

InetBoot (GRUB + BuildRoot) "netfs" version is released.

<http://openlab.jp/oscircular/inetboot/>

InetBoot is a **bootloader** which gets kernel and disk image via Internet and boots from it. "netfs" version boots from a ISO file of KNOPPIX/VMKnoppix which is uploaded on a HTTP server. The sample bootable CD (5MB) can boot 3 types of KNOPPIX and 5 types of VMKnoppix.

3 types of KNOPPIX(511,501, 402) and

5 types of VMKnoppix (Xen: 3.2.0, 3.1.1, 3.1.0, 3.0.4.1, 3.0.4)

InetBoot will boot an ISO file which is based on KNOPPIX 4.0.2 or later. (CAUTION: It doesn't not support special customization. Refer known problems.)

■ Special Feature

InetBoot down-loads a kernel from a HTTP server and reboots it with "kexec". Since it doesn't use BOOTP and TFTP which are used for normal network boot (PXE), InetBoot is not limited on LAN environment. It doesn't use *satefull* NFS server for root file system. InetBoot uses *stateless* HTTP for root file system and enables dynamic load lancing.

All you have to designate the URL of KNOPPIX at the boot menu and you can boot the KNOPPIX from Internet. It means you don't need to burn a CD/DVD for new KNOPPIX.

InetBoot is consisted of **GRUB and BuildRoot (BusyBox)**. It is not simple boot loader. It boots a mini Linux, sets up the network, obtains a new kernel from a HTTP server, re-masters the miniroot, reboots with "kexec". The new OS boots with loopback-mounting an ISO file at HTTP server with **httpfs**.

■ Usage

Download "linux" and "minirt.gz" of BuildRoot and set up GRUB.

Only you have to designate the URL of ISO file of KNOPPIX at GRUB menu.

Ex: Normal KNOPPIX

```
kernel /boot/grub/linux netdir=http://***/knoppix.iso ramdisk_size=100000 lang=ja vga=normal
initrd /boot/grub/minirt.gz
```

Ex: VMKnoppix. Add "bootxen=1" option.

```
kernel /boot/grub/linux netdir=http://***/Xenoppix.iso bootxen=1 ramdisk_size=100000 lang=ja
vga=normal # One line
initrd /boot/grub/minirt.gz
```

The sample bootable-CD includes some URLs of ISO file. They are load balanced by SLB(Global Server Load Balance) and InetBoot finds a suitable site automatically from 3 sites in US, 3 sites in EU, and 7 sites in Japan.

- ◆ knoppix511 (linux 2.6.19)
- ◆ knoppix501 (linux 2.6.17)
- ◆ knoppix402 (linux 2.6.12)
- ◆ VMKnoppix (Xen3.2.0+Linux 2.6.18)
- ◆ VMKnoppix (Xen3.1.1+Linux 2.6.18)
- ◆ VMKnoppix (Xen3.1.0+Linux 2.6.18)
- ◆ VMKnoppix (Xen3.0.4.1+Linux 2.6.18) Oprofile
- ◆ VMKnoppix (Xen3.0.4) +Linux 2.6.18

The GRUB Menu of sample bootable CD

```
GNU GRUB version 0.97 (638K lower / 260K upper)
netfsboot KNOPPIX 5.1.1
netfsboot KNOPPIX 5.0.1
netfsboot KNOPPIX 4.0.2
netfsboot VMKnoppix(Xen3.2.0)
netfsboot VMKnoppix(Xen3.1.1)
netfsboot VMKnoppix(Xen3.1.0)
netfsboot VMKnoppix(Xen3.0.4.1) Oprofile
netfsboot VMKnoppix(Xen3.0.4.0)
```

CAUTION: The included URLs are temporal service. The service will be stop after a certain period.

■ Detail of Implementation

The designated URL at GRUB Menu is passed to BuildRoot as a kernel option.

On the BuildRoot (BusyBox) do the following steps.

