

SFS-KNOPPIX

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Contents

- What is 1CD Linux “KNOPPIX”? What is advantage and disadvantage?
- How to solve.
 - Get a root file system *via Internet at boot time*
 - Self-certifying File System (SFS)
 - Customize Boot Sequence
- Performance under network delay.
- Discussion and Conclusions

What is KNOPPIX?

- 1CD bootable Linux
 - KNOPPIX doesn't use hard disk.
 - We can try Linux on Windows PC.
- OS + Applications + Samples
 - Desktop Environment “KDE”
 - MS Office compatible “OpenOffice.org”
 - Outlook compatible “Sylpheed”
 - Photoshop compatible “GIMP”
 - Browser “Mozilla”
 - Windows Emulator “WINE”
- We can customize and re-distribute because they are free software.

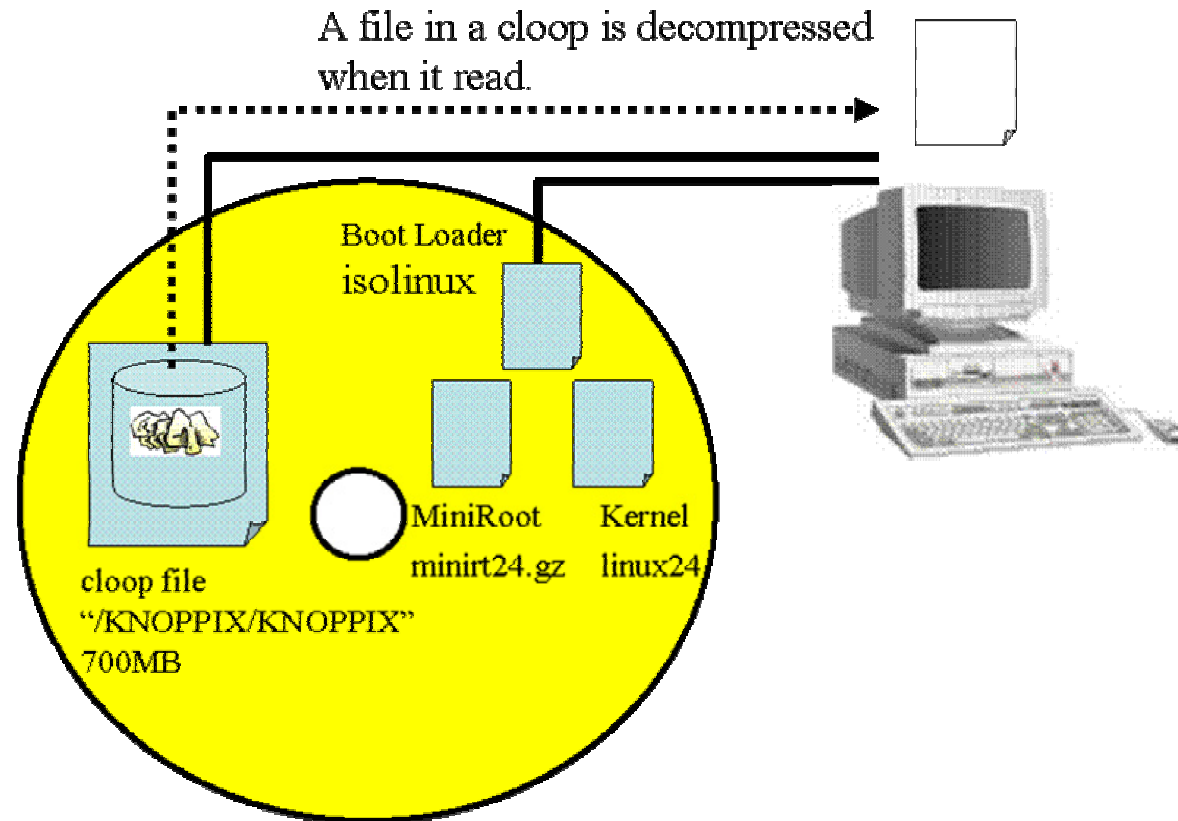


Special Feature 1 (AutoConfig)

- Detect attached devices and setup suitable drivers at boot time
 - video cards, sound cards, Network cards, SCSI, and USB devices.
 - setup IP connection with DHCP.
 - detect File Systems.
 - Read/Write Windows FAT.
 - Read Windows NTFS.
- Autoconfig offers "ready-to-go" Linux Environment.

