The gory details of the build service backend

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Outline

Data management
- storing projects and packages
- the source repository

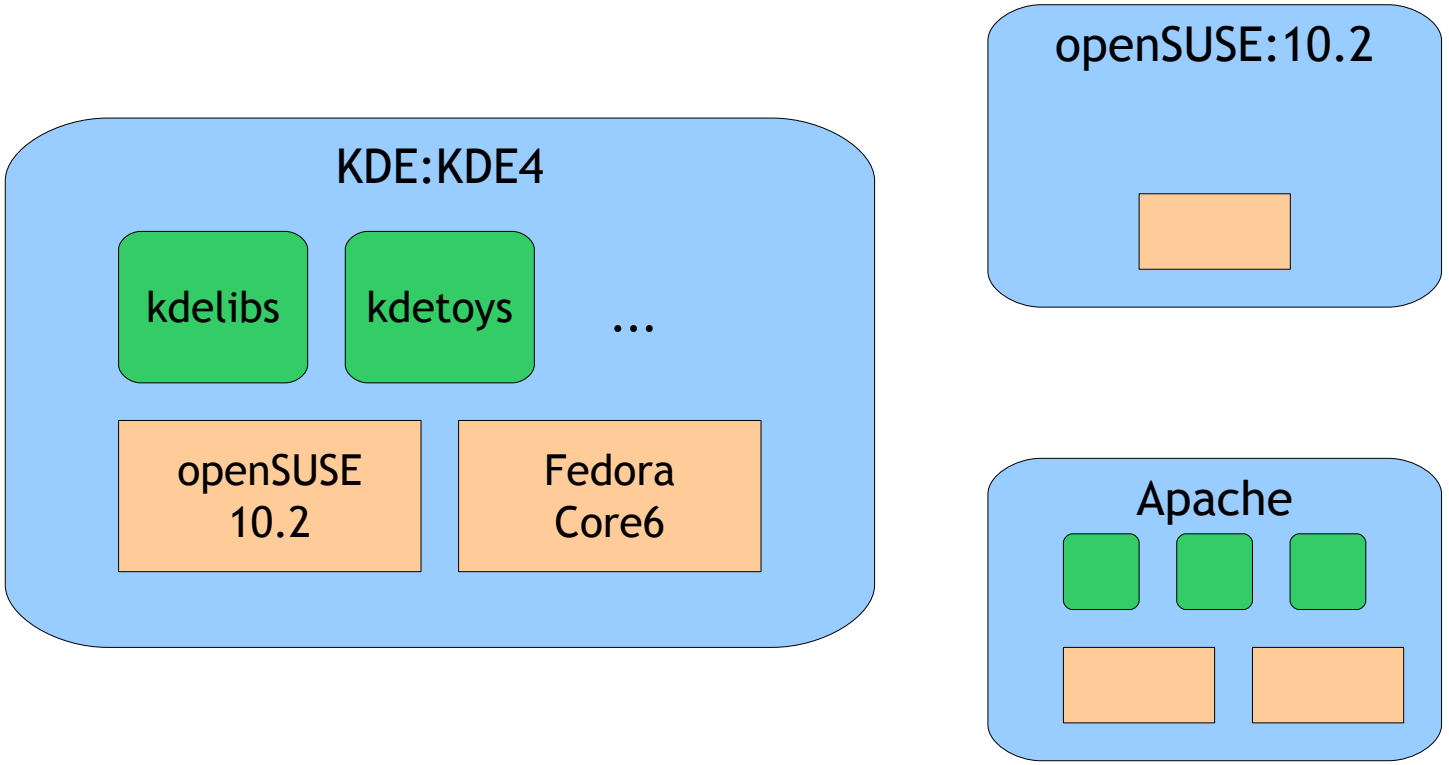
Server framework
- data flow client to the backend
- example: listing package files

