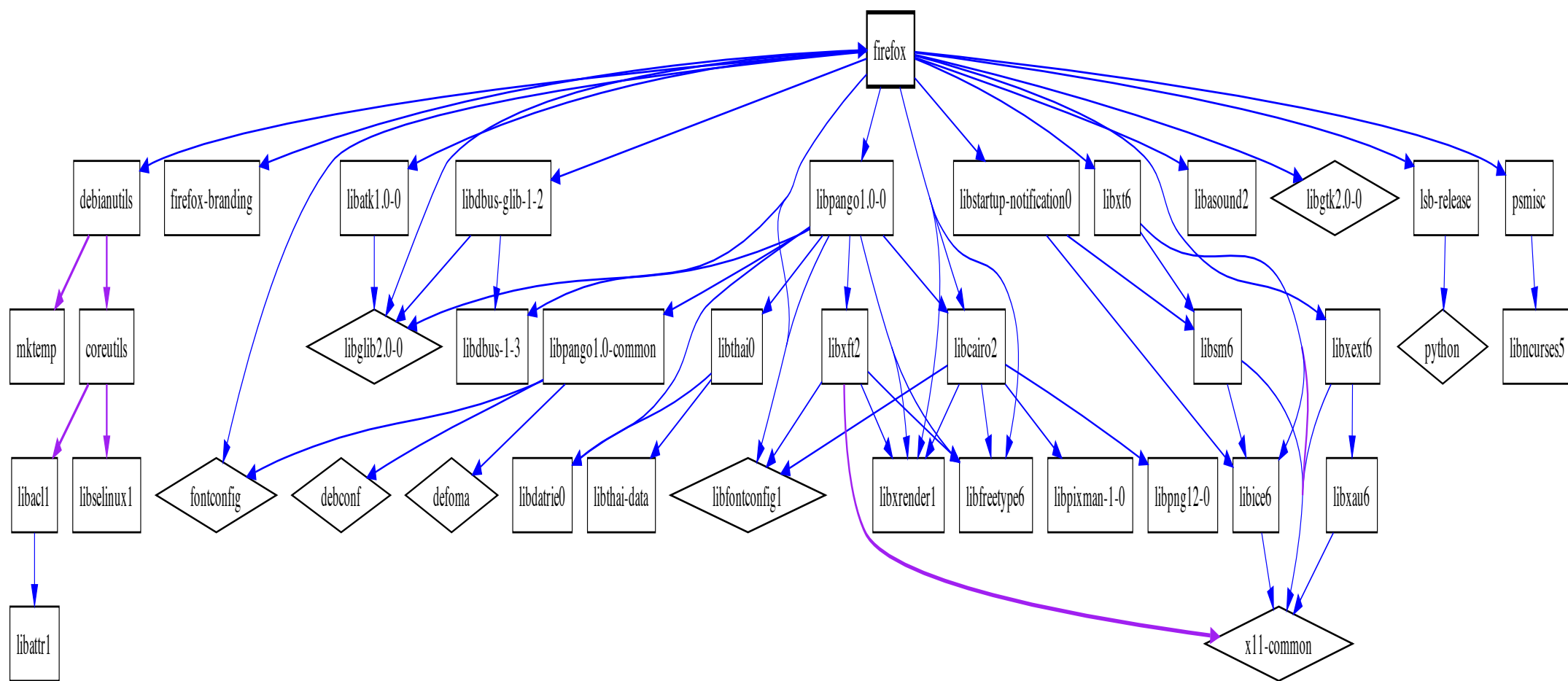


Problem: Scientists use software to analyze their data. Result reproducibility depends on the ability to run the software. Changing environments, extraneous dependencies, and large data sets makes software distribution / reuse a challenge.



Preliminary Effort: Use package management to prune extraneous dependencies. Further refine using language-specific partial evaluation.

```
Building dependency tree
Reading state information... Done
The following packages will be REMOVED:
apt-utils* belocs-locales-bin* BSDmainutils* casper* confconsole*
console-setup* console-terminus* cpp* cpp-4.2* cron* cron-apt* dctrl-tools*
debtree* di-live* dmssetup* eject* ethtool* gdebi-core* gpgv* groff-base*
grub* hdpam* host* inithooks* iptables* iputils-ping* kbd* klogd* less*
libapt-pkg-perl* libauthen-pam-perl* libc6-dev* libcap1* libdebconfclient0*
libdebian-installer4* libio-pty-perl* libmd5-perl* libnet-ssleay-perl*
libpam0g-dev* libparted1.7-1* libssl-dev* linux-image-2.6.24-27-generic*
linux-libc-dev* linux-ubuntu-modules-2.6.24-27-generic* locales* man-db*
mtools* nano* ntp* ntpdate* openssl* os-prober* python-apt* python-central*
python-dialog* python-support* resolvconf* rsync* screen* shellinabox*
sudo* sysklogd* syslinux* traceroute* turnkey-core-2009.10* turnkey-pylib*
unzip* user-setup* vim-common* vim-tiny* webmin* webmin-custom*
webmin-file* webmin-firewall* webmin-net* webmin-passwd* webmin-shell*
webmin-software* webmin-ssh* webmin-syslog* webmin-text-editor*
webmin-theme-stressfree* webmin-time* webmin-updown* webmin-useradmin*
wget* xkb-data* zlib1g-dev*
0 upgraded, 0 newly installed, 88 to remove and 0 not upgraded.
After this operation, 173MB disk space will be freed.
```

Use package metadata to compute set that can be removed.

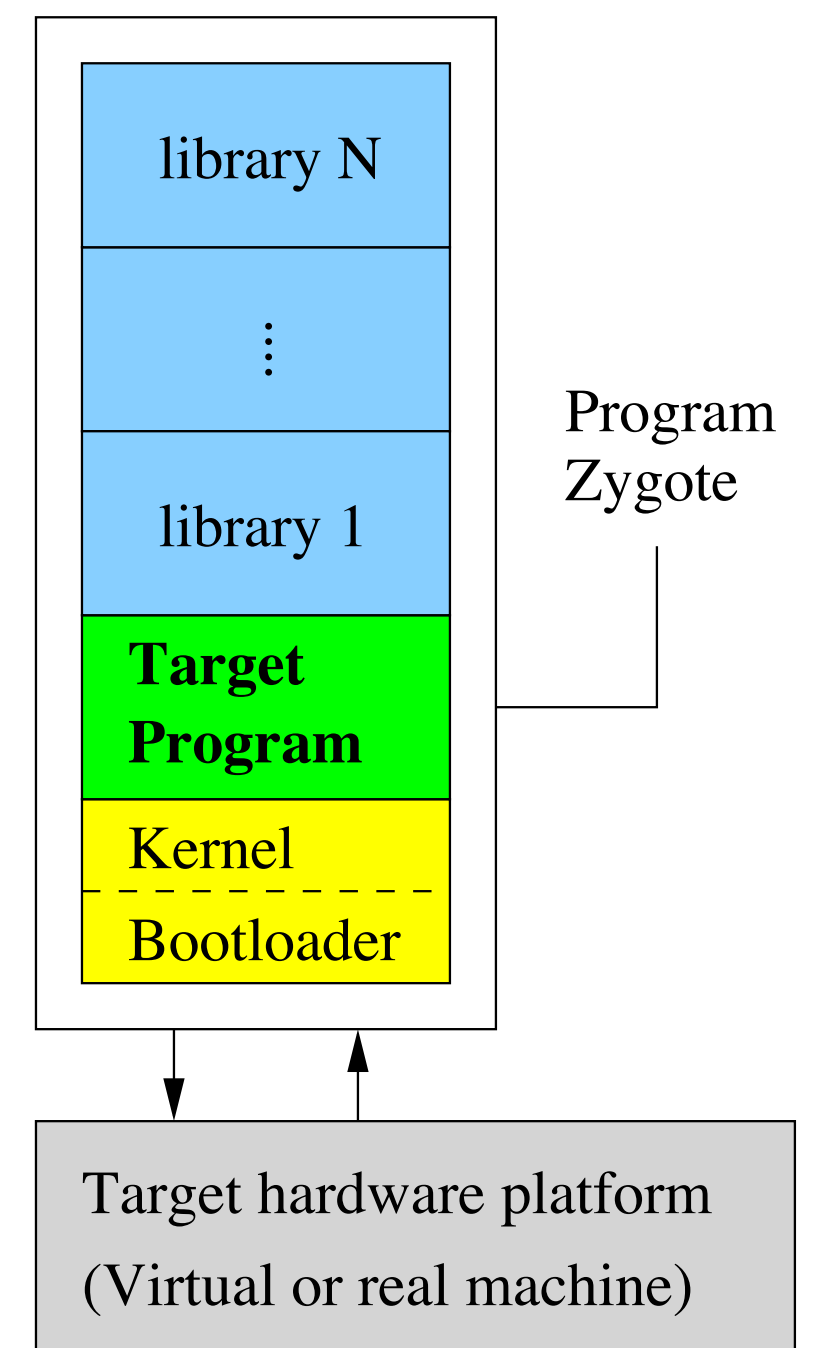
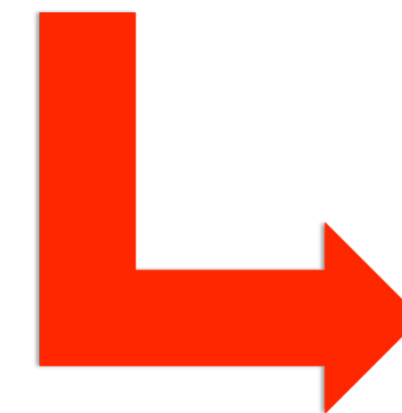
```
if( argc < 3 || argc > 3 || !__CMI__(spectime)strcmp(argv[1], "-?") ) {
    (void)__CMI__(spectime)printf("hint: nweb Port-Number Top-Directory\n\n"
    "\tnweb is a small and very safe mini web server\n"
    "\tnweb only servers out file/web pages with extensions named below\n"
    "\t and only from the named directory or its sub-directories.\n"
    "\tThere is no fancy features = safe and secure.\n\n"
    "\tExample: nweb 8181 /home/nwebdir &\n\n"
    "\tOnly Supports:");
    for(i=0;extensions[i].ext != 0;i++)
        (void)__CMI__(spectime)printf(" %s",extensions[i].ext);

    (void)__CMI__(spectime)printf("\n\tNot Supported: URLs including \"..\",
    "\tNot Supported: directories / /etc /bin /lib /tmp /usr /dev /sbin \n"
    "\tNo warranty given or implied\n\tNigel Griffiths nag@uk.ibm.com\n"
    );
    exit(0);
}
```

Insert specialization directives for C-Mix/II, Tempo.

Current Approach: Tool to build self-contained software packages. Specify environment to minimize external dependencies. Use partial evaluation to winnow the codebase. Specialize with respect to target data to reduce package size.

- > **occam /configure**
- > **occam make**
- > **occam make install**



Build program with all code dependencies.

```
#include <math.h>
float compute_building_height(float building_distance){
    float viewing_angle = pi/4;
    float building_height =
        compute_opposite(building_distance, viewing_angle);
    return building_height;
}
float compute_opposite(float adjacent, float angle){
    float opposite = adjacent * tan(angle);
    return opposite;
}
```

Use partial evaluation with respect to known inputs to prune program, dependencies.



```
float compute_building_height(float building_distance){
    float building_height =
        compute_opposite_specialized(building_distance);
    return building_height;
}
float compute_opposite_specialized(float adjacent){
    float opposite = adjacent * 1;
    return opposite;
}
```

Use LLVM compiler optimization for intra-procedural pruning and iteratively compute inter-procedural interfaces (specializing when possible) till fixed point reached.

