Distribute Legacy Applications to Thousands of PC

Boinc / yoyo@home / Wrapper

Rechenkraft.net - Uwe Beckert – 23.05.2013

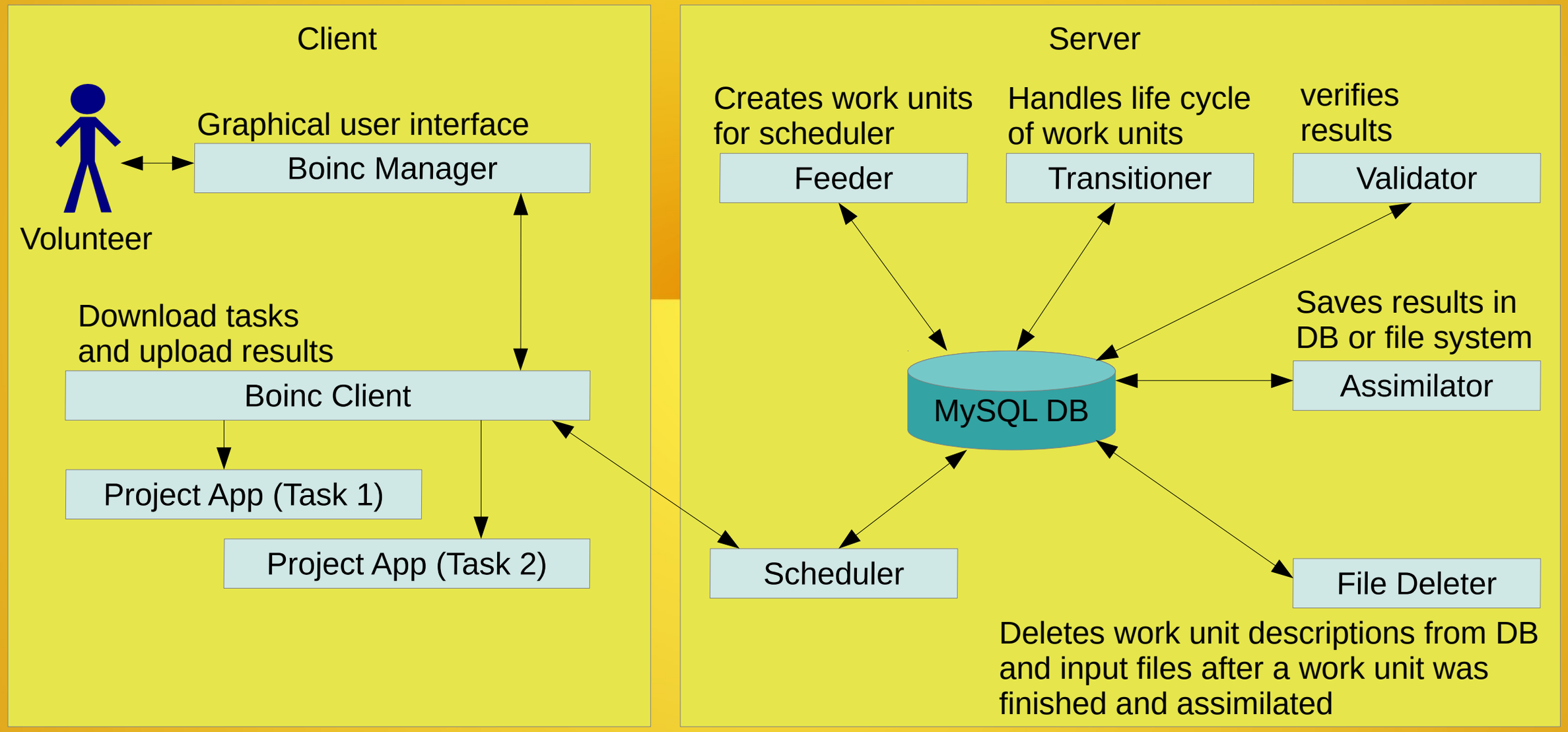
Berkeley Open Infrastructure for Network Computing