Special Feature 2 (cloop)

- Compressed loopback device
 - It enables to have 2GB of software on 700MB CD-ROM.



**BOOT Loader
Level**

Stage 1

- Boot from CD-ROM by “isolinux”
 - load linux kernel with miniroot.gz
 - miniroot.gz is decompressed on RAM_DISK

**Miniroot
Level**

Stage 2

- /linuxrc of “miniroot”
 - mount cloop file to /KNOPPIX
 - create links and copy file from /KNOPPIX to RAM_DISK
 - Ex: cp /KNOPPIX/sbin/init /etc/init

**Root File System
(cloop)
Level**

Stage 3

- /etc/init
 - /etc/init.d/knoppix-autoconfig
 - hwsetup
 - Network is detected and setup with DHCP
 - Start xsession (default desktop manager: KDE)

1CD Linux “KNOPPIX” is convenient but ...

- Download 700MB when renewed.
 - Even if an application is changed, we have to download 700MB iso image, because cloop file is faster to CD-ROM.
- Burn CD-ROM every renewal.



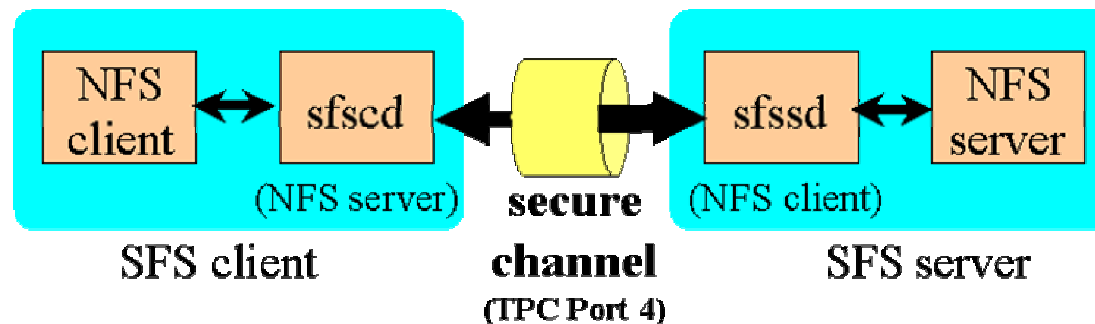
- We proposed **SFS-KNOPPIX**.
 - Cloop file (root file system) is obtained via Internet File System.
 - Don't need to burn a new CD-ROM for application customized KNOPPIX.

Internet File System

- Candidates: Coda, SHFS, SFS, etc.
- Selection criteria
 - Security
 - On Server: Prevent invasion. Restrict Read-Only.
 - On Client: Prevent rogue server and misrepresentation of data.
 - Performance
 - Faster is better.
 - Usability
 - No License Problem to distribute.
 - Easy maintenance.

Self-certifying File System (SFS)

- SFS Server had a public key. A Server's file is derived using the public key.
- The file is accessed by the SFS Path-name on a client.
 - `/sfs/@host.domain.jp,fuq2fbnsghj3fzxsdivef8ts5zsq28yh/knoppix/data`
 - Hostname + public key generated by SHA-1 hash + path on server
 - With this manner SFS prevents rouge server and misrepresentation of data
- The server is restricted read-only as an option.
- The client and server daemons (sfscd & sfssd) establish secure channel.
- A file is accessed by NFS manner. sfscd & sfssd communicate with the kernel using NFS loopback.



Customize Boot Sequence

- We customize KNOPPIX to get a cloop with SFS.
- Customization point
 - SFS client have to setup before mounting Root File System. But *Network is established with Root File System on Normal KNOPPIX Boot Sequence.*
 - We customized *miniroot* to be able to establish Network.

**BOOT Loader
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**Miniroot
Level**

Stage 2

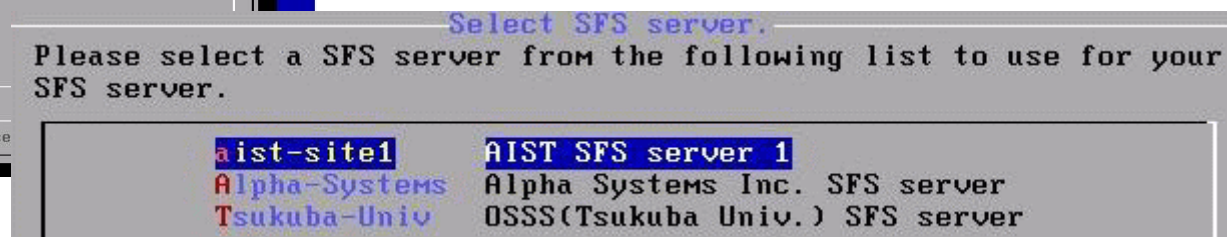
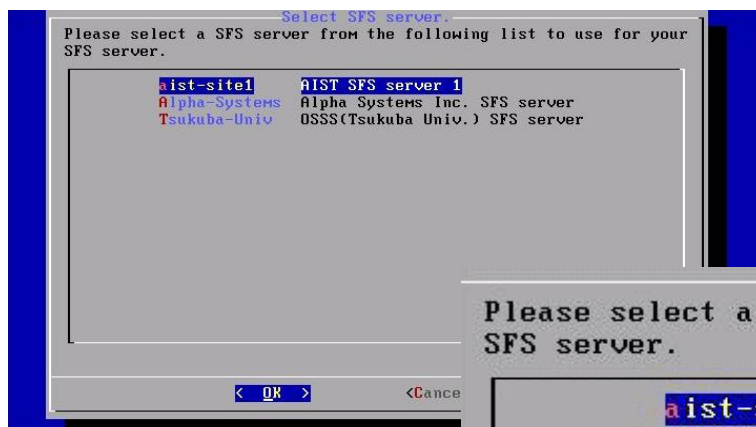
- /linuxrc of “miniroot”
 - **Mount CD-ROM to /stand for network software**
 - **Network card is detected and setup with DHCP**
 - **Execute SFS client and mount SFS server**
 - **Select a cloop file from SFS server**
 - **mount a cloop file of SFS server to /KNOPPIX**
 - create links and copy file from /KNOPPIX to RAM_DISK
 - Ex: cp /KNOPPIX/sbin/init /etc/init

**Root File System
(cloop)
Level**

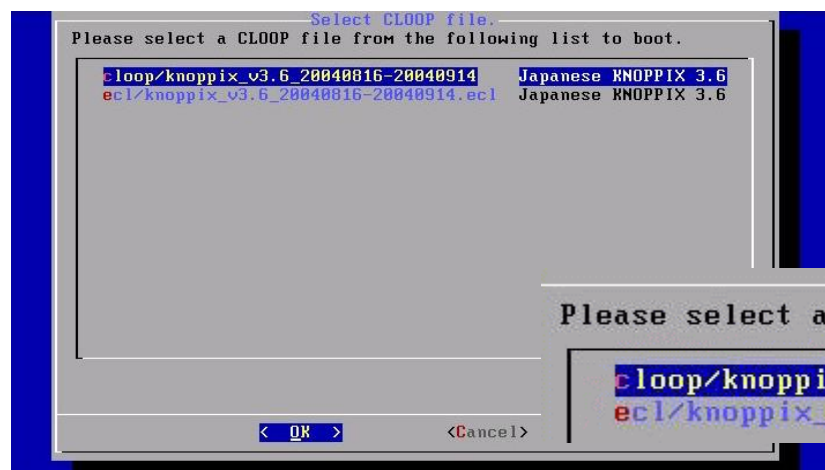
Stage 3

- /etc/init
 - /etc/init.d/knoppix-autoconfig
 - hwsetup
 - Network is detected **but ingored.**
 - Start xsession (default desktop manager: KDE)

Select SFS Server Menu



Select CLOOP Menu



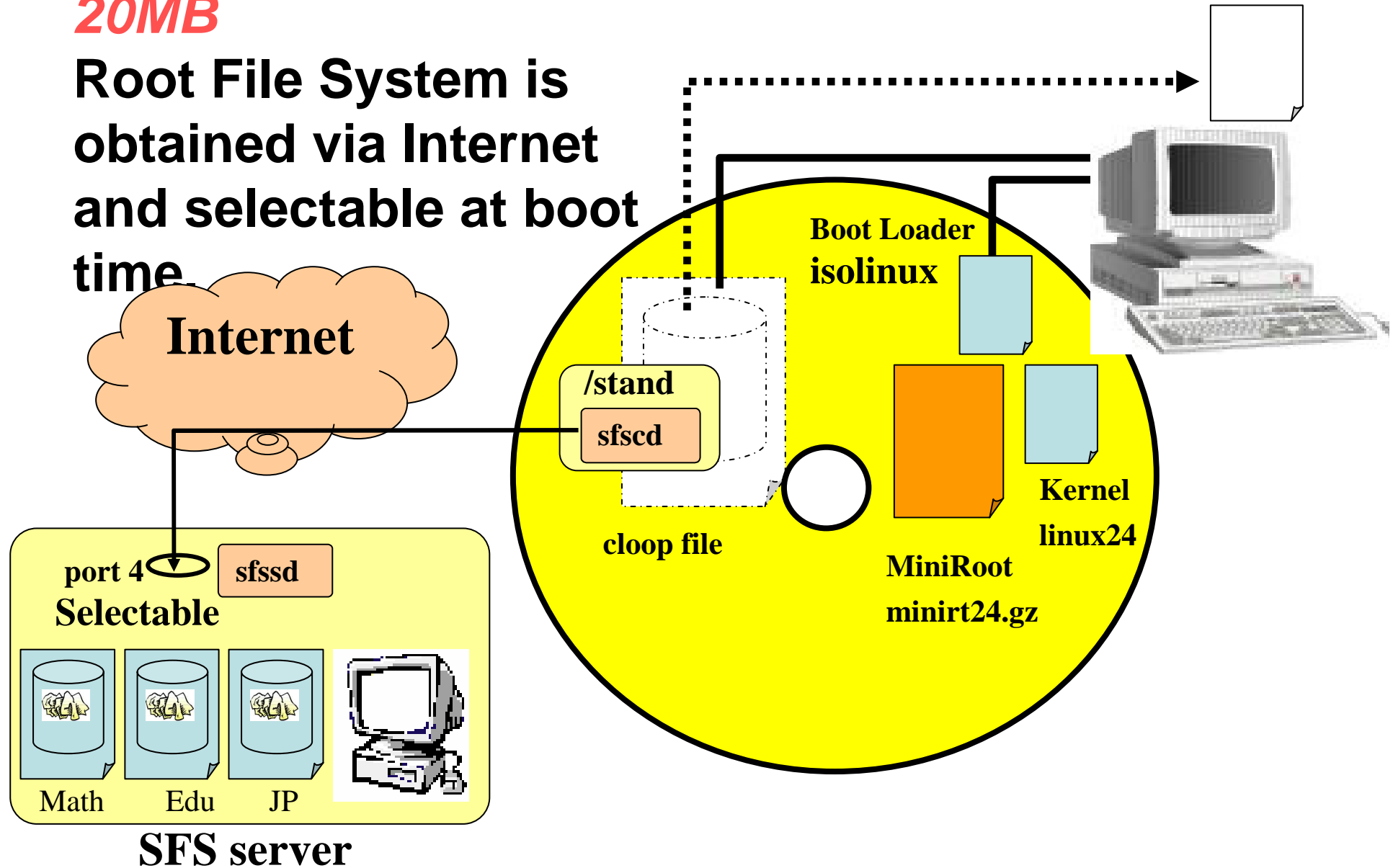
Selection is done by Miniroot level

SFS-KNOPPIX CD-ROM

20MB

Root File System is obtained via Internet and selectable at boot time.

A file in the cloop is decompressed when it read.



Performance Evaluation

- Can we boot SFS-KNOPPIX as fast as CD-ROM KNOPPIX?
 - Machine Environment.
 - Server: Pen4 2.66GHz, 512M mem, 1Gbps NIC
 - Client: PenM 1.00GHz, 512M mem, 100Mbps NIC, 24x CD-ROM
- Check effect of network latency.
 - The latency made by dummy-net of BSD-Network bridge.
 - 0, 10, 20, 30, 40 msec delay

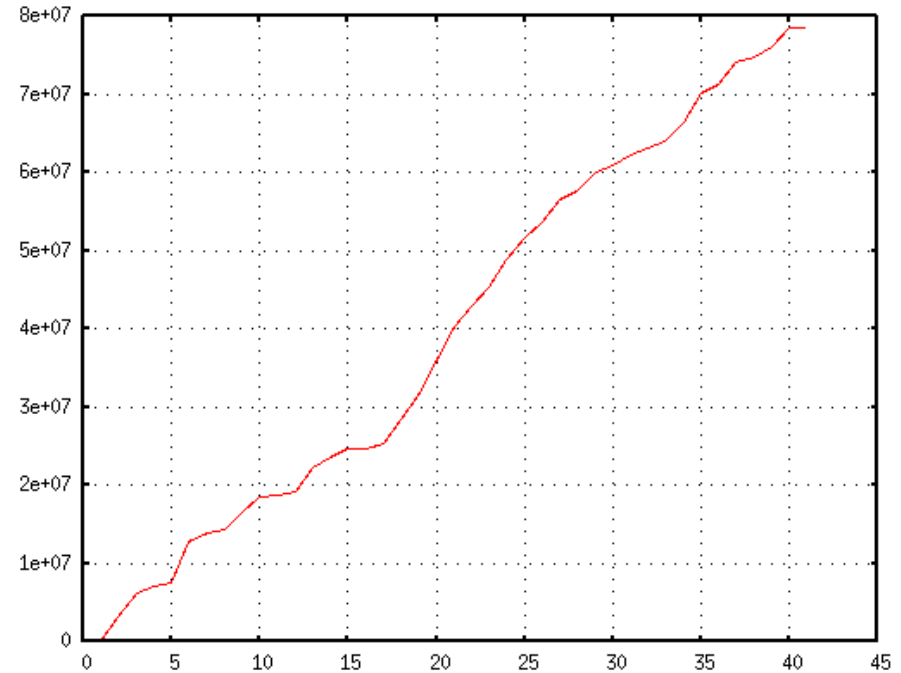
Boot Time

- SFS-KNOPPIX is faster than normal CD-KNOPPIX on LAN environment.
 - The boot time is till rich desktop “KDE”.

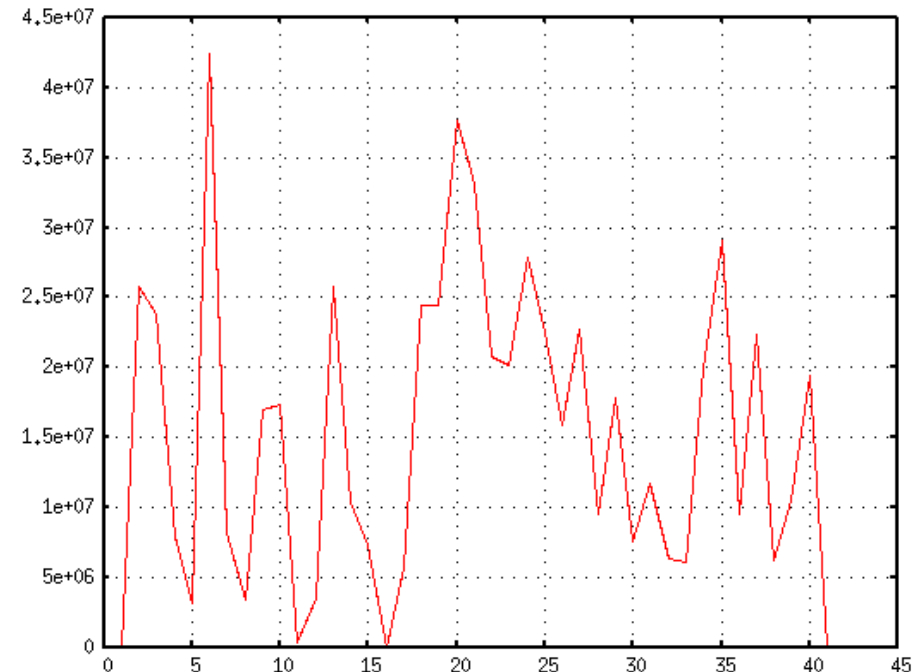
SFS	CD-ROM
80sec 40sec to setup up SFS with miniroot. 40sec on CLOOP via SFS	180sec 24x CD-ROM

Network Performance

Transferred data
80MB, 40sec
(X: second, Y: Byte)



Throughput
Max is 45Mbps
Average is 20Mbps
(X: second, Y: bps)

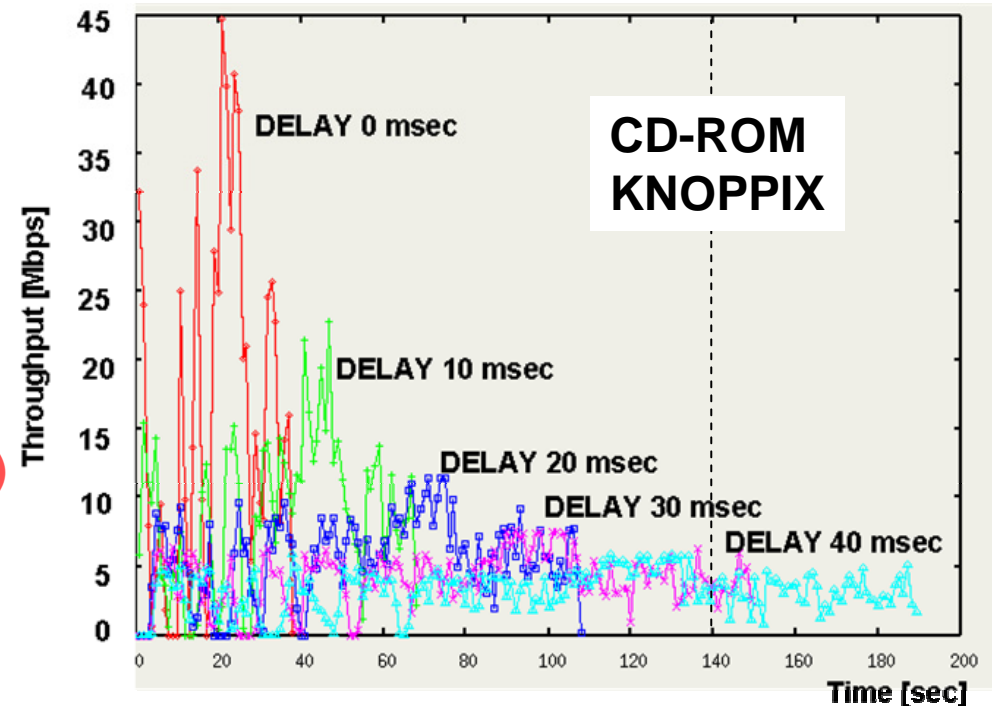
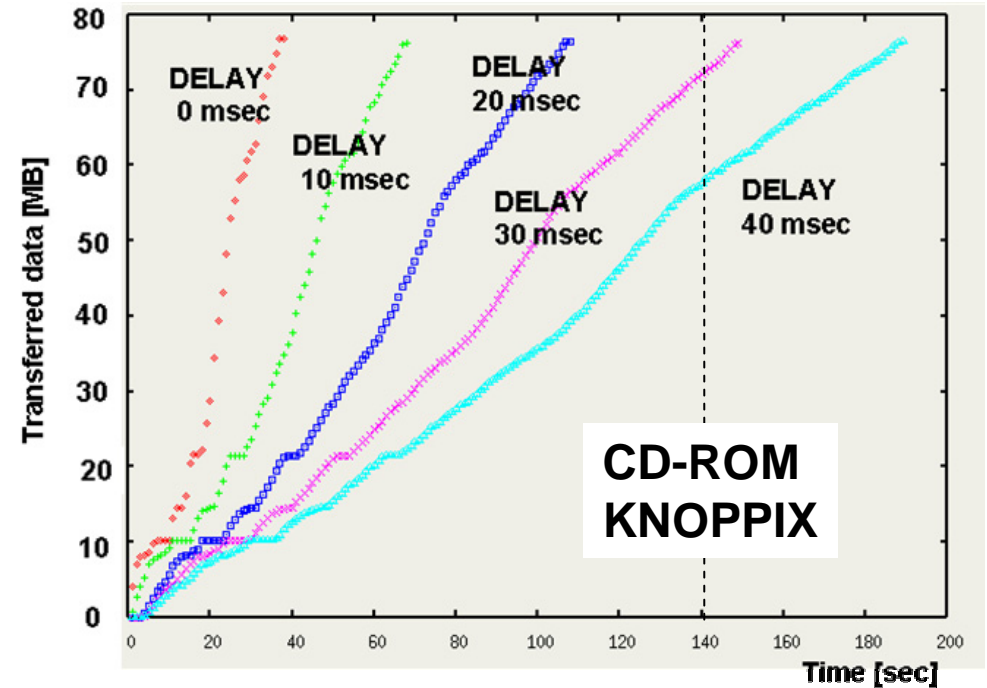


Effect of Network Latency

Transferred data
40,68,108,148,189 sec
on 0, 10, 20, 30, 40 msec delay
(X: second, Y: Byte)

Throughput
45,24,12,10,8 Mbps
on 0, 10, 20, 30, 40 msec delay
(X: second, Y: bps)

To compare to CD-ROM boot (189sec)
less than 30 msec delay acceptable.
SFS-KNOPPIX is effective on
Metropolitan Area Network



Discussion

- We released SFS-KNOPPIX on 18/Nov/2004.
 - <http://unit.aist.go.jp/itri/knoppix/sfs/index-en.html>
 - Problems
 - Latency.
 - NY User took 30 min to boot from SFS server in Japan, because network delay is more than 100 msec.
 - Firewall. SFS requires No4 port open.
- Future Plan
 - Expand P2P to make short latency
 - Use Open Port (Ex: 80)
 - To pass over Firewall
 - We are making **HTTP-FUSE KNOPPIX** which boot from P2P HTTP Proxy.

Conclusions

- SFS-KNOPPIX reduced CD image from 700MB to 20MB. Even if KNOPPIX because DVD, the size of SFS-KNOPPIX is not changed.
- CD of SFS-KNOPPIX is reusable. It makes easy to customize KNOPPIX.
- Performance is sensitive of Network Delay.
 - SFS-KNOPPIX is acceptable by Metropolitan Area Network (Latency is less than 30msec).