Easy Software-Installation on Linux, Solaris, NetBSD, etc. using pkgsrc

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Problems

Installation of Open Source software on Unix and Unix-like systems has a number of problems:

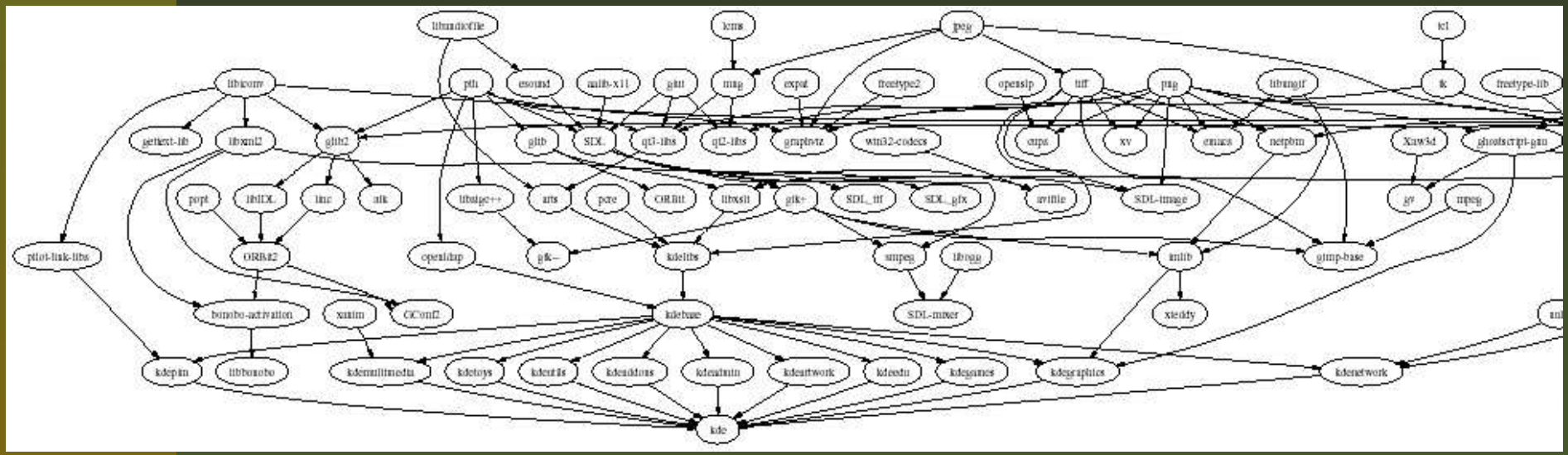
- Many programs and lots of version changes
- Compilation costs time
- Software often is not written with portability in mind (but we don’t want to give a c0ding lesson here...)
- Installation is not trivial

Problems (cont'd)

- Installation is not trivial:
  - Some basic knowledge about tools is necessary
  - Various ways to configure things (GNU autoconf, Imake, ...)
  - Side effects (depending on other packages, compiler, ...)
  - Many inter-depending packages
  - Troubleshooting requires expert knowledge

Problems (cont'd)

Illustration of complexity of inter-depending packages:



(created from a pkgsrc system running NetBSD, using pkgdepgraph and dot/graphviz)

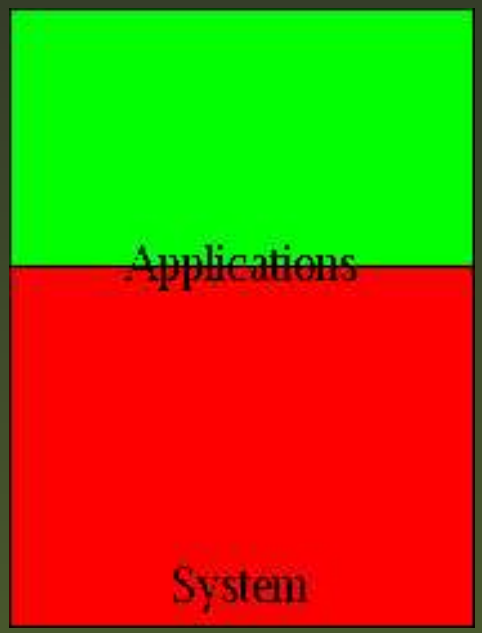
Solution: It depends! (1/2)

Classic, flexible software management:

- difficult to install
+ easy to maintain

E.g. Solaris, Irix, Linux From Scratch

Hybrid systems:



+ easy to install
+ easy to maintain

E.g. NetBSD, FreeBSD, Debian & Gentoo Linux

Complete integration of applications and system:

+ easy to install
- difficult to maintain

E.g. SuSE, RedHat, Mandrake Linux

Solution: It depends! (2/2)

Where do you want to go today?