- open source middle ware system
- for volunteer and grid computing
- originally developed to support the SETI@home project
- For what can it be used?

  a) to solve thousands of independent problems

  b) a BIG problem which can be cut up to thousands of small problems

Components


Client
Graphical user interface
Boinc Manager
Volunteer
Download tasks
and upload results
Boinc Client
Project App (Task 1)
Project App (Task 2)
Server
Creates work units
for scheduler
Feeder
Handles life cycle
of work units
Transitioner
verifies
results
Validator
Saves results in
DB or file system
Assimilator
MySQL DB
Scheduler
File Deleter
Deletes work unit descriptions from DB
and input files after a work unit was
finished and assimilated

For what can it be used ?

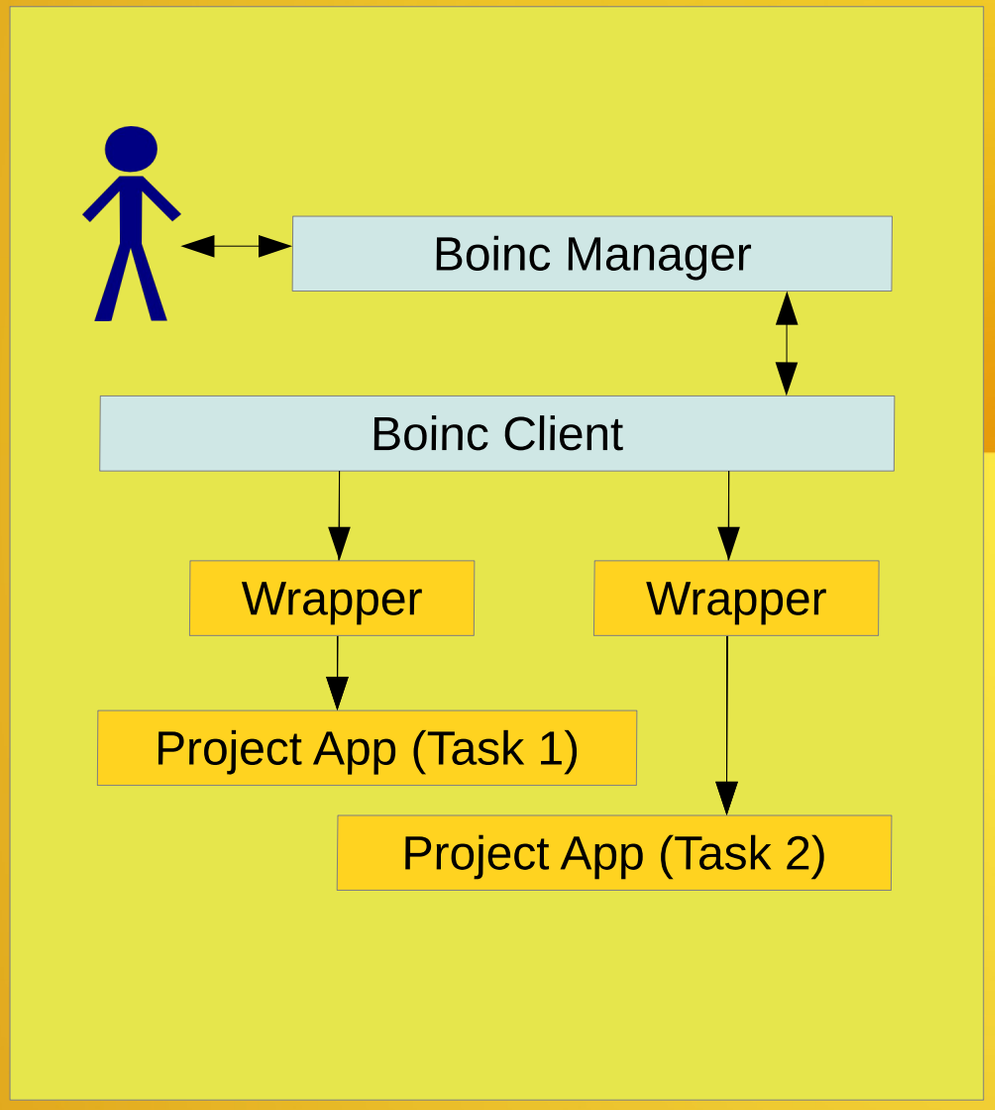
Quake Catcher Network	Distributed sensing	Seismology	Star
Radioactive@Home	Distributed sensing	Environmental research	BOI
RNA World	Biologie und Medizin	Molecular biology	Rec
Rosetta@home	Biologie und Medizin	Biology	Univ
SAT@home	Mathematics, computing, and games	Computer Science	Inst Inst Con of S
SETI@home	Astronomy, Physics, and Chemistry	Astrophysik, Astrobiologie	BOI Kali
SIMAP	Biologie und Medizin	Biology	Univ
Spinhenge@home	Astronomy, Physics, and Chemistry	Chemical engineering and nanotechnology	Biel Scie
sudoku@vtaiwan	Mathematics, computing, and games	Mathematics	Nati Taiv
Superlink@Technion	Biologie und Medizin	Genetic linkage analysis	Tec
Surveill@Home	Mathematics, computing, and games	Web performance	Univ
SZTAKI Desktop Grid	Mathematics, computing, and games	Mathematics	MTA and

the wrapper platform
Yoyo @ home
for natural science

www.rechenkraft.net/yoyo

- Run legacy applications on thousands of volunteer computers
  - Harmonious Trees
  - Elliptic Curve Factorization (includes 9 projects)
  - Muon
  - evolution@home
  - OGR (distributed.net)
  - Euler (6,2,5)

a) binary legacy application



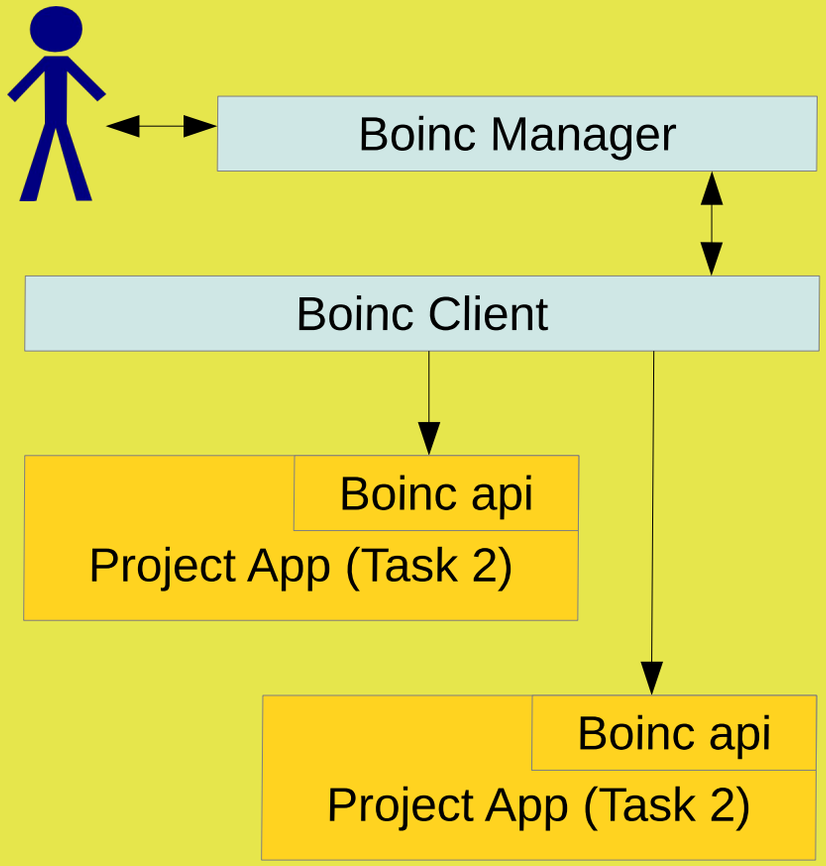
The source code of wrapper is in boinc/samples. You can get pre-compiled versions here:

- wrapper_26002_windows_intelx86.zip
- wrapper_26002_windows_x86_64.zip
- wrapper_26002_i686-pc-linux-gnu.zip
- wrapper_26002_x86_64-pc-linux-gnu.zip
- wrapper_26002_i686-apple-darwin.zip
- wrapper_26002_x86_64-apple-darwin.zip

job.xml for wrapper

```
<job_desc>
    <task>
        <application>worker</application>
        [ <stdin_filename>stdin_file</stdin_filename> ]
        [ <stdout_filename>stdout_file</stdout_filename> ]
        [ <stderr_filename>stderr_file</stderr_filename> ]
        [ <command_line>--foo bar</command_line> ]
        [ <weight>X</weight> ]
        [ <checkpoint_filename>filename</checkpoint_filename> ]
        [ <fraction_done_filename>filename</fraction_done_filename> ]
    </task>
    <task>
     ...
    </task>
</job_desc>
```

b) legacy app with C source



Mandatory

- Add calls to BOINC initialization and finalization routines.
- Precede each fopen() call with a BOINC function that maps logical to physical names.
- Link it with the BOINC runtime library.

Optional

- Report fraction done
- Use configured checkpoint intervals
- Report checkpoints

BOINC API

Add calls to BOINC initialization and finalization routines.

```
#include "boinc_api.h"
int main(){
    boinc_init();
    …
    boinc_finish(0);
}
```

Precede each fopen() with a BOINC function that maps logical to physical names.

```
// f = fopen("my_file", "r");  // replaced with
string resolved_name;
retval = boinc_resolve_filename_s("my_file", resolved_name);
if (retval) fail("can't resolve filename");
f = boinc_fopen(resolved_name.c_str(), "r");
```

BOINC API

Report fraction done

```
double m=1.0-(double)headcount/(double)totalheadcount;
boinc_fraction_done(m); // 0 < m < 1
```

Use configured checkpoint intervals and report checkpoints

```
if (boinc_time_to_checkpoint()) {
    fio=boinc_fopen("ckpt.txt", "w");
    … // save the data
    fclose(fio);
    boinc_checkpoint_completed();
}
```

BOINC API

Link it with the BOINC runtime library.

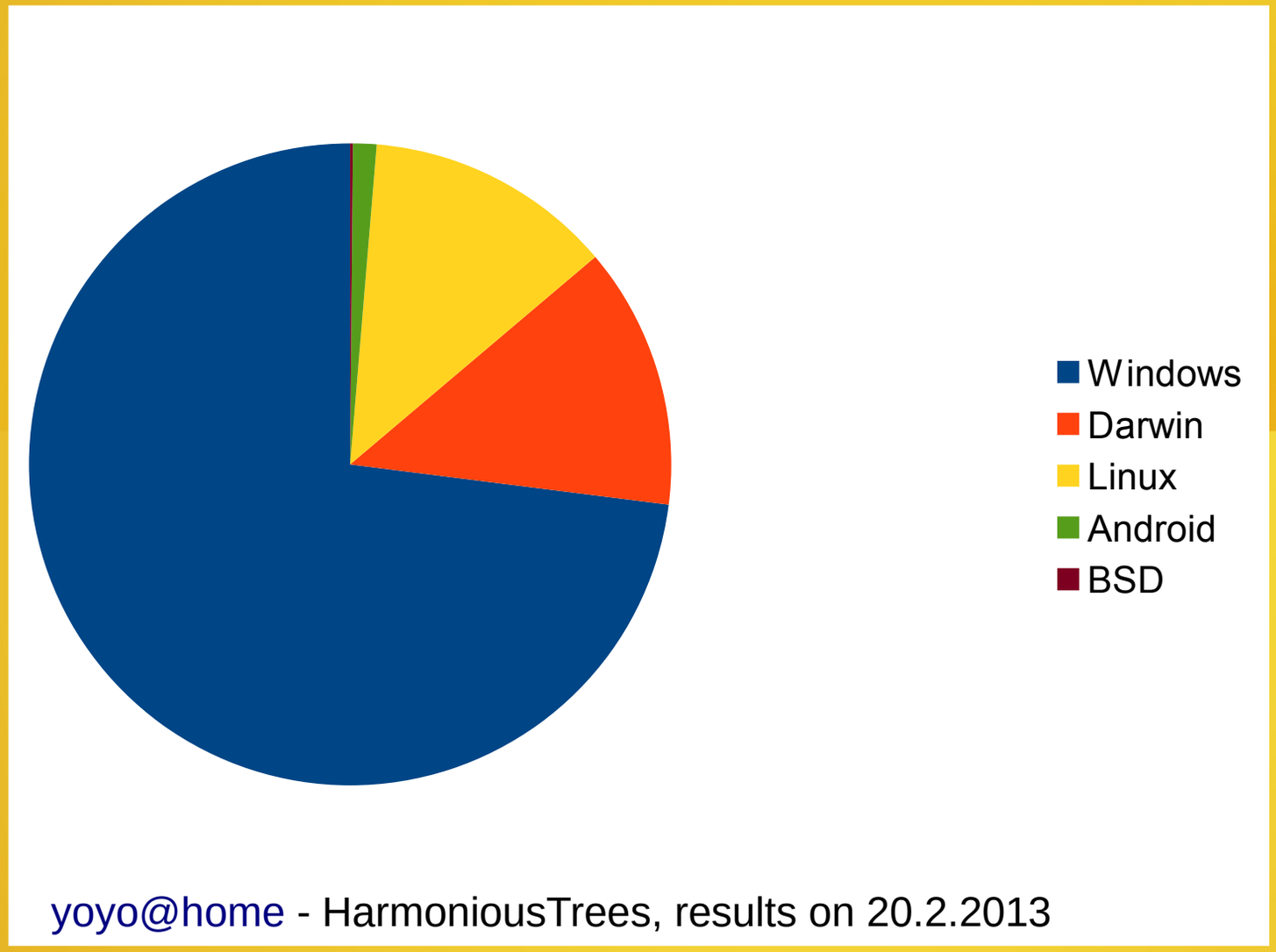
```
BOINC_DIR = ../../boinc
BOINC_API_DIR = $(BOINC_DIR)/api
BOINC_LIB_DIR = $(BOINC_DIR)/lib
CXXFLAGS = -O3 --static -static-libgcc \
    -I$(BOINC_LIB_DIR) -I$(BOINC_API_DIR) \
    -L$(BOINC_API_DIR) -L$(BOINC_LIB_DIR) \
    -L.

app: app.o libstdc++.a $(BOINC_LIB_DIR)/libboinc.a $(BOINC_API_DIR)/libboinc_api.a
    g++ $(CXXFLAGS) -o $@ app.o libstdc++.a -pthread -lboinc_api -lboinc -static-libgcc
    strip $@
```

Problems

- Application must be self contained
- Link with -static-libgcc
- Runtime 1 – 10h
- Checkpoints
- Progress indicator
- Result validation (quorum, Linux/Windows/Mac eol)
- Credits
- Volunteers
  - Regular news, answer questions in forum
  - Be honest and communicate open also about problems

Which Platform to support



Ideas - Brainstorming

- Ready made Boinc application for bio/med open source tools, e.g.:
  - mfold (www.bioinfo.rpi.edu/applications/mfold)
  - autodock (autodock.scripps.edu)
  - mopac (openmopac.net)
  - gromacs (gromacs.org)
  - scilab
  - ...
- Job submission interface

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