**Major FOSS and Distributions**

* OS and middleware
  + OS (Operating System) : the basis of systems
  + Middleware: software parts between applications and OS
* Servers
  + FOSS became popular initially as server applications
* Desktops
  + FOSS applications are expected to be suited for desktops
* Development environment
  + Cost merits for starting development easily
* Major GNU/Linux distributions
  + Providing an overview of GNU/Linux distributions

**OS (Operating System)**

* GNU/Linux
  + The leading free/open-source OS
* FreeBSD/NetBSD/OpenBSD
  + Honorable descendants of BSD
* Darwin
  + Open source OS kernel as a basis of Mac OS X
* Other free/open-source OS
  + OpenBeOS (Haiku), Plan 9, GNU/Hurd, etc.
* Other OS Trends
* Microsoft's shared source and activities of Sun Microsystems regarding its product Solaris

**GNU/Linux**

* Unix for PC, brainchild of Linus Torvalds
  + Created in 1991
  + Bazaar-style development; ported to various platforms ranging from embedded to mainframe
    - Architectures supported:
      * x86, PPC, Alpha, MIPS, SPARC, S/390, etc.
* Strict definition and wider definition
  + Strict definition: Linux kernel
  + Wider definition: Linux package (distribution) with applications
    - cf. “About Distributions”
  + Diverse range of GNU/Linux systems popular worldwide

**FreeBSD, NetBSD, OpenBSD**

* BSD : Berkeley Software Distribution
  + Unix-compatible OS created by William Joy(Bill Joy) and Chuck Haley
  + Based on Unix V6 with networking enhanced
    - Highly influential on development of today’s Internet-related technologies
* FreeBSD/NetBSD/OpenBSD
  + Free/Open-Source OS’es derived from BSD
* Features
  + FreeBSD: Emphasis on stability; frequently used for servers, etc.
    - FreeBSD derivatives: DragonFly BSD, Firefly BSD, etc.
  + NetBSD: Runs on diverse platforms
  + OpenBSD: Emphasis on security

**Darwin**

* Kernel of Mac OS X
  + Released by Apple as FOSS
  + Mac OS X includes Darwin kernel and GUI (Quartz), APIs (Cocoa, Carbon), etc.
* Derived from 4.4BSD
  + Microkernel: Mach 3.0
  + Released under Apple Public Source License (APSL) version 2.0
  + Supports PowerPC and x86 architectures
* OpenDarwin Project
  + Founded in April 2002 by Internet Systems Consortium and Apple Computer
    - <http://opendarwin.org>/

**Other Free/Open-Source Operating Systems**

* Haiku OS (aka OpenBeOS)
  + Development of BeOS stopped when Be, Inc. was purchased in 2001
  + FOSS version of BeOS; development restarted using released source code
* Plan9
  + Next-generation OS developed by Bell Labs of AT&T (now of Lucent Technologies), original developers of Unix
  + Basic design: All resources including CPU are distributed across network
* GNU/Hurd
  + Kernel of operating system based entirely on Free Software; developed by GNU
    - Aimed at replacing current kernel of GNU/Linux

**Other OS Trends**

* Shared Source Initiative
  + Microsoft’s strategic response to FOSS
  + Source code for Microsoft products released through individual agreements with governments, universities and enterprises
    - Prohibits release of modified source code
    - Not free to redistribute
  + Completely removed from FOSS; does not fit definition of FOSS
* Developments in Solaris OS
  + Source code released as OpenSolaris in June 2005
  + Some codes only available in binary files; not fully FOSS

**Middleware**

* Web application frameworks
  + Middleware as a framework for constructing Web applications
    - JBOSS, Tomcat, etc...
* libraries
  + Software libraries are enormous assets
  + Example of libraries
    - Widget set, graphics library, etc.

**Web Application Frameworks**

* Tomcat
  + Part of Apache Jakarta Project
  + Type of servlet container
    - Servlet: Mechanism for running Java programs on Web servers
* JBOSS
  + Implements Java for J2EE
    - J2EE: Platform for enterprise Java deployment
    - Simplifies deployment of Enterprise JavaBeans (EJB)
      * EJB: Java software component implemented on server side
  + Developed by JBOSS Inc.

**Libraries**

* glibc (GNU C Library)
  + Collection of most basic and general-purpose components (printf, etc.)
  + Called “C Library” because development on Unix focused on C language
* lib\*.so
  + Shared library
    - Used by multiple programs
  + Vast array of libxxx.so
    - libglib, libstdc++, libgtk, etc.
  + Ex. GNU Readline
    - Library for editing command lines
      * Features: History, complementation, etc.
  + Also provided as libxxx.so: Widget sets, graphics libraries, etc.