- **Easy Installation:** choose this if your software doesn't change often. Use ready-to-user binary distribution. E.g. for desktop systems install Windows or SuSE Linux from CD/DVD.
- **Easy Maintenance:** choose this if you have few packages that change a lot. Take a stable base operating system, and install important packages on your own, e.g. compile on your own on a webserver with Solaris, Apache and PHP.
- **Both:** Welcome to pkgsrc!

A Cross-Platform Solution: pkgsrc

Introducting pkgsrc

- System for easy installation and updating of packages
- Source-based package management system
- Uses original source code for compiling
- Creation and installation of binary packages is possible
- Components: Management tools & packages collection (pkgsrc)
- Automatic handling of dependencies (of course!?!)

Introducing pkgsrc (cont'd)

- Originally ported from FreeBSD to NetBSD
- Primary development platform of pkgsrc: NetBSD
- Ported to: AIX, BSD/OS, Darwin, FreeBSD, Irix, Linux, NetBSD, OpenBSD, Solaris, Windows w/ "Interix"
- Linux Distributions: SuSE 9.0, Debian, ROOT Linux, Slackware, RedHat 8.1/9, Mandrake 9.2, Bluewall, ...

pkgsrc in Detail

How to get going

- Grab pkgsrc
- Install bootstrap kit (binary, or compile via pkgsrc/bootstrap)
- cd pkgsrc/www/mozilla
- bmake install

Grabbing pkgsrc

```
$ cd $HOME/OS
$ env CVS_RSH=ssh \
  cvs -d \
  anoncvs@anoncvs.NetBSD.org:/cvsroot \
  co pkgsrc
U pkgsrc/Makefile
U pkgsrc/Packages.txt
U pkgsrc/README
...
```

Alternative: ftp://ftp.NetBSD.org/pub/NetBSD/NetBSD-current/tar_files/pkgsrc.tar.gz

Bootstrap Kit: Binaries

- Grab a precompiled binary or compile on your own
- Precompiled binary kits are available on http://www.pkgsrc.org/ for:

Darwin 7.3.0/powerpc
Darwin 7.0/powerpc
Darwin 6.6/powerpc
Debian Linux/i386
FreeBSD 3.5/i386
FreeBSD 5.1/i386
FreeBSD 5.2.1/i386
Interix 3.5
IRIX 6.5/mips
IRIX64 6.5/mips
OpenBSD 3.2/i386
OpenBSD 3.5/i386
Slackware 8.1/i386
Slackware 9/i386
Solaris 8/sparc
Solaris 9/sparc
Solaris 9/i386

Bootstrap Kit: Compiling (1/2)

```
$ cd pkgsrc/bootstrap
$ export MY_HOME=$HOME/OS/OS-‘uname -s‘
$ export LOCALBASE=${MY_HOME}/pkg
$ export PKG_DBDIR=${MY_HOME}/db/pkg
$ ./bootstrap \
?         --prefix=${LOCALBASE} \
?         --pkgdbdir=${PKG_DBDIR} \
?         --ignore-user-check
===> bootstrap command: ./bootstrap --prefix=/home/feyrer/OS/OS-Linux/pkg -
===> bootstrap started: Wed Dec  8 14:42:23 CET 2004
Working directory is: work
===> running: /usr/bin/sed -e ’s|@DEFAULT_INSTALL_MODE@|’0755’|’ files/inst
===> running: /bin/chmod +x work/install-sh
===> building as unprivileged user feyrer/bedienst
===> Building libnbcompat
===> running: /bin/sh work/install-sh -d -o feyrer -g bedienst work/libnbco
===> running: (cd work/libnbcompat; /bin/sh ./configure -C --prefix=/home/f
configure: creating cache config.cache
checking build system type... i686-pc-linux-gnu
checking host system type... i686-pc-linux-gnu
checking whether make sets $(MAKE)... yes
.....
```

Bootstrap Kit: Compiling (2/2)

```
....
/usr/bin/install -c -m 444 linkfarm.cat1 /home3/bedienst/feyrer/OS/OS-Linux
/usr/bin/install -c -m 444 pkg_view.1 /home3/bedienst/feyrer/OS/OS-Linux/pk
/usr/bin/install -c -m 444 pkg_view.cat1 /home/feyrer/OS/OS-Linux/pkg/man/c
===> Installing packages(7) man page
===> running: /bin/sh work/install-sh -c -m 444 files/packages.cat7 /home/f

Please remember to add /home/feyrer/OS/OS-Linux/pkg/bin to your PATH enviro
and /home/feyrer/OS/OS-Linux/pkg/man to your MANPATH environment variable,

An example mk.conf file "work/mk.conf.example" with the settings you
provided to "bootstrap" has been created for you.
Please copy work/mk.conf.example to /home/feyrer/OS/OS-Linux/pkg/etc/mk.con

You can find extensive documentation of the NetBSD Packages Collection
in /home/feyrer/OS/pkgsrc/Packages.txt and packages(7).

Hopefully everything is now complete.
Thank you
===> bootstrap started: Wed Dec  8 14:44:09 CET 2004
===> bootstrap ended:   Wed Dec  8 14:55:52 CET 2004
$
```

Bootstrap Kit: Adjust $PATH etc.

```
$ cd $HOME/OS/OS-‘uname -s‘/pkg
$ export PATH=‘pwd‘/bin:‘pwd‘/sbin:${PATH}
$ export PKG_DBDIR=$HOME/OS/OS-‘uname -s‘/db/pkg
$
$ pkg_info
digest-20021220     Message digest wrapper utility
```

Installed Commands

The binaries installed by the bootstrap procedure provide the core functionality of the pkgsrc system:

```
$ cd OS/OS-‘uname -s‘/pkg/
$ ls bin sbin
bin:
bmake       cpio        digest      ftp
pax         tar

sbin:
linkfarm    pkg_add     pkg_create  pkg_info
mtree       pkg_admin   pkg_delete  pkg_view
```

Compiling Packages - Overview

Beware! Make sure that instead of “make” the BSD-compatible “bmake” is being used!

```
$ export MAKECONF=‘pwd‘/pkgsrc_env_no-root # see below
$
$ cd $HOME/OS/pkgsrc
$ cd misc/figlet
$ bmake
...
$ bmake install
...
$
$ pkg_info
digest-20021220     Message digest wrapper utility
figlet-2.2.1nb2     Print text banners in fancy ASCII art ch
```

Compiling Packages - Details (1/2)

```
$ bmake
===> *** No /home/feyrer/OS/OS-Linux/../distfiles/pkg-vulner
===> *** skipping vulnerability checks. To fix, install
===> *** the pkgsrc/security/audit-packages package and run
===> *** '/home/feyrer/OS/OS-Linux/pkg/sbin/download-vulnera
=> Checksum OK for figlet221.tar.gz.
work.i386 -> /home/feyrer/OS/OS-Linux/tmp/misc/figlet/work.i
===> Extracting for figlet-2.2.1nb2
===> Patching for figlet-2.2.1nb2
===> Applying pkgsrc patches for figlet-2.2.1nb2
===> Overriding tools for figlet-2.2.1nb2
===> Configuring for figlet-2.2.1nb2
===> Building for figlet-2.2.1nb2
gcc -O2 -DDEFAULTFONTDIR=\"/home/feyrer/OS/OS-Linux/pkg/shar
chmod a+x figlet
gcc -O2 -o chkfont chkfont.c
$
```

Compiling Packages - Details (2/2)

```
$ bmake install
===> Installing for figlet-2.2.1nb2
===> Becoming root@rfhinf032 to install figlet.
Warning: not superuser, can't run mtree.
Become root and try again to ensure correct permissions.
install -d -o feyrer -g bedienst -m 755 /home/feyrer/OS/OS-L
mkdir -p /home/feyrer/OS/OS-Linux/pkg/share/figlet
cp figlet /home/feyrer/OS/OS-Linux/pkg/bin
cp chkfont /home/feyrer/OS/OS-Linux/pkg/bin
chmod 555 figlist showfigfonts
cp figlist /home/feyrer/OS/OS-Linux/pkg/bin
cp showfigfonts /home/feyrer/OS/OS-Linux/pkg/bin
cp fonts/*.flf /home/feyrer/OS/OS-Linux/pkg/share/figlet
cp fonts/*.flc /home/feyrer/OS/OS-Linux/pkg/share/figlet
cp figlet.6 /home/feyrer/OS/OS-Linux/pkg/man/man6
===> Registering installation for figlet-2.2.1nb2
$
```

Compiling Packages - Running

```
$ type figlet
/home/feyrer/OS/OS-Linux/pkg/bin/figlet
$
$ figlet Hello ‘uname -s‘
 _   _        _ _                 _      _
| | | | ___| | | ___   | |   (_)_ __  _   ___  __
| |_| |/ _ \ | |/ _ \  | |   | | ’_ \| | | \ \/ /
|  _  |  __/ | | (_) | | |___| | | | | |_| |>  <
|_| |_|\___|_|_|\___/  |_____|_|_| |_|\__,_/_/\_\
```

Compiling as Non-root

To use pkgsrc without root privileges, put the following into $MAKECONF (shortened!):

```
MY_NAME!=       whoami
MY_GROUP!=      groups | sed 's/ .*$$//'
MY_HOME=        ${HOME}/OS
BINOWN=         ${MY_NAME}
BINGRP=         ${MY_GROUP}
WRKOBJDIR=      ${MY_HOME}/tmp
LOCALBASE=      ${MY_HOME}/pkg
VARBASE=        ${MY_HOME}/var
OBJMACHINE=     1
SU_CMD=         /bin/sh -c
CHOWN=          true
CHGRP=          true
BINMODE=        755                     # for Solaris strip(1)
```

Complete: http://www.feyrer.de/OS/pkgsrc_env_no-root!

Behind the Scenes

1. `make fetch`: Download sources
2. `make checksum`: Ensure integrity
3. `make install-depends`: Install required packages
4. `make extract`: Unpack
5. `make patch`: Apply patches
6. `make configure`: Configure
7. `make build`: Compile
8. `make install`: Install and register package (for pkg_info(1), pkg_delete(), etc.)

Other Interesting Targets

- `make package`: Create binary package for pkg_add(8)
- `make clean`: Remove working directory
- `make deinstall`: Deinstall package
- `make replace`: Replace installed package with new version
- `make update`: Rebuild package and all dependencies

What packages are there: Categories

```
$ cd .../pkgsrc/
$ ls
CVS             databases       lang            pkglocate
Makefile        devel           licenses        pkgtools
Packages.txt    distfiles       mail            print
README          doc             math            regress
archivers       editors         mbone           security
audio           emulators       meta-pkgs       shells
benchmarks      finance         misc            sysutils
biology         fonts           mk              templates
bootstrap       games           multimedia      textproc
cad             geography       net             time
chat            graphics        news            wm
comms           ham             packages        www
converters      inputmethod     parallel        x11
cross
```

Example:d WWW Category

```
$ cd .../pkgsrc
$ ls www
CVS                 cadaver             jakarta-servletap p5-Apache-Test
Makefile            calamaris           jakarta-tomcat    p5-Apache-ePerl
Mosaic              cgic                jakarta-tomcat4   p5-CGI
SpeedyCGI           cgicc               jsdk20            p5-CGI-Applicatio
adzap               cgilib              jssi              p5-CGI-FastTempla
amaya               checkbot            kannel            p5-CGI-FormBuilde
analog              chimera             kdewebdev3        p5-CGI-Kwiki
ap-Embperl          clearsilver         kimagemapeditor   p5-CGI-Minimal
ap-access-referer   cocoon              lhs               p5-CGI-Session
ap-aolserver        communicator        libghttp          p5-CGI_Lite
ap-auth-cookie      cronolog            libgtkhtml        p5-ExtUtils-XSBui
ap-auth-ldap        curl                libwww            p5-FCGI
ap-auth-mysql       cvsweb              liferea           p5-HTML-Clean
ap-auth-pam         dillo               links             p5-HTML-FillInFor
ap-auth-pgsql       drivel              links-gui         p5-HTML-FixEntiti
ap-auth-postgresq   elinks              lynx              p5-HTML-Format
ap-auth-script      elinks04            mMosaic           p5-HTML-Mason
ap-bandwidth        emacs-w3m           make_album        p5-HTML-Parser
...
```

Number of Available Packages

```
$ date
Wed Dec  8 15:16:19 MET 2004
$
$ cd .../pkgsrc/
$ ls */*/Makefile | wc -l
    5189                          <- pkgsrc
$ ls wip/*/Makefile | wc -l
    940                           <- SourceForge's pkgsrc-wip
$ expr 5189 + 940
6129                              <- total
```

Internals

Makefile: Construction Manual

```
$ cat x11/xteddy/Makefile
# $NetBSD: Makefile,v 1.10 2002/08/25 21:52:57 jlam Exp $

DISTNAME=       xteddy-1.1
CATEGORIES=     x11 games
MASTER_SITES=   http://www.ITN.LiU.SE/~stegu/xteddy/

MAINTAINER=     johnam@mail.kemper.org
HOMEPAGE=       http://www.ITN.LiU.SE/~stegu/xteddy
COMMENT=        Xteddy is a cuddly teddy bear for your X Windows desktop

USE_BUILDLINK2= YES
USE_X11=        YES
GNU_CONFIGURE=  YES

pre-install:
        ${INSTALL_DATA_DIR} ${PREFIX}/share/xteddy
        ${INSTALL_DATA_DIR} ${PREFIX}/share/xteddy/pixmaps

.include "../../graphics/xpm/buildlink3.mk"

.include "../../mk/bsd.pkg.mk"
```

Dependencies

Various ways:

- Compile-time only: BUILD_DEPENDS
- Compile- and runtime: DEPENDS
- Compile- and runtime: buildlink3.mk

Dependencies: *DEPENDS

```
$ cd .../pkgsrc/
$ grep ^DEPEND meta-pkgs/kde3/Makefile
DEPENDS+=       kdeaccessibility-3.3.0nb1:../../misc/kdeacce
DEPENDS+=       kdeartwork-3.3.0nb1:../../misc/kdeartwork3
DEPENDS+=       kdeaddons-3.3.0nb1:../../misc/kdeaddons3
DEPENDS+=       kdeadmin-3.3.0nb1:../../misc/kdeadmin3
...
```

The variable DEPENDS is assigned pairs of “Name-Version:Directory”. “Name-Version” is name and version of the required package, “Directory” is the path relative to this pkg’s directory where the package can be found if it’s not installed and needs to be built from source.

Dependencies: buildlink3.mk

These files contain variables which say ...

- which header-files to use
- which libraries to use
- which name+version of this package should be expected
- in which pkgsrc directory to look if the package needs to be installed
- if there are additional CPP flags to use
- if this package needs further packages installed

Example: tiff/buildlink3.mk

```
$ cat graphics/tiff/buildlink3.mk
# $NetBSD: buildlink3.mk,v 1.8 2004/10/03 00:14:58 tv Exp $

BUILDLINK_DEPTH:=       ${BUILDLINK_DEPTH}+
TIFF_BUILDLINK3_MK:=    ${TIFF_BUILDLINK3_MK}+

.if !empty(BUILDLINK_DEPTH:M+)
BUILDLINK_DEPENDS+=     tiff
.endif

BUILDLINK_PACKAGES:=    ${BUILDLINK_PACKAGES:Ntiff}
BUILDLINK_PACKAGES+=    tiff

.if !empty(TIFF_BUILDLINK3_MK:M+)
BUILDLINK_DEPENDS.tiff+=        tiff>=3.6.1
BUILDLINK_RECOMMENDED.tiff+=    tiff>=3.6.1nb3
BUILDLINK_PKGSRCDIR.tiff?=      ../../graphics/tiff
.endif  # TIFF_BUILDLINK3_MK

.include "../../devel/zlib/buildlink3.mk"
.include "../../graphics/jpeg/buildlink3.mk"

BUILDLINK_DEPTH:=       ${BUILDLINK_DEPTH:S/+$//}
```

Questions? Answers!

http://www.pkgsrc.org/

http://www.NetBSD.org/packages/

info@pkgsrc.org