Building packages
- from scheduler to build host and back
- scalability issues

Automatic rebuild triggering
- package meta files

Backend basics

Projects, packages and repositories



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How projects are stored

A project consists of

- a project name
- project meta data (summary, description, repositories...)
- project build configuration (setup information, preferred binary packages, rpm macros...)
- multiple packages

```
projects/home:mlschroe.xml
        /home:mlschroe.conf  (if not empty)
        /home:mlschroe.pkg/
```

How packages are stored

A package consists of

- a package name
- package meta data (summary, description, ...)
- package revision log

```
/projects/home:mlschroe.pkg/
    screen.xml
    screen.rev
```

Revision log format (last line is latest revision):

```
12|76|f6d2e7a398fdbd801d7ddc18eaa76e2d|4.0.2|1155842871|mlschroe|
Revision                                version
   Release number                             checkin time
      Source repository identifier                        checkin user
```

The source repository

Manages sources of packages

- allows retrieval of old versions
- switching to new source revisions must be atomic
- identical files in multiple projects and revisions should be shared, i.e. not take extra disk space

Implementation

- files are prefixed with the md5sum value of their content
- a revision is identified by the md5sum over a MD5SUMS file
- nothing gets deleted, just new files added

The source repository (cont.)

Example: the screen package

```
revision:
    screen_4.0.2-4.1.diff.gz
    screen_4.0.2-4.1.dsc
    screen_4.0.2-4.1.spec
    screen_4.0.2.orig.tar.gz

MD5SUMS:
    8f8725fa9b3385042115e84a06866ce6  screen_4.0.2-4.1.diff.gz
    64276af3d6f9c364528fb49223b995a3  screen_4.0.2-4.1.dsc
    47cc233ceb7ba64bf43807978b52c40a  screen_4.0.2-4.1.spec
    ed68ea9b43d9fba0972cb017a24940a1  screen_4.0.2.orig.tar.gz

md5sum MD5SUMS:
    f6d2e7a398fdbd801d7ddc18eaa76e2d  MD5SUMS
```

The source repository (cont.)

Example: the screen package

```
source/screen/
    8f8725fa9b3385042115e84a06866ce6-screen_4.0.2-4.1.diff.gz
    64276af3d6f9c364528fb49223b995a3-screen_4.0.2-4.1.dsc
    47cc233ceb7ba64bf43807978b52c40a-screen_4.0.2-4.1.spec
    ed68ea9b43d9fba0972cb017a24940a1-screen_4.0.2.orig.tar.gz
    ...
    ...
    f6d2e7a398fdbd801d7ddc18eaa76e2d-MD5SUMS
    ...
```

Revision identifier is MD5SUMS' md5sum:

```
f6d2e7a398fdbd801d7ddc18eaa76e2d
```

The source repository (cont.)

How to retrieve a file from the repository:

Task: read file `screen_4.0.2-4.1.spec` from source revision `f6d2e7a398fdbd801d7ddc18eaa76e2d` package `screen`:

- enter directory `source/screen`
- read `f6d2e7a398fdbd801d7ddc18eaa76e2d-MD5SUMS`
- find md5sum of file `screen_4.0.2-4.1.spec`: `47cc233ceb7ba64bf43807978b52c40a`
- read file `47cc233ceb7ba64bf43807978b52c40a-screen_4.0.2-4.1.spec`

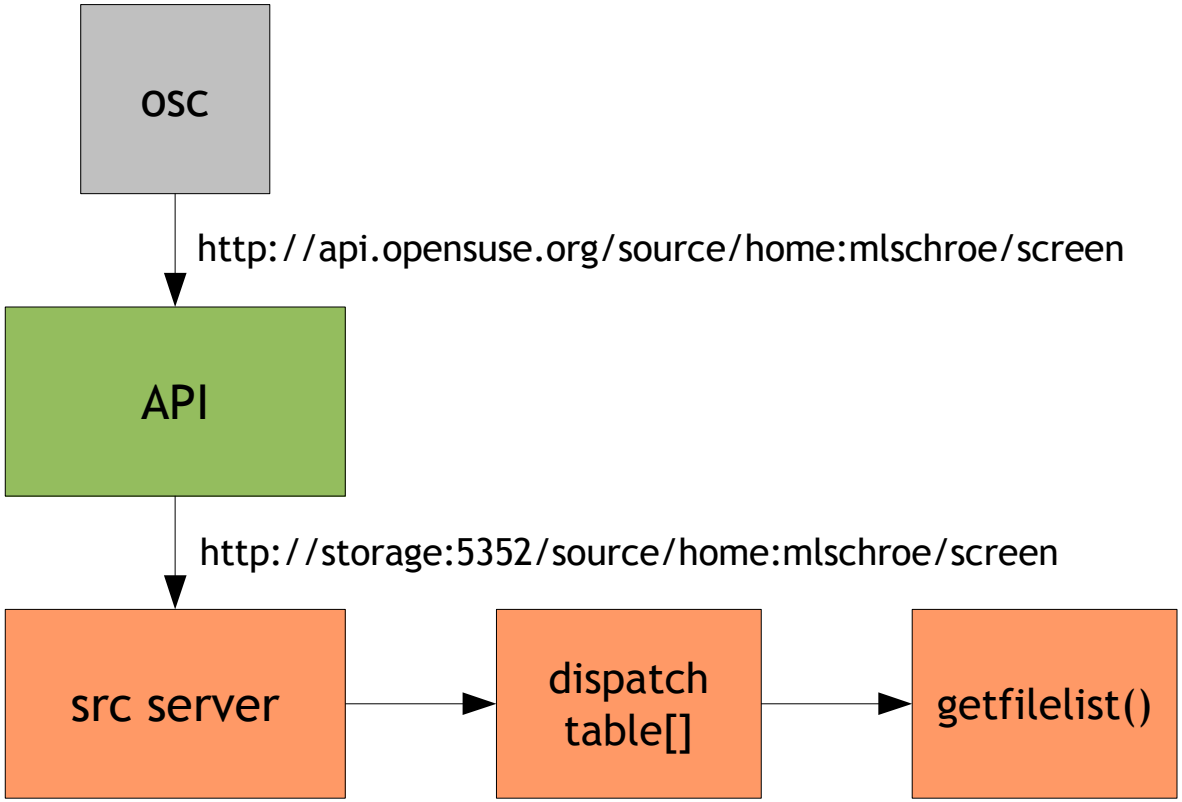
Server Framework

Flexible, extensible http server framework

- written for the build server, perl5
- supports file/cpio streaming
- automatic parameter type checking
- forks a process for every request, but requests taking long time can be passed to a special process
  - used for AJAX updates of build status and for logfile streaming
  - if load gets too high, return “retry after *n* seconds” error

Server Framework (cont.)

Example: getting a source listing



Server Framework (cont.)

Requests are dispatched via a dispatch array:

```
my $dispatches = [ ...
    '/source/$project/$package rev?' => \&getfilelist,
... ];


sub getfilelist {
    my ($cgi, $projid, $packid) = @_;
    my $rev = getrev($projid, $packid, $cgi->{'rev'});
    my $files = lsrep($projid, $packid, $rev->{'srcmd5'});
    my $dir = {'name' => $packid, 'rev' => $rev->{'rev'}};
    ...
    $dir->{'entry'} = \@res;
    return ($dir, $BSXML::dir);
}
```

Server Framework (cont.)

Conversion to XML is done via the XML::Structured module

```
$BSXML::dir = [
  'directory' =>
    'name',
    'rev',
    [ $BSXML::entry ],
];


$BSXML::entry = [
  'entry' =>
    'name',
    'size',
];

$dirxml = XMLout($BSXML::dir, $dir);
$dir = XMLin($BSXML::dir, $dirxml);
```

```
<directory name="screen" rev="12">
  <entry name="screen_4.0.2-4.1.d..."
         size="33462" />
  <entry name="screen_4.0.2-4.1.dsc"
         size="624" />
  <entry name="screen_4.0.2-4.1.spec"
         size="1611" />
  <entry name="screen_4.0.2.orig..."
         size="840519" />
</directory>
```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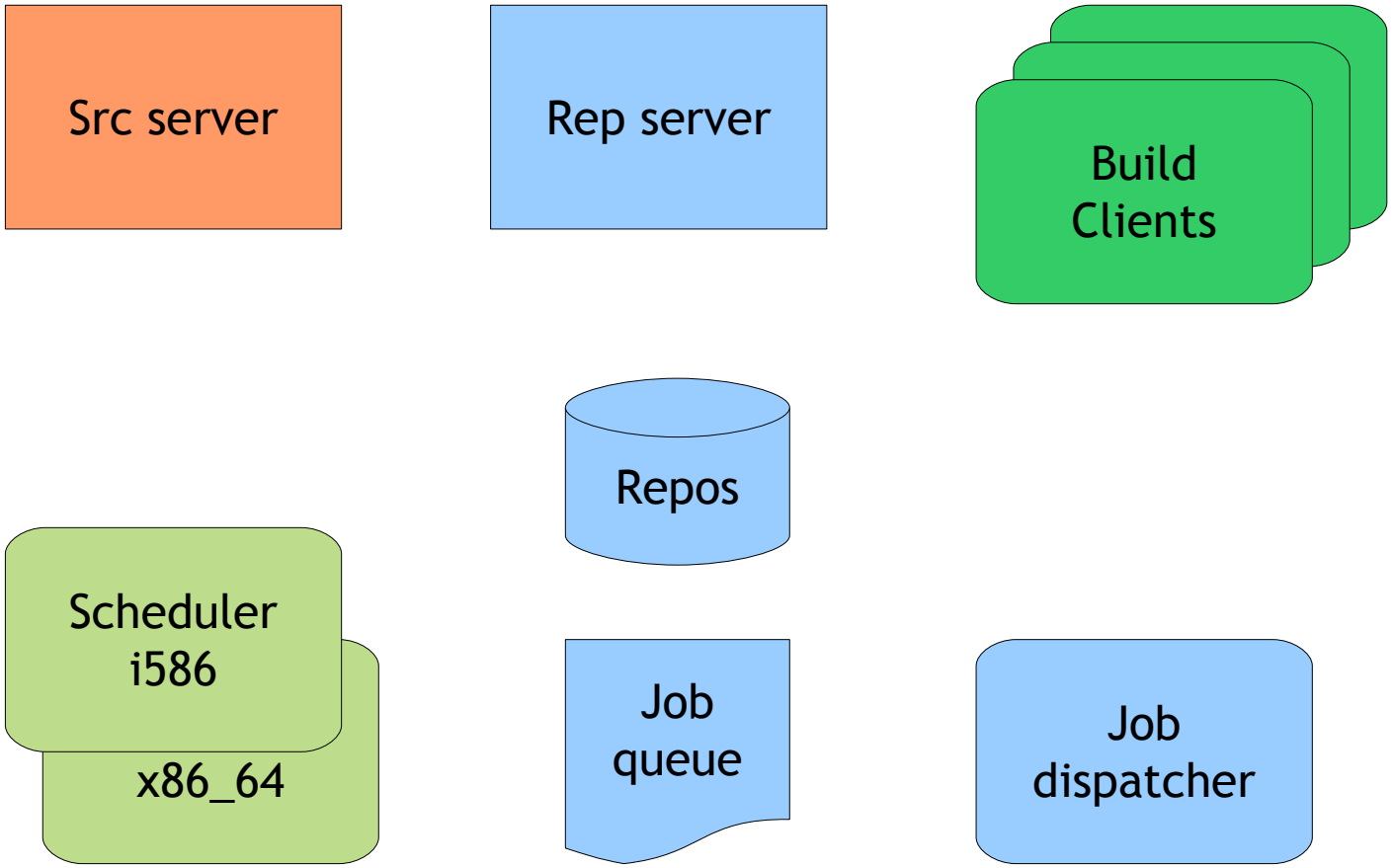
Backend Architecture



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