**Examples of Libraries**

* Widget sets
  + GTK+(Gimp Tool Kit)
    - Developed for GIMP graphics editor
    - Used by GNOME
  + Qt
    - GUI toolkit developed by Trolltech
    - Used by KDE
  + OpenMotif
    - GUI toolkit for X Window System; FOSS version of Motif
* Mesa (OpenGL)
  + Open Source implementation of OpenGL
  + OpenGL: 3D computer graphics interface developed by SGI
* Mono (.NET)
  + Open Source implementation of .NET
  + .NET framework advocated by Microsoft; competes with Java

**Servers**

* Web server
  + Apache
* Mail servers
  + MTA
  + ML server
  + POP3/IMAP
* DB server
  + PostgreSQL/MySQL/Fire
  + bird
* DNS
  + BIND
* File sharing
  + Samba/WebDAV
* LDAP
  + OpenLDAP
* Mining server
  + namazu
* CMS
  + XOOPS/Zope
* Business applications
  + E-Learning, ecommerce and many others

**Web (HTTP) Servers**

* Apache De facto standard for HTTP servers
  + 72% market share (according to E-soft survey of May 2005)
* History
  + Developed in 1995 by Rob McCool at NCSA
  + Development stalled when McCool later left NCSA
  + Developers in various places began modifying Apache
  + These developers got in touch and started up Apache Project
  + Name originates from “a patchy” server and the Apache Native Indian tribe
* Features
  + Light, fast and reliable (uses modules)
  + Runs on many platforms (Unix, Mac, Windows)

**Mail Transfer Agents (MTA)**

* Sendmail
  + Long used on Unix (developed in 1982)
  + Supports various protocols
  + Many security holes
  + Commercial version sold by Sendmail, Inc.
* Postfix
  + Inter-operable with Sendmail
  + Simple to configure
* qmail
  + Fast, robust
    - No security holes discovered
  + Simple to configure
  + Not FOSS, strictly speaking (distribution of modified versions is restricted)

**Mailing List Server**

* Mailman
  + Web-based list administration
  + Implemented in Python
  + E-mail archiving
  + Built-in attachment file and spam filtering
  + Extensive internationalization support
* QuickML
  + A list created just by sending an e-mail
  + Implemented in Ruby
  + Accepts any name for address

POP3/IMAP Servers

* qpopper
  + Qualcomm’s extension of Berkeley popper
  + Also supports APOP
* UW-IMAP
  + Developed by authors of RFC about IMAP
    - reference implementation

**Database Management Systems (DBMS)**

* PostgreSQL
  + Based on POSTGRES (previously Ingres) developed at UC Berkeley
  + Pioneering object-relational database
* MySQL
  + Developed by Swedish company MySQL AB
    - Dual license (GPL and commercial license)Streamlined features and fast performance
* Firebird
  + Free/Open-Source version of InterBase from Borland; released in 2000
  + Name clashed with Mozilla Firebird, prompting Mozilla to rename it Firefox
* PostgreSQL top in Japan; MySQL top worldwide

**Domain Name System (DNS)**

* BIND (Berkeley Internet Name Domain)
  + DNS server
    - System for linking domain names to IP addresses
  + Developed at UC Berkeley
    - Current maintenance work by Internet SystemsConsortium (ISC)
  + De facto global standard
    - 95% share (based on 2000 survey)

<http://www.isi.edu/~bmanning/in-addr-versions.html>

**Sharing of files**

* samba
  + SMB (Server Message Block) protocol
    - Windows networking uses SMB to implements file and printer sharing
  + Samba implements SMB services on Unix
* WebDAV
* File sharing and version management specification
* Extends HTTP protocol
  + Web browser interface
  + Supports any OS on client machines
  + Only port 80 opened
  + Be secure using SSL and other security features
* Supports major Web servers and browsers including Apache, etc

**Lightweight Directory Access Protocol (LDAP)**

* LDAP
  + Lightweight Directory Access Protocol
  + Protocol for accessing directory services
  + Central management of user data, etc.
  + LDAP-compatible software: MS Active Directory, etc.
* OpenLDAP
  + Open Source version of LDAP
    - Based on SLAPD developed at University of Michigan

**Information Retrieval**

* namazu
  + Full-text search system in Japanese
  + Features
    - Builds index in advance for fast searching
    - Filters can be used to search other files in addition to text files
    - Functions as a WWW full-text search system when used as CGI
* Recent search systems
  + Estraier: a personal full-text search system
    - <http://estraier.sourceforge.net/>
  + Rast: A full-text search system
    - <http://www.netlab.jp/rast/>
  + GNU mifluz (Senga information retrieval software)
    - <http://www.gnu.org/software/mifluz/>