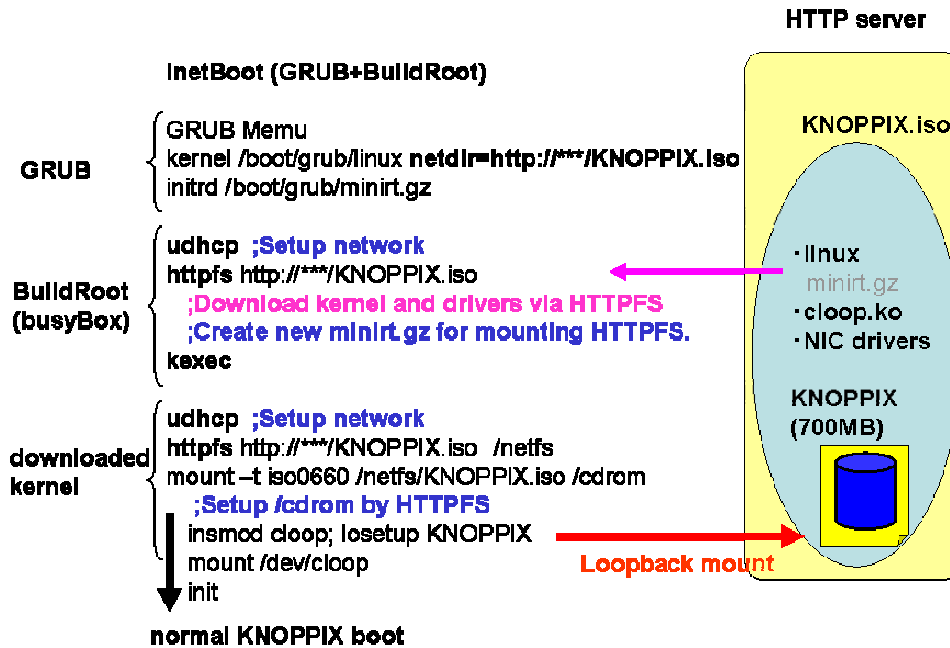
- 1) Set up the network by “udhcp”
- 2) Mount the ISO file by “httpfs”
- 3) Extract the kernel
- 4) Re-master the miniroot. (The new kernel will mount ISO file with “httpfs”.)
- 5) Reboot by “kexec” (Warm Boot)

The download kernel boots with the re-mastered miniroot.

- 1) Mount the ISO file at /cdrom with “httpfs”

2) Pass the control to “init” and boots as the normal KNOPPIX.
 After that it works as the normal KNOPPIX.

The boot procedure is indicated at the following figure.



■ Known Problems

- ◆ Depend on Network Interface.
 - InetBoot sets up Network Interface TWICE (in BuildRoot and downloaded new kernel). Both of them have to set up a suitable driver.
- ◆ Depend on the situation of server and network.
 - It is sensitive of network latency and load of the server because the root file system is mounted by “httpfs”.
 - The situation may change by rebooting because the load balancer (GSLB) may select another site.
- ◆ InetBoot is not applied a deeply re-mastered KNOPPIX.
 - InetBoot has to know the boot procedure to re-master miniroot.
- ◆ Some HTTP servers have 2GB limitation. “httpfs” can not mount DVD ISO file from the servers.

■ Related URL and Paper

URL

[1] BuildRoot: <http://buildroot.uclibc.org/>

- [2] httpfs: <http://httpfs.sourceforge.net/>
- [3] kboot: <http://kboot.sourceforge.net/>
- [4] Linux Symposium 08 BOF: OS Circular,
http://www.linuxsymposium.org/2008/view_abstract.php?content_key=231

Paper & Presentation

- [1] Kuniyasu Suzaki, Kengo Iijima, Toshiki Yagi, Nguyen Anh Quynh, Megumi Nakamura and Seiji Muhetoh, **TPM + Internet Virtual Disk + Platform Trust Services = Internet Client**, ASPLOS08 poster (Thirteenth International Conference on Architectural Support for Programming Languages and Operating Systems)
 - (A) HP: <http://research.microsoft.com/asplos08/posters.htm>
 - (B) Poster: <http://openlab.jp/oscircular/ASPLOS08-poster-slide.pdf>
 - (C) Leaflet: <http://openlab.jp/oscircular/ASPLOS08-poster-leaflet.pdf>
- [2] Kuniyasu Suzaki, Toshiki Yagi, Kengo Iijima, and Nguyen Anh Quynh, **OS Circular: Internet Client for Reference**, USENIX LISA07 (21st Large Installation System Administration Conference)
 - (A) HP: <http://www.usenix.org/events/lisa07/tech/suzaki.html>
 - (B) Paper PDF http://www.usenix.org/events/lisa07/tech/full_papers/suzaki/suzaki.pdf
 - (C) Slide PDF <http://openlab.jp/oscircular/LISA07-Slide-suzaki.pdf>

■ Download

- ◆ Sample Bootable CD (ISO file)
 - ◇ **The included UPLs are temporal service. Please designate your favorite URL.**
 - ◇ <http://www.ring.gr.jp/archives/linux/oscircular/iso/inetboot-netfs-20080409-us.iso>
 - ◇ MD5: 1c32b27fbe93903ee2decaec220cfbc6
- ◆ kernel and miniroot of BuildRoot
 - ◇ <http://www.ring.gr.jp/archives/linux/oscircular/iso/inetboot-netfs-20080409/linux>
 - ◇ <http://www.ring.gr.jp/archives/linux/oscircular/iso/inetboot-netfs-20080409/minirt.gz>

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