Debian/GNU Linux

Overview

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Agenda

The history of the computer equipment at RISC

Overview the early times at/from 1985

Needs of computing resources at RISC

- writing and printing scientific articles, using latex
- using mathematical software
  - Mathematica,1992, on floppies for NeXT-Stations

Solution: Unix Workstations

- Multiuser, multitasking OS
- Graphical user interface for the main user (WS:200K ATS)

Solution-B: ASCII RS232 Terminals

- using the resources of a workstation remotely
- only an ASCII window (24x80 chars) available (no X!), 10k ATS

RISC is from the beginning a place for UNIX

The history of Unix at RISC

The different workstation (and Unix) types

Only Unix workstations from the beginning on...

- Apollo Workstations (later HP Apollo) / HP Workstation
  - Apollo Domain OS Unix; from 1986; max. 14 WSs
- DEC Workstations
  - DEC Ultrix - Digital Unix; 1991-1992; 8 WSs
  - the most stable workstation ever (last switched off 2003)
- X-Terminals
  - Graphical Terminal (1991-1995), max. 20 NCD X-Terminals
- Other Workstations
  - 2 Sun workstations; Sun Solaris Unix
  - IBM-RT workstation; IBM AIX Unix
- NeXT-Stations
  - NeXT-Mach 3.0 Unix; with excellent GUI !!
  - in 1992, 1993. Number of WS: 12; for secretaries, too!

The history of Unix at RISC

Migrating to Linux

Migrating to Linux

- Silicon Graphics Workstations,
  - IRIX SysV.3, SGI Unix; January 1993; 14 WS.
- Sequent Symmetry
  - Multiprocessor computer; 20 Intel 386 CPU; late 1991
  - 32 RS232 terminals connected (mainframe for RISC)
- Unix PCs
  - early 1991; 3 PC; Interactive Systems Unix SysV.3
  - supporting the transputer systems (16 CPUs)
- GNU/Linux Debian, 1995
  - new hardware: only PCs; Debian PCs replacing slowly WSs, X-Terms
- Advantage of Linux
  - Free Software by no cost! Thousands of software packages
  - multiuser OS; multitasking OS; very stable, very secure OS

Agenda

Structure of Linux

Kernel, Shell

Kernel

- loaded by start of the OS
- managing processes (scheduler)
- managing memory (real and virtual); access to memory
- serves the File System
- manages rights and permissions (users, files)
- manages hardware units (I/O, equipments, etc.)

Shell

- User Interface to the OS.
- interprets command line inputs;manages display output
- lot of built in commands
- invokes programs; redirects input/output; makes pipelining
- included is a programming language (shell script)

Structure of Linux

Unix Processes

Process - a running program

- started by kernel;
- get CPU time slices (multitasking)
- priority: 0 to 64 (minimal)
- PID (process ID, sequential number)
- first process: swap
  - for virtual memory management
- second process: init, PID=1
  - start and stop the system (i.e. all processes)
- process state: see ps output
  - running (R) - stopped (T),
  - active (S) - idle (I) (waiting 20sec)

First Steps in Linux - The Login

How to login

Directly

- on the serial console (24x80 terminal)
- xdm/kdm: by graphical display managers login prompt

Remotely

- from other computer (through network) from terminal window
  - telnet host name/host IP; ssh [-X] host name/host IP

Working Environment

- shell in terminal window; command line input, closed by RETURN
- some simple commands:
  - ls; who; date; wc (word count); passwd; in RISC: yppasswd

Logout

- shell: exit, logout, etc.; X: use GUI

First Steps in Linux - Need Help about the system parts

How to get information about commands, files, etc.

Man pages

- command not known:
  - man -k topic (e.g.: man -k file; man -k shell; man -k ls)
- structure of man pages (learn, check: 8 sections)
  - man man; man tty; man 1 tty; man 4 tty;
- xman: graphical tool

Info pages

- another structuring of the information
- man info; info info, etc. (often man page points to info page)

T LDP - The Linux Documentation Project

- http://www.tldp.org/
- HOWTOs, GUIDEs, FAQs, Wiki, etc.

Agenda

The Linux file system

Structure and Components

File System

- tree structure, begins with the root (/) directory
- any number of (nested) subdirectories
- any number of files (file = leaf in the tree structure)

File Types

- ordinary files (text, executable, jpeg, wav, doc, etc.)
- special files (dev files = device description files)
- symbolic link (pointer to another file)
- subdirectories contains any type of files

Linux Root directory structure

```
/bin/ /boot /cdrom  /dev /etc /home /lib
/lost+found /media /proc /root /tmp /usr /var
```

The Linux file system

Linux Root directory structure

Root directory structure in detail

- base is the the root (/) directory
  - in Windows this is the C: drive
- programs are located in /bin, /usr/bin, /usr/sbin, /usr/local/bin
- /home for the home directories of the users
- /lost+found used by fsck (for lost and found files)
- /etc for system and application configuration files
- /proc contains every information about a running system
- /dev contains the physical devices files
- /media contains the mounted units (/media/cdrom; /media/IOMEGA HDD;)
- /var working area (/var/log; /var/spool/mail; /var/run)
- /tmp used for temporary files

The Linux file system

Some special files and directories: /proc /dev

Features of the /proc file system

- process information pseudo-file system
- used as an interface to kernel data structures

Quick tour through the /proc hierarchy

- /proc/[number]: subdirectory for each running process
- /proc/cpuinfo: CPU and system architecture dependent items
- /proc/modules: list of modules loaded by the system (lsmod)
- /proc/net: status of some part of the networking layer

I/O devices

- acces as/through files: /dev/cdrom, /dev/audio, /dev/hda

The Linux file system

Symbolic link, path

Symbolic links:

- only one physical file; any number of symlink to it
- delete symlink: not the physical file

```
lrwxrwxrwx 1 ke ke 24 2008-10-21 22:04 oxygen.png -> ../oxy.png
```

Path

- the exact location of an object (file, subdir)
  - /usr/share/doc/latex-beamer/solutions/generic-talks
- absolute path; relative path (../rlogin-ssh)
- gives shell the directory list to search for executable commands
- commands: pwd - current location; cd - change dir
- echo $PATH

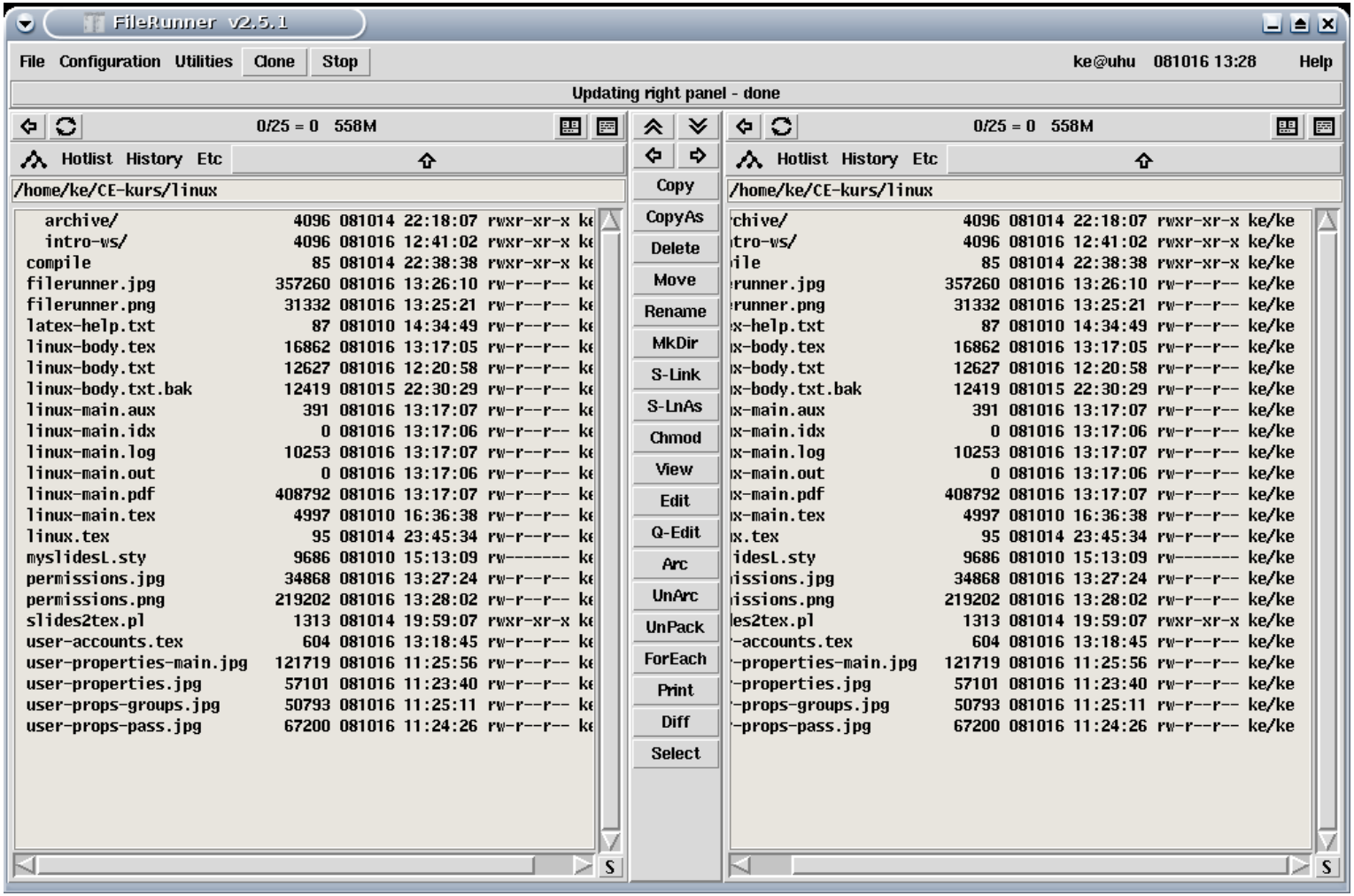
```
/usr/local/bin:/usr/bin:/bin:/usr/bin/X11:/usr/games:/zvol/timer/bi
/home/ke/bin:/usr/NX/bin:/usr/local/Adobe/Acrobat7.0/bin
```

Permissions in Linux file system

Permissions

- files and users have miscellaneous attributes
- the user belongs to a group in Liux(adm, root, audio, etc.)
- the file gets attributes for the grouping: u/g/o
  - u: the user, who owns the file; g: all users in a group
  - o: other users not in the files group and not owner (=world)
- file attributes: r: read; w: write; x: execute; -: no rights
  - special permissions: s: execution with rights of the owner
- directory:
  - r: list of files; w: create/delete file; x: change into directory; -: no
- ls -l /etc/resolv.conf
  - -rw-r–r– 1 root root 119 Nov 02 1999 /etc/resolv.conf

Filerunner - main window



Filerunner - File permissions

Changing attributes in Linux file system

Commands to change rights

- chmod [ugoa]*([-+=]([rwxXst-]*—[ugo]))+
  - a: all (u+g+o)
  - chmod g-rwx,o-rwx /home/kerdei
  - chmod 700 /home/kerdei/private (4: read; 2: write; 1: execute; 0: no right)

Agenda

The Shell - Main Features

The User Interface to the OS

Shell features

- an ASCII terminal window will be started
  - like in XP the DOS window (run - cmd)
- shell versions
  - sh, csh, bash, tcsh; others; see the man pages of the shells
  - at RISC default is the tcsh; echo $SHELL
- miscellaneous parameters will be set per default
- environment variables: inherit values to sub-shells
  - list with printenv; set with setenv VARIABLE value
- local variables: scope only for the active shell
- lot of internal commandos; invoking external (OS) commandos, too
- programing language: powerful shell scripting possible
- man sh: 4918 lines (80 pages)

The Shell - Redirection

Input/Output, process management

Input/Output redirection

- standard input: console; standard output: display
- input output redirection;
  - ls -l > junk; cat jj >> junk; grep "txt" < junk|wc
- pipeline connects output/input of two subsequent processes:
  - ps auxw | grep sendmail|wc
  - more pipelines: who | sort | lpr
  - processes executed parallel

Process management

- commands for listing/killing processes:
  - ps auxw ; ps auxw | grep pattern
  - kill -TERM process number; kill -9 process number
- starting a command in foreground / background
  - commands: &; bg; fg; jobs; kill % number

The Shell - Environment Variables

List of the environment parameters

Environment variables

```
SHELL=/bin/tcsh
HOST=uhu
USER=ke
GROUP=ke
HOSTTYPE=i486-linux
PATH=/usr/local/bin:/usr/bin:/bin:/usr/bin/X11:
/zvol/timer/bin:/home/ke/bin:
DESKTOP-SESSION=kde
PWD=/home/ke
LANG=en-US.UTF-8
HOME=/home/ke
OSTYPE=linux
VENDOR=intel
LOGNAME=ke
MACHTYPE=i486
DISPLAY=:0
TERM=xterm
```

Agenda

Working on a command line

Using commands in a shell

Useful commands:

- ls -laRtrF (d: directory; -:ordinary files; l: link)
- du -s *
- find . -name "*pattern*"
  - man find, please check, extreme powerful command
  - find /tmp -name EXP; find / -name "*latex*"
- grep -r -i -v pattern path; egrep; searchmonkey
  - grep process etch-allpackages.txt — wc
  - grep " processes" software/etch-allpackages.txt — wc
- top - display Linux tasks; htop
- mount - list/mount file systems and devices
- which mathematica:
  - /zlocal/mathematica/mathematica-6.0/Executables/mathematica

Working on a command line

Installing Debian packages

Debian package system

- package structure: main contrib non-free
  - (package ends: .deb)
- http://www.at.debian.org/distrib/packages/
- http://packages.debian.org/stable/
  - get the file: (compact compressed textlist) - allpackages.htm
  - search it with grep by keywords for topics

Installing Debian packages (command line)

- apt-get install package-name (as root !)
- use the aptitude command (for advanced user)
- sudo apt-get install searchmonkey

Installing Debian packages with KDE Kpackager

- KDE menu -> System -> Package manager (Kpackage)

Working on a command line

i.e. working in a shell

Summary

- you work in a terminal window on the console
  - Kmenu: Utilities: Terminal / Root Terminal
  - Kmenu: System: Terminal Program (Konsole)
- from a MS Windows computer by SSH (ssh.com, putty)
- from other Linux/Unix/Mac computer:
  - ssh -X -l username computername

Advantages

- common for every Linux/Unix system
- more flexible than a windowing interface
- based on commands you can write (big) shell programs
- according your rights
  - you can start (all) programs on the system
  - you have (full) control on the OS
  - as root user you have the full control without restrictions by GUIs

Agenda

File and directory management

Commands and File Managers

using a terminal window (on a command line)

- create, remove: mkdir directory; rmdir directory; touch file; rm file
- cp file1 file2; mv file1 file2; mv directory1 directory2
- change permissions
- create symbolic links (for files, directories)

using a GUI, i.e. a File Manager

- there are a lot of file managers in Debian
  - get list with grep "file manager " etch-packages.txt
  - check them for features, looks, etc.
- some of them: konqueror, bsc, mc, filerunner, xfe

File managers in details I

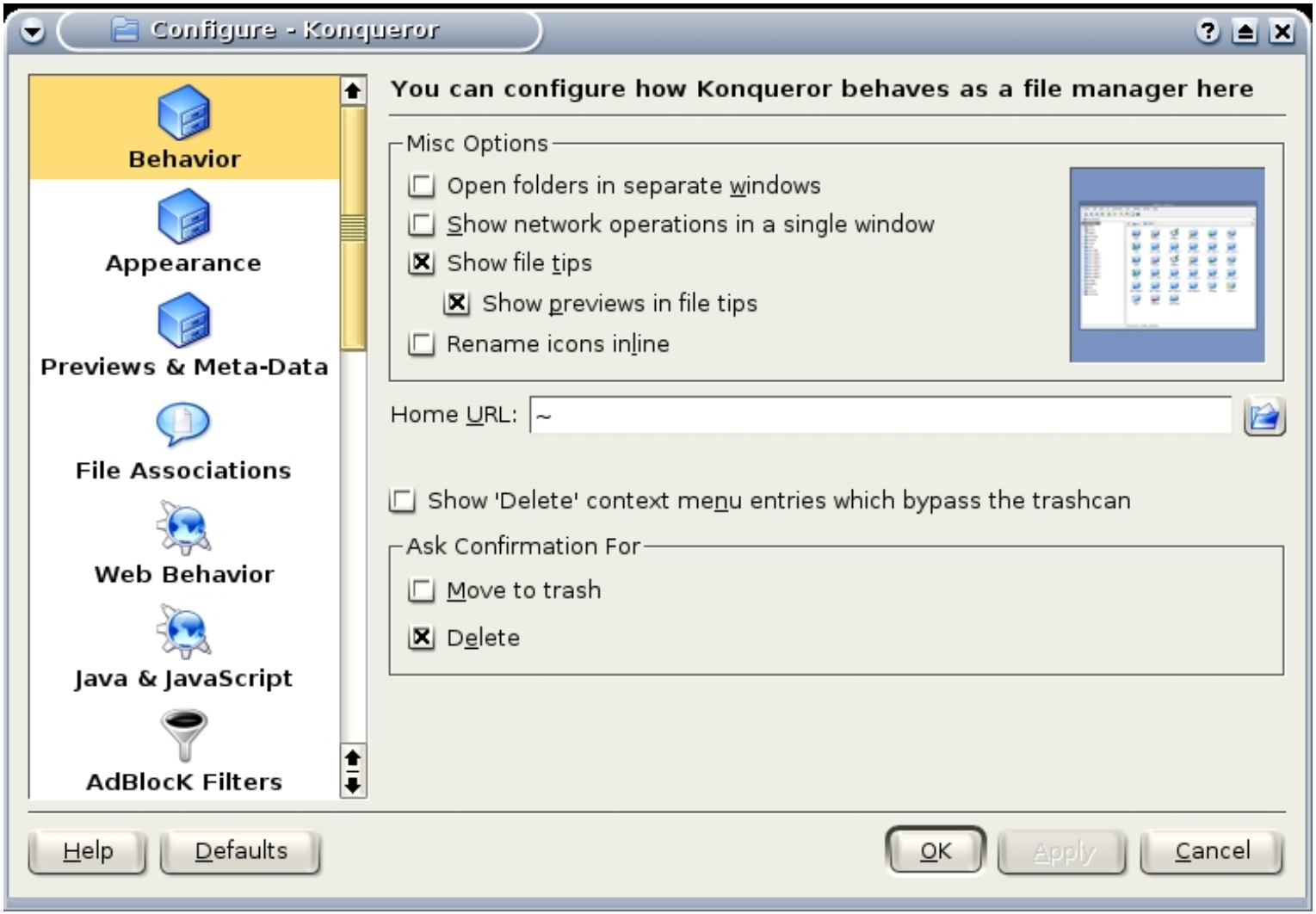
File Managers

- bsc: BeeSoft Commander
  - graphical file manager with two panels
- mc: midnight commander
  - a powerful file manager
- filerunner:
  - X-Based FTP program and file manager, very powerful
- xfe: X file explorer
  - a lightweight file manager for X11,like Windows Explorer
- konqueror:
  - advanced file manager and the central unit in KDE
  - a web browser, document viewer, application starter
  - Desktop configurator, etc.

Konqueror - Start window

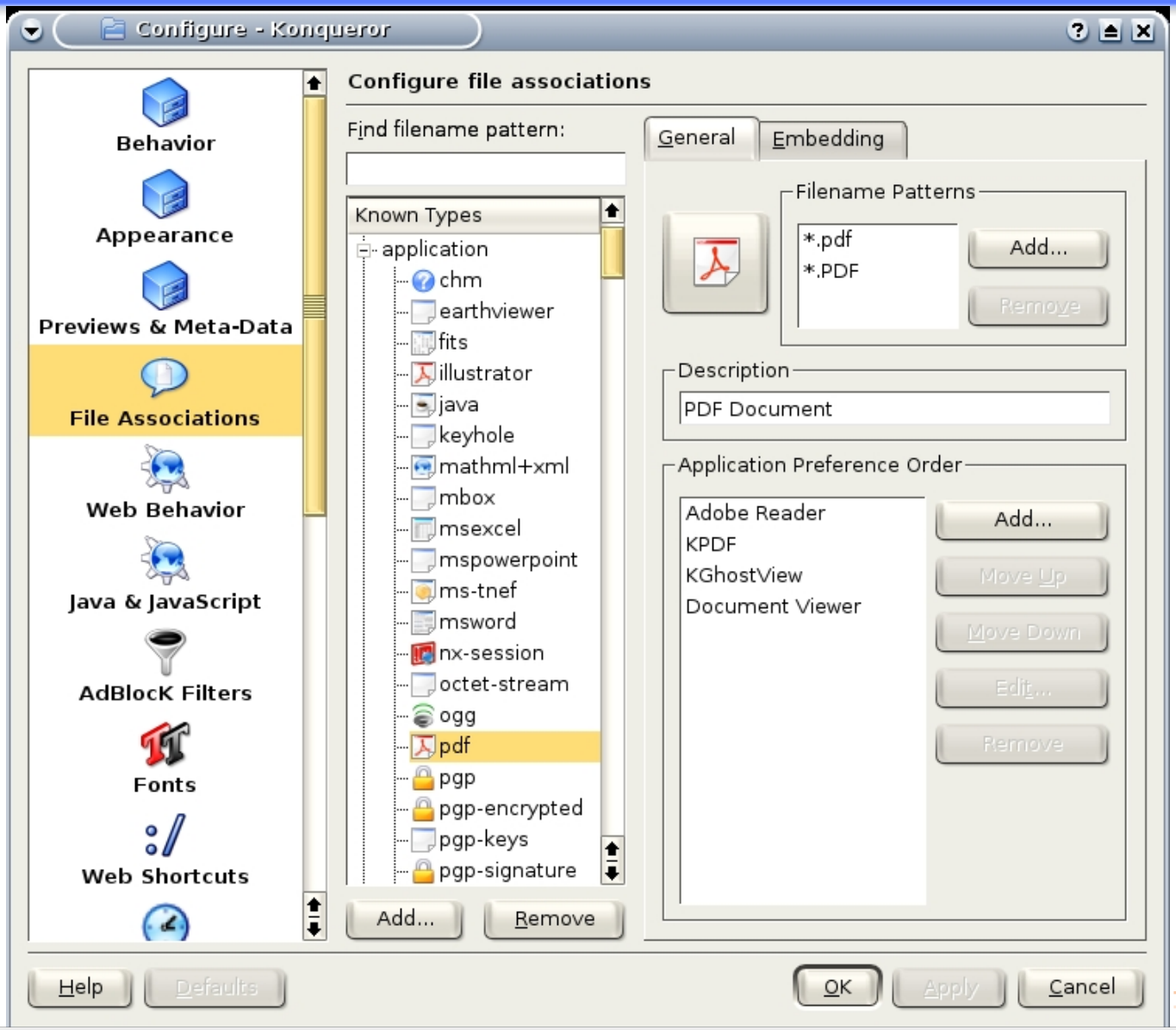
Konqueror - Configuration

Behavior



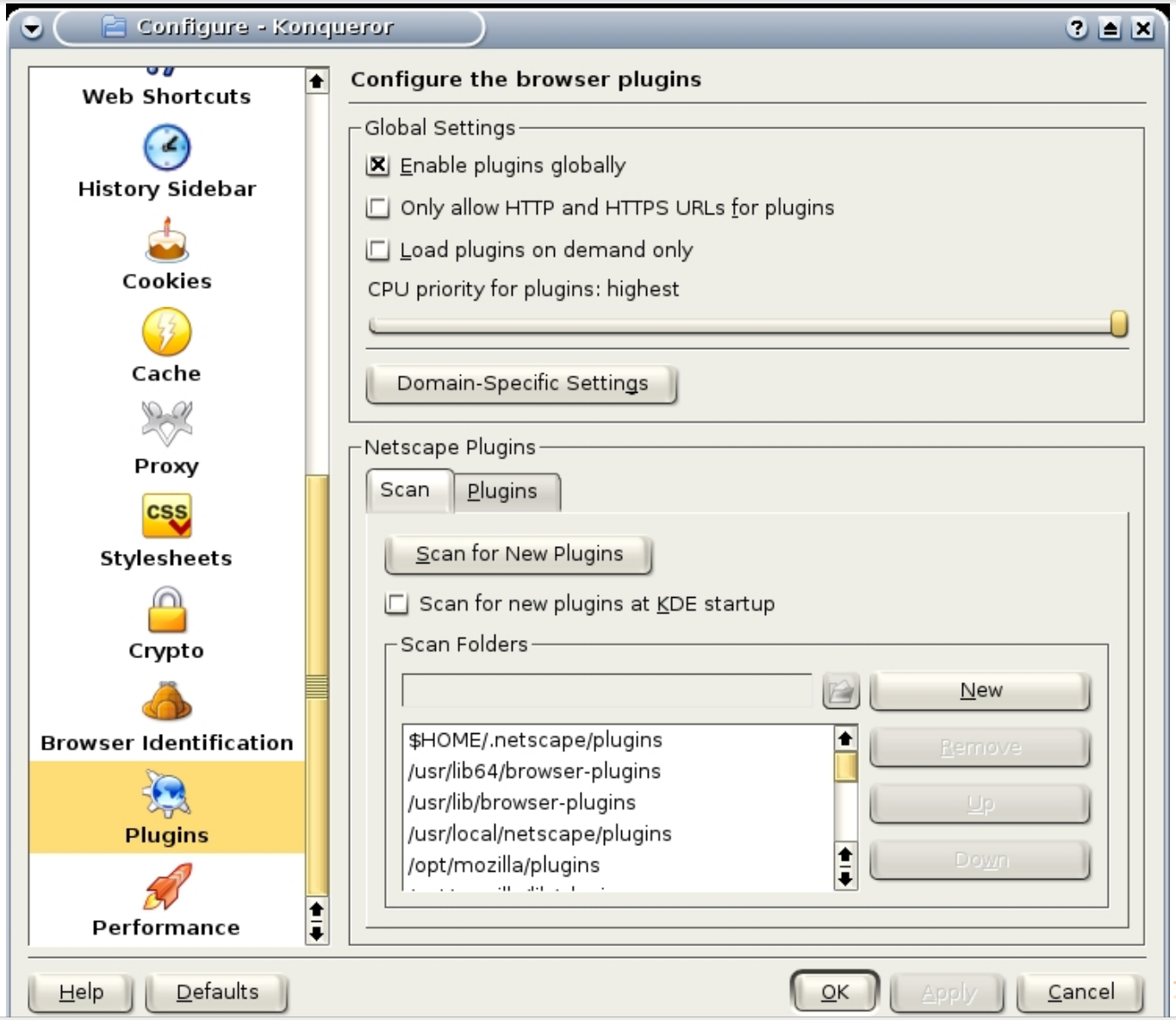
Konqueror - Configuration

File associations



Konqueror - Configuration

Plugins



Agenda

Editing function in Linux

Editing

- what kind of object do we want to edit
  - text file, audio file, jpeg image file, etc.
  - cd, dvd contents
- dozens of editor are available
  - check them with grep editor etch-packages.txt
  - 236 etch packages, with 'editor'
- general purpose text editors of different power
- special editors for specific objects
  - audacity, gimp, kguitar, xfig
  - K3B CD/DVD creator

Office suites

Suites

- Open Office (OO)
  - oowriter (Word processor)
  - oocalc (Spreadsheet)
  - ooimpress (Presentation)
  - oodraw (Drawing)
  - oobase (Database), oomath (Equation editor)
- K-Office (KDE Office suite)
  - kwriter
  - kspread
  - kpresenter
  - kformula, kthesaurus, etc.

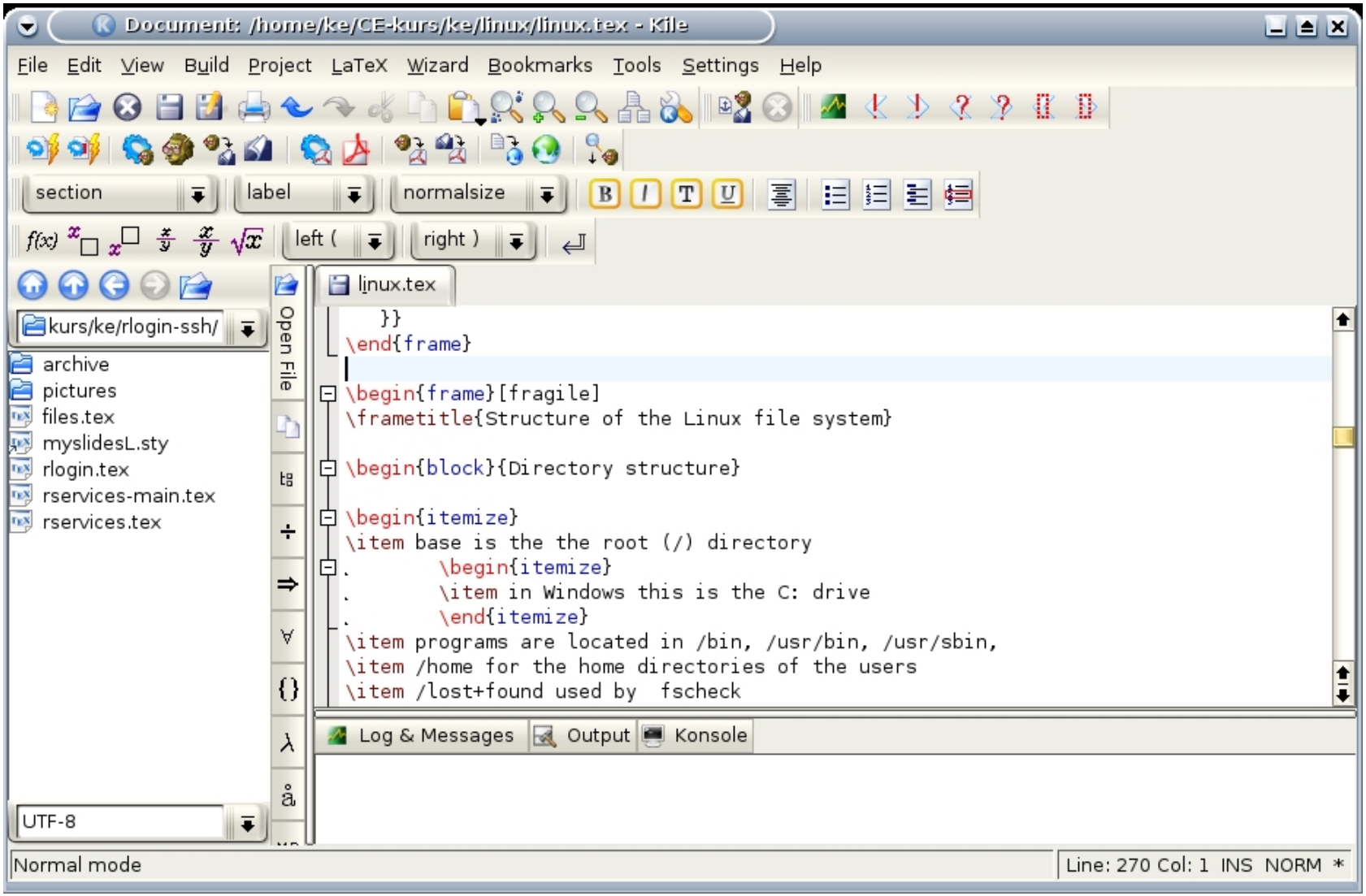
Text editors

Text Editors

- ed: The classic Unix line editor
- vi: historical times, but very powerful
- gvim: emacs-like, very powerful (www.vim.org)
- emacs: very powerful
- axe, nedit
- kedit, gedit: basic editors 4 KDE,GNOME
- kate: advanced text editor for KDE
- bluefish: html, php, etc
- conglomerate: XML editor
- kile: KDE Integrated LaTeX Environment
  - Latex Editor (XP: TexnicsCenter)

Text editors

LaTeX Editor - Kile



Text editors
vi

vi modes: command mode, editing mode

- change to command mode: ESC from editing

command mode

- file: read: :e file; write: :w file reread: :e! file; insert: :r file
- file: exit: :q, ZZ; starting vi: vi filename;

change to edit mode

- i - insert text; a append text to line;

editing commands

- 5yy - mark 5 lines; p insert marked lines; r2w - replace two words;

advantage of vi for emergency case:

- you can always connect to Linux computer by ssh
- you can always use vi in the terminal window

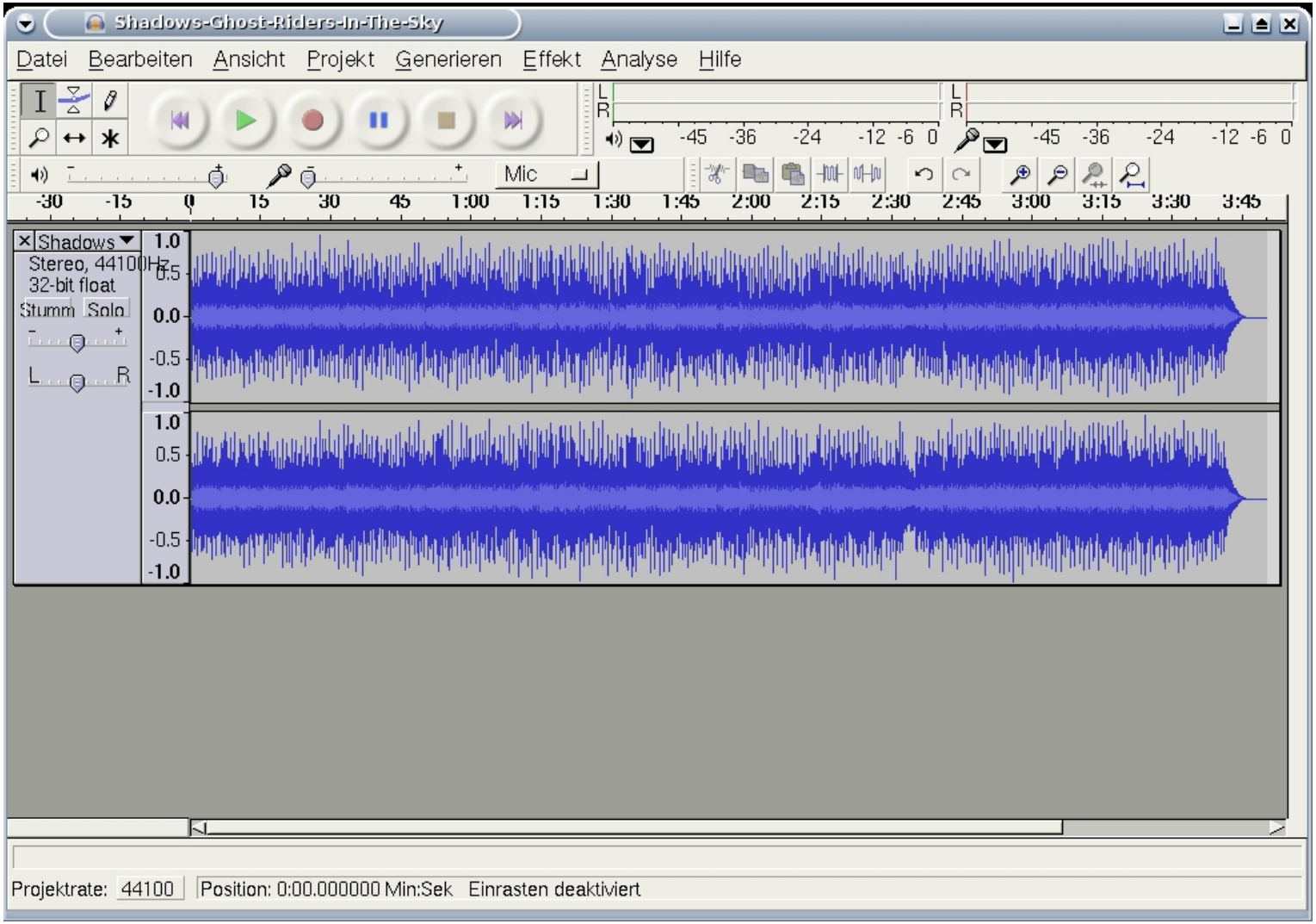
Special editors

For object types

Object Editors

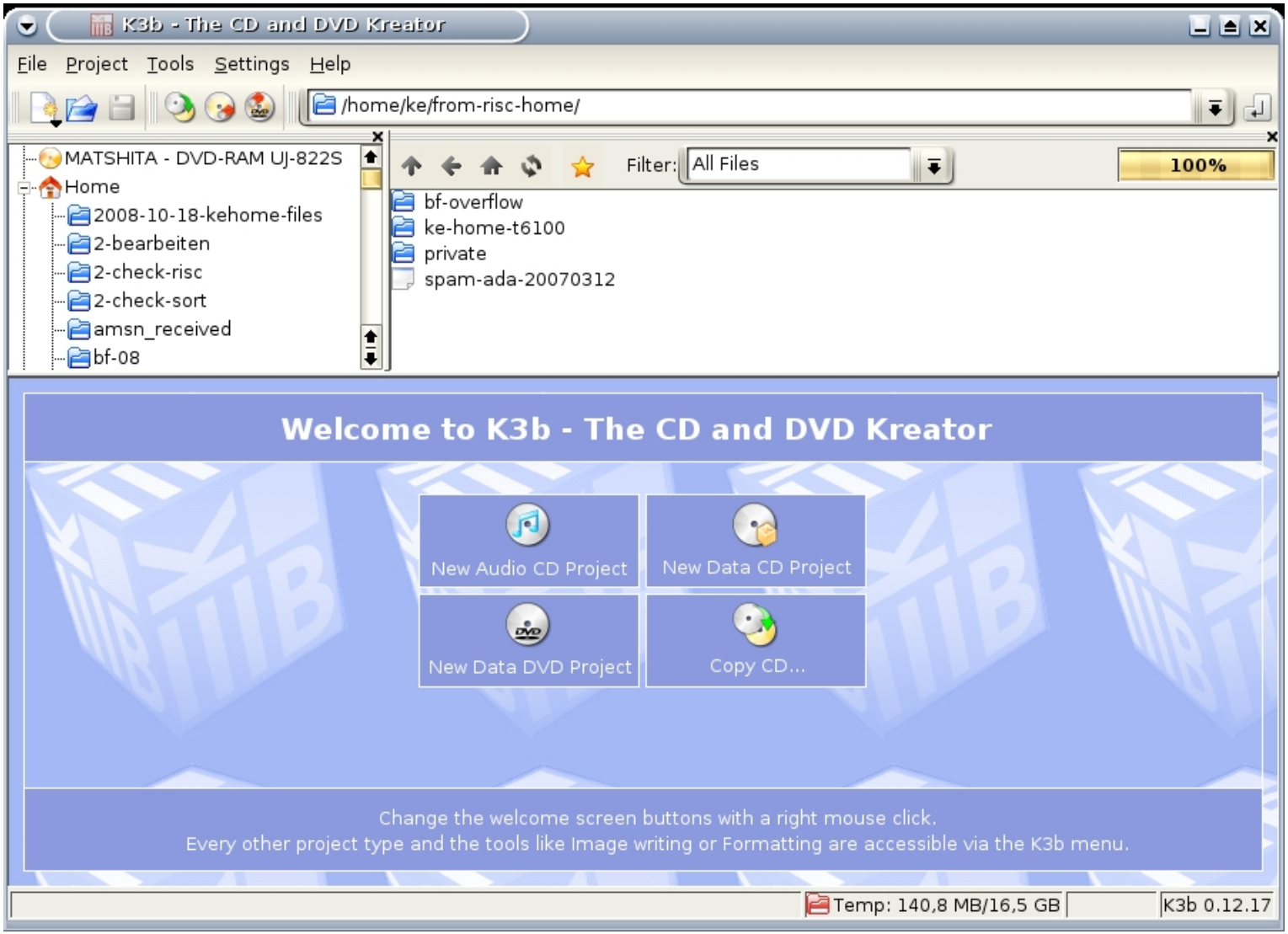
- audacity: a fast, cross-platform audio editor
  - audio recorder, converter, audio file manipulator
  - Linux, Windows, Mac versions available
- dia: diagram editor
- etktab: ASCII guitar tab editor
- kguitar: Stringed instrument tablature editor KDE
- pixmap: a pixmap editor
- GIMP: the Gnu Image Manipulation Program
- K3B: the KDE CD and DVD creator

Object Editors - Audacity



Object Editors - K3B

CD-DVD creator



Agenda

X Window System

The X-Server

X Window System

- X-Windows, Version 11: X11 - today: X.org
  - Developed in 1984 at MIT
  - supported by DEC, HP, SUN, IBM
  - Network-based graphics window system for Unix
  - Uses the multitasking function of Unix

A client-server model

- X server
  - runs on a host (in the network)
  - controls the display (=graphics card) and keyboard/mouse
  - binds to the D-K-M (in contrast to XVNCServer)
  - intermediator between X-clients (applications) and D-K-M
  - accepts client connections from local host (remote host)

X Window System

The X-client

X client

- connects to the X-server, to display its GUI
- most important X-clients
  - the X Window Manager; Xterm - the terminal emulator
- name begins with x (xterm, xclock, xcalc, etc.)
- any window on the screen is an X-client !

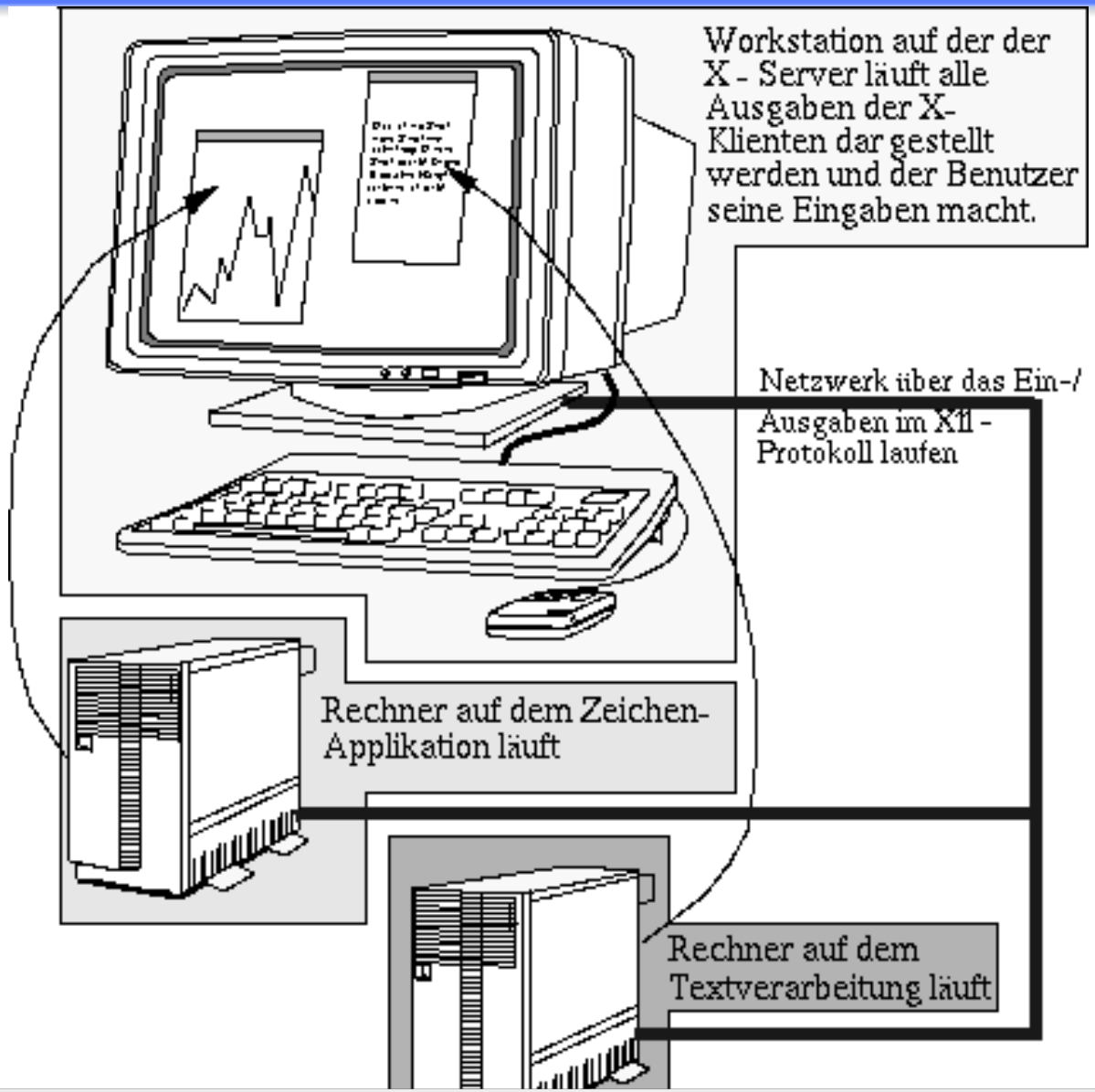
Networking feature of X-Window system

- host runs an X-server
- any X-client executed on the host connects to X-server
- any X-client executed on a remote host can connect to the X-server
  - it displays its GUI on the remote server !
- client and server (may) run on different hosts

Seperation between where a program runs and where its display is!

X Window System

X11 scenario



X Window System

Some components

X Window Manager

- provides the frame around a window with its functions
- responsible to move, resixe, minimize, maximize, close any window
- responsible for the pointing device input
- provides part of GUI: look and feel; lot of WM; grep for it

X terminal emulator

- a window that functions as a standard terminal
- xterm the first version; try, use: gnome-terminal, konsole

Display Manager

- displays the graphical login window ("login manager")
- after successfull authentication starts an x-session
- restarting the display manager
  - finishes all programs in the session (new login window)

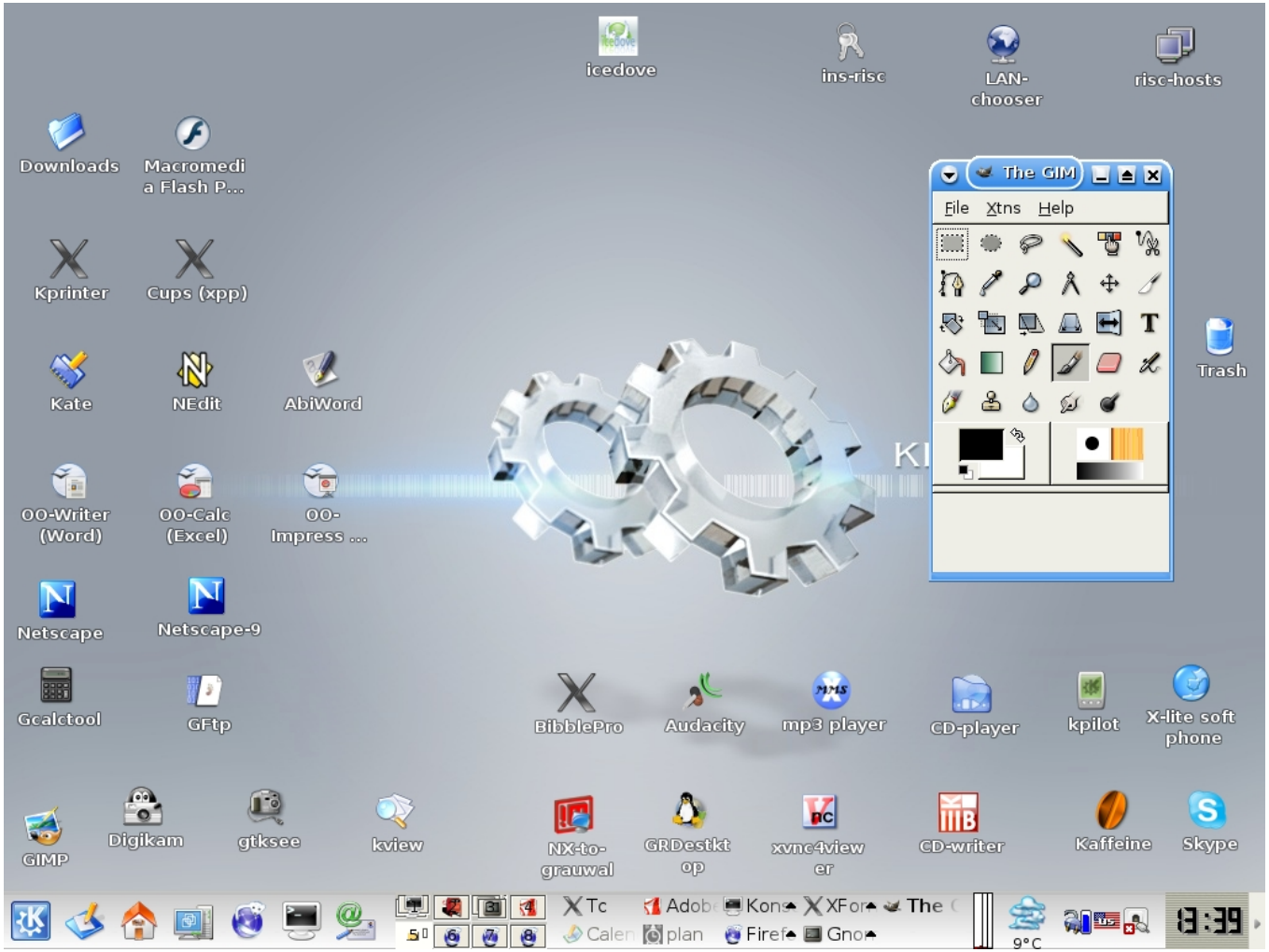
Agenda

The KDE Desktop, details

Desktop KDE

- KDE is a very big, powerful system (desktop environment)
- explore the KDE menu Application tree
- explore the KDE Application Debian tree
- customizing the menu bar
  - adding new applications and applets
  - virtual desktops
- creating desktop icons
- learn the KDE Control Center
- learn the KDE components
- learn the Help in KDE

My KDE Screen

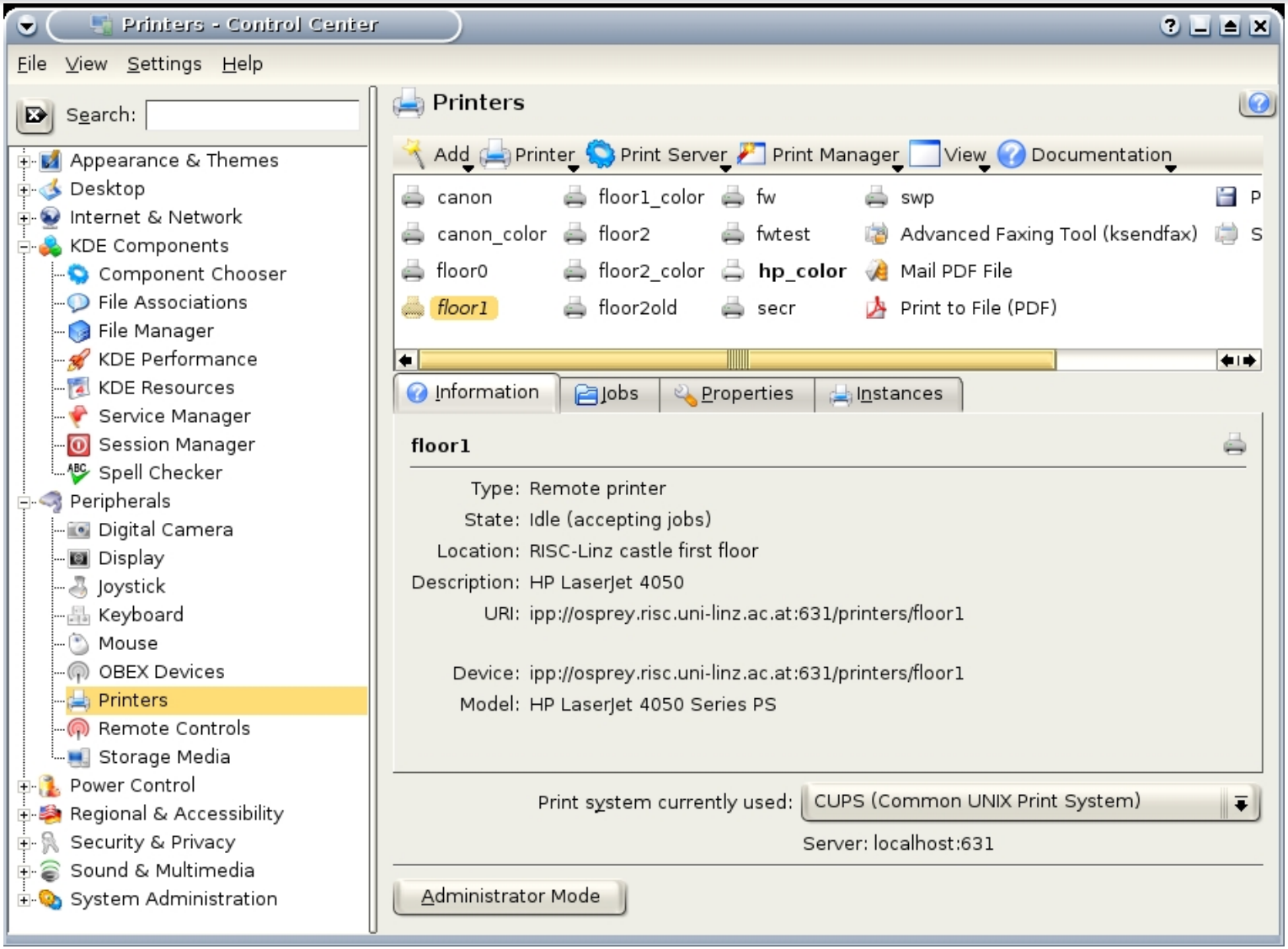


The KDE Control Center

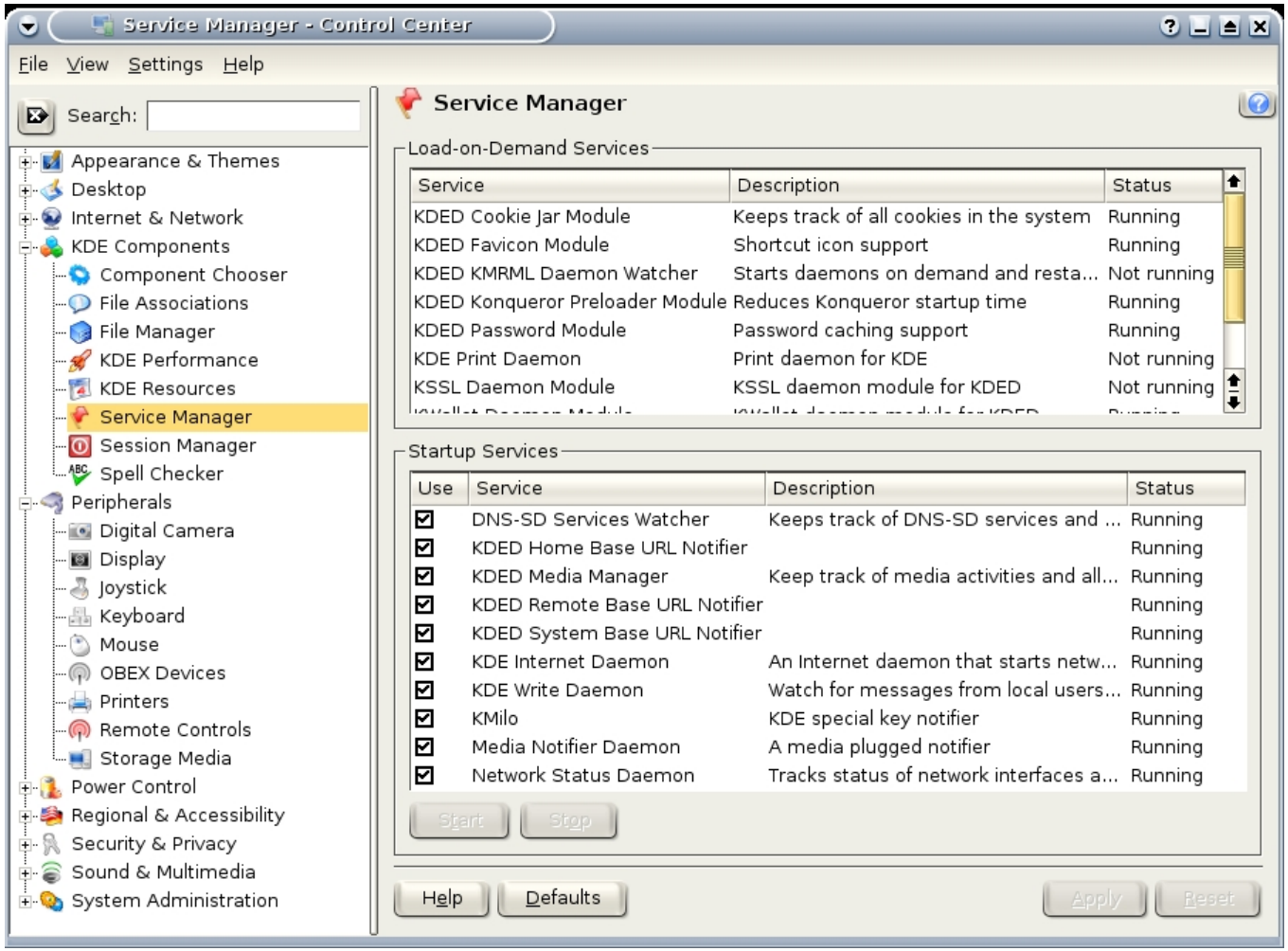
Main KDE components:

- Desktop (Multiple Desktops)
- Internet and Network
  - bluetooth, WLAN, Samba
- KDE Components (File Association)
- Peripherals (Display, Keyboard, Printers, etc.)
- Power Control (Laptop Battery)
- Regional settings
- etc: Security, Sound, System Administration

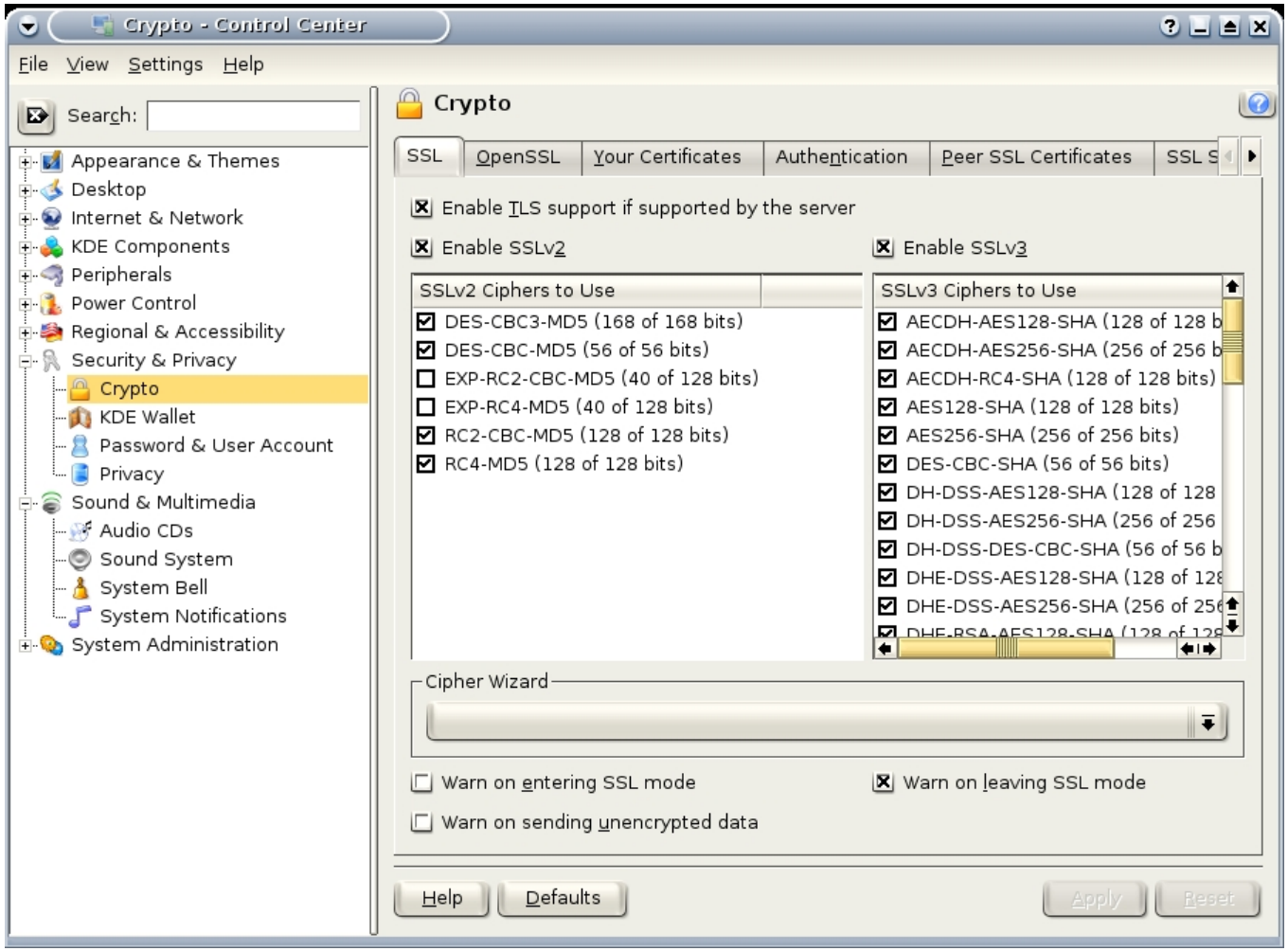
KDE Control Center - Printer



KDE Control Center - Service Manager



KDE Control Center - Security and Privacy



End of Overview

Thanks for your attention !