**Content Management Systems (CMS)**

* XOOPS
  + Features
    - Built using PHP and MySQL
    - Simple to install and build sites
    - Top FOSS CMS in Japan
* Core developers are Japanese (from beginning)
  + Fork version decided in May 2005, due to dissatisfaction with development structure
  + Shift to independent development structure in Japan
* Zope
  + Application server written in Python
* Plone
  + CMS that runs on Zope

**Business Applications**

* Diverse range of FOSS business applications
* e-Learning
  + Moodle, Atutor, FOSS LMS, CFIVE, ...
* e-Commerce
  + OsCommerce
* Business Server combines
  + Mail-, Groupware-, Web-, Database-Server, Document Management, Anti-Virus, Anti-Spam
* ERP (Enterprise Resource Management) and CRM (Customer Relationship Management)
  + OpenERP, SugerCRM, OSSuite ERP, Compiere, ERP5
* Business specific applications
  + Cerveza restaurant supply procurement system
  + Garagardoa reservation management system

**Desktop Environment**

* GUI and integrated desktop environment
  + What is a desktop environment?
* Mail and web browser
  + MUA (Mail User Agent)
  + Web browser
* Document processor
  + Editor
  + Office suites
  + Type setting
  + Printing
* Multimedia
  + Image processing
  + CG (Computer Graphics)
  + Video
  + Audio, music
* Others
  + Computation, science and technology
  + Input of non-latin scripts

**GUI Environment**

* X Window System
  + De facto standard graphics environment for Unix
  + Originally developed at MIT; widely used today
    - Core development shifted to XFree86 Project, then to
  + X.Org Foundation
  + Designed for network transparency
    - No distinction between local and remote computing resources
* Window Manager
  + Software to control window size, positioning, overlap, etc.
  + Separate from X Windows System itself; installed as standalone application
  + Installation of various window managers
    - twm, tvtwm, Fvwm, WindowMaker, Enligntenment, Kwin, Metacity, Sawfish, Xfce, etc...

**Integrated Desktop Environment**

* What is an integrated desktop environment?
  + Provides a common GUI environment
  + Enables operations involving coordination between applications
    - Copy & paste
    - Drag & drop, etc.
* GNOME
  + Integrated desktop environment based on GTK+ library
* KDE
  + Integrated desktop environment based on Qt library

**MUA (Mail User Agent)**

* MUAs using typical three-pane configuration
  + (Three-pane configuration: Folder tree, title pane and message pane)
  + Evolution
  + Sylpheed
  + Thunderbird
    - MUA derived from Mozilla
* MUAs for running within Emacs
  + Mew
  + Wanderlust
* Text-based MUAs
  + Mutt

**Web Browsers**

* Konqueror
  + Browser in KDE
  + Integrates different media
* Firefox
  + Web browser from Mozilla project; designed to be light and fast
* Other browsers
  + Text-based browsers
    - w3m
    - lynx

**Editors**

* GNU Emacs
  + Developed by Richard Stallman
  + Extensible using Emacs Lisp
  + Not just an editor: platform for text-oriented applications
* Vi clones
  + Based on vi created by Bill Joy
  + Various vi-compatible installations exist today v
    - im (vi improved)
    - nvi
    - elvis, etc.

**Office Suites**

* OpenOffice.org (OOo)
  + Derived from StarOffice, product of German company StarDivision
    - Acquired and now maintained by Sun Microsystems
* Sun’s strategy
  + Portions of StarOffice not restricted under license are published as FOSS
* Comparison with commercial Office software
  + Comparable function-wise and operation-wise
* Full suite of office software
  + OOo Writer word processor
  + OOo Calc spreadsheet program
  + OOo Impress presentation tool
  + OOo Draw draw/paint tool
  + OOo Base database program

**Typesetting**

* What is typesetting software?
  + Uses commands to apply a style to a structured document; used for publishing
  + Not WYSIWYG (What You See Is What You Get), but produces high quality output
* TeX / LaTeX
  + TeX : Typesetting software created by Donald Knuth
  + LaTeX : Extension of TeX created by Leslie Lamport
  + Features
    - Strict concept of style, produces high quality output
    - Simplifies typesetting of formulas
    - Highly extensible (various extensions are available)
* Typesetting steps
  + Edit source in TeX (LaTeX)
  + Typeset in TeX (LaTeX) and generate DVI file
  + Check typeset results using xdvi
  + Convert into PS or PDF file
  + Print document
* GhostScript
  + Renders PostScript (PS) files
  + Used for verification on screen, or used on request by printer driver
* xpdf
  + PDF file viewer program

