/etc/dhcpd.conf`. Then launch the DHCP server as root by issuing an `/etc/init.d/dhcpd force-reload`. If you prefer to restrict access to specific MAC addresses, add the line `host pxeclient { hardware ethernet MAC_address; }` with curly brackets.

TFTP, Too!

YaST helps you set up TFTP on openSUSE: select *Network Services | TFTP Server* (the icon with the green sneaker); click the circle next to *Enable* and add the path to your PXE image. The path for openSUSE is `/tftpboot`. Click *Quit* to start the server and modify firewall settings.

On Ubuntu, you need to modify the TFTP server configuration file before you launch TFTP. Enter

```
# sudo pico
/etc/default/tftpd-hpa
```

and change `RUN_DAEMON = "no"` to `RUN_DAEMON = "yes"`. The line below shows which directory TFTP expects to find the image in – this is normally `/var/lib/tftpboot`.

Relaunch the daemon by typing `sudo /etc/init.d/tftpd-hpa force-reload`. Netstat should show you that both the DHCP server and the TFTP daemon are running. The PXE images that LittleHelper will deliver to the clients when they establish a connection are missing now.

PXE Files

Several popular Linux distributions provide PXE-related files. See your vendor documentation. If you use Ubuntu as your PXE server, copy the client files to the `/var/lib/tftpboot` directory; this is `/tftpboot` on openSUSE.

Start by downloading the files in the normal way. Ubuntu users can change to a directory where they have read privileges and type the following non-intuitive command:

```
$ wget -nH --cut-dirs=2
8 -r -R *index*,gif,html,jpg
http://archive.ubuntu.com/
ubuntu/dists/feisty/main/
installer-i386/
current/images/netboot/
```

Replace the *feisty* entry with your version of the distribution, such as *dapper*, *edgy*, or *gutsy*. Then, acting as root, copy the files to the `/var/lib/tftpboot` directory.

On openSUSE, start by launching YaST to install the `syslinux` package. Then execute the following steps at the console, working with root privileges. Create two directories on LittleHelper – `mkdir -p /tftpboot/pxelinux.cfg`. This is where you will be storing the image files. Because you have installed Syslinux, you will already have a `pxelinux.0` file on your computer; you can copy the file to the `/tftpboot` directory you just created:

```
# cp -a /usr/share/syslinux
/pxelinux.0 /tftpboot
```

The next step is to type `vi /tftpboot/pxelinux.cfg/default` to create a configura-

Tip: Firewall Issue

If you have LittleHelper advertising its images on openSUSE, but Santa fails to find it, this could be an issue with the openSUSE firewall. To modify the configuration, go to the *Security* tab and select *User*.



Figure 2: After booting, the client searches for the DHCPProxy on the PXE server.

tion file called *default*; press *I* to insert text, and enter the following lines:

```
default linux
prompt 1
timeout 30
label linux
kernel linux
append initrd=
initrd splash=silent
showopts
```

Press Esc and then *:wq* to store these settings – you need to be root for all of this. Then go to the */tftpboot* directory and download the two files you need off the network (this is for the openSUSE 10.3 installation):

```
# wget
http://download.opensuse.org/distribution/SL-0SS-factory/inst-source/boot/i386/loader/initrd
# wget
```

```
http://download.opensuse.org/distribution/SL-0SS-factory/inst-source/boot/i386/loader/linux
```

You can replace these files with versions for openSUSE 10.2 or SUSE Linux 10.1 as required.

New Day – New System

To start with the installation, change the boot sequence on the Santa client, and power the client on. A line will show you that the client is looking for the PXE server (Figure 2). If it quits, you can assume that something is awry with your *dhcpd.conf*.

If everything works out fine, you should see the boot menu. At the prompt, press Enter to boot openSUSE, or select the matching installation from the start menu for Ubuntu. The client will then load the kernel and the root filesystem.

If you want to rely on Internet repositories to complete the installation, you

will need Internet access, which means connecting to a router.

In some cases, you might need to add the http or ftp source for the installation repository manually.

Alternatively, you can use a local Ubuntu or openSUSE repository on LittleHelper for the install instead of retrieving the files from the Internet. ■

INFO

- [1] Intel PXE specification:
<http://www.pix.net/software/pxeboot/archive/pxespec.pdf>
- [2] Linux Terminal Server Project:
<http://www.ltsp.org>

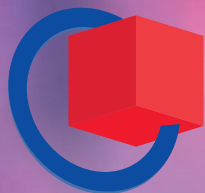
THE AUTHOR

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