**Printing**

* LPRng
  + ng stands for “new generation”
    - Designed to replace common Berkeley LPR for Unix
  + Provides security and incorporates modern features, but retains customary interface
* CUPS (Common Unix Printing System)
  + Standard print spooler
* Issues with UNIX printing systems
  + Lack of common GUI
    - Ex. Printing dialogs, printer status, etc.
  + OpenPrinting project under development by Free Standards Group

**Image Processing**

* GIMP
  + Photo retouching software
  + Features and ease of use comparable to commercial applications
* ImageMagick
  + Set of command-line tools for image processing
    - Convert image data format
    - Change size and color gradation
    - Various special effects
* Many other image viewers
  + gqview, eog, ee, gthumb...
* Photo retouching in GIMP

convert, identify, composite,

montage, compare, display,

animate, import, conjure

* Command set in ImageMagick

**Computer Graphics (CG)**

* POV-Ray
  + Ray tracing program for CG creation
* blender
  + Program for 3D CG creation
  + Released as FOSS after development company went bankrupt
    - Can be used with YafRay (Yet Another Free Raytracer)
* Open Inventor
  + VRML rendering library
  + SGI software released as FOSS

**Video**

* xanime, mtv, plaympeg
  + First wave of video players
* MPlayer, Xine
  + Support many video formats
    - MPEG, AVI, ASF, WMA, QT, MOV, etc.
  + Continued development in danger due to software patent issue
* XawTV, tvtime
  + TV viewing software relying on TV capture device
* Kino, Coriander
  + Saves video from FireWire (IEEE 1394) cameras
* Other tools: FFmpeg (video format converter), Ogle (DVD player), etc.

**Audio, Music**

* XMMS (X Multimedia System)
  + Audio file and CD player
* LAME (Lame Ain't an MP3 Encoder)
  + MP3 encoder
* Ogg Vorbis
  + Free music compression format
  + Designed to replace other compression formats having many rights issues
* RoseGarden
  + Desktop music creation tool
* Timidity
  + Software MIDI synthesizer

**Computation, Science and Technology**

* R
  + Statistical computing package
  + Compatible with S language
* SciLab, Octave
  + Science and technology computing software
  + Compatible with MATLAB
* Maxima
  + Formula manipulation software
  + Comparable to Mathematica
    - Capable of high quality formula display when used with TeXMacs
* Graph drawn in gnuplot
  + gnuplot Plotting software

**Kana-Kanji Conversion**

* FreeWnn
  + FOSS version of Wnn from Omron Software
* Canna
  + Kana-kanji conversion software developed by NEC
  + Restarted in 2002 through volunteer-driven development
* Anthy
  + New entry, developed since 2000; started in response to the dismal state of FOSS-based kana-kanji conversion software
* Issues with kana-kanji conversion were
  + No standard common framework
    - Candidates: XIM, IIMF and UIM protocols
  + Poor performance due to patents covering conversion methods

**Input of Non-Latin Scripts**

* Increasingly users require non-latin scripts
* Goal: provide common framework
* Examples: Kanji, Chinese, Hangul, Cyrillic
  + but also for German, French, Spanish, ...
* Smart Common Input Method (SCIM)
  + full featured input method user interface
  + for POSIX-style operating systems
  + Linux, FreeBSD and other Unix
  + development platform for input methods
  + currently supports more than 30 languages

**Development Environments**

* Languages
  + Various programming languages are provided as FOSS
* Integrated development environments
  + Eclipse: the most famous FOSS IDE (Integrated Development Environment)
  + Other IDEs: KDevelop, Anjuta, WideStudio, etc.
* Development frameworks
  + Struts is quoted as a typical example of a framework which can improve development efficiency and average quality of products

**Developing Languages**

* gcc (GNU Compiler Collection)
  + Collection of compilers for C, C++, Fortran, Java, etc.
  + Standard compiler for development on Unix
* Perl
  + Strong text processing
  + Flexibility to use various syntax for same process
    - TMTOWTDI: There's More Than One Way To Do It.
  + Frequently used for system management and CGIs
* PHP
  + HTML-embedded, server-side scripting language
  + Main language for Java and Web system development
    - LAMP/LAPP
* Python
  + Features block designation using indentation
* Ruby
  + Developed by Yukihiro Matsumoto
* Python and Ruby are rival languages
  + Python is an object-oriented version of Perl

**Integrated Development Environments (IDE)**

* Eclipse
  + Development environment implemented in Java
  + Supports languages other than Java
    - Plug-ins for C/C++ development
    - C/C++ Development Toolkit (CDT)
* IDE for various desktop environments
  + Kdevelop for Qt/KDE
  + Anjuta for GTK+/GNOME
* Other IDE
  + WideStudio
    - For creating GUI applications using C/C++

**Development Frameworks**

* Framework
  + Implements basic framework for data I/O, error handling, screen transitions, etc.
    - Improves development efficiency
    - Standardization of quality: Same quality regardless of who writes it
  + Difficult to implement features outside of framework
* Struts
  + Java-based Web application framework
    - Uses Java servlet and JSP technology
    - Uses MVC architecture
    - Simple and powerful framework
    - Runs on servlet container such as Tomcat
  + Developed by Jakarta Project

**Major GNU/Linux Distributions**

* About distributions
  + Collection of software
* RedHat / Fedora
  + Top share for enterprise
  + Full of leading-edge functions
* Turbo-Linux
  + Focus: desktop
* Ubuntu
  + Based on Debian
  + Focus: desktop
* SUSE LINUX
  + Distribution originally from Germany
  + The second largest share of GNU/Linux market
* Vine Linux
  + Well-tailored Japanese environment
* Debian GNU/Linux
  + Many developers in the world
* KNOPPIX
  + Bootable from CD

**About Distributions**

* GNU/Linux distributions
  + Standard applications do not run on Linux kernel alone
  + Requires a shell, libraries, tools, etc.
    - Also requires application software
  + Distributions bring together necessary software to simplify installation
    - Can be installed by novices
* What sets a distribution apart?
  + Different applications or configurations for server/desktop use
  + Inclusion of commercial software
    - Commercial-free versions often available for free download
  + Package management systems
    - rpm, deb, Portage
  + Boot method (hard drive, CD or floppy)

**Red Hat Linux, Fedora Core, CentOS, etc.**

* Red Hat Linux
  + From Red Hat, the largest GNU/Linux distributor
    - Red Hat focus is on enterprise applications
  + Development of free Red Hat Linux stopped in 2003
    - FOSS development shifted to Fedora Project
  + Clone distributions excluding commercial software
    - White Box Enterprise Linux, CentOS
* Fedora Core
  + Community-based development under Fedora Project
    - Supported by Red Hat
  + Aggressively adopts advanced features
    - Also serves as Red Hat’s test version
    - Uses UTF as default character code
      * Some conflicts with existing software

**Turbolinux**

* Developed and marketed by Japanese company Turbolinux, Inc.
  + Japan: No. 2 in GNU/Linux server OS market share (2003 survey) \*1
  + China: No. 1 in GNU/Linux server OS market share (2003 survey) \*2
    - Released Chinese version of GNU/Linux
  + Joined UnitedLinux industry consortium in 2002
    - Purpose: Establish standard distribution for GNU/Linux
* Focus on desktop GNU/Linux OS
  + Releases: Turbolinux 10 Desktop, etc.
    - Enhanced with Windows-like GUI
    - Comes with player supporting Windows Media video files

**SUSE Linux**

* Originally developed by German company SUSE Linux
  + No. 2 in global market share
    - No. 1 in Europe
  + Acquired by Novell in 2004
  + OpenSuse: contains only FOSS
* Features
  + Adopted KDE as standard desktop environment
  + First enterprise GNU/Linux distribution to use Linux kernel 2.6
  + Includes YaST integrated management tool

**Vine Linux**

* Community-based development by Project Vine in Japan
  + Commercial version available from Vine Caves, Ltd. with additional fonts and kana-kanji conversion
* Features
  + Japanese language environment is easy to use
  + Emphasis on stability
    - Slow to adopt new features
  + Employs apt package manager (compatible with RPM)

**Debian GNU/Linux**

* Developed by Debian Project
  + Debian Project also develops other free operating systems outside of GNU/Linux
  + Encompasses nearly 1,000 developers
* Features
  + Uses apt and deb package managers
  + Vast number of packages (over 15,000)
  + Entirely made up of FOSS
* Various distributions derived from Debian GNU/Linux
  + KNOPPIX
  + Linspire: Windows-like commercial OS
  + Skolelinux: GNU/Linux distribution for schools

**KNOPPIX**

* Developed by Klaus Knopper
  + derived from Debian
* Features
  + Boots from CD-ROM
    - Easy to try out; does not affect existing environment
    - Can be installed to hard drive
  + Excellent automatic device detection

**Ubuntu**

* Based on Debian
* Started by Mark Shuttleworth
* Commercial support and development by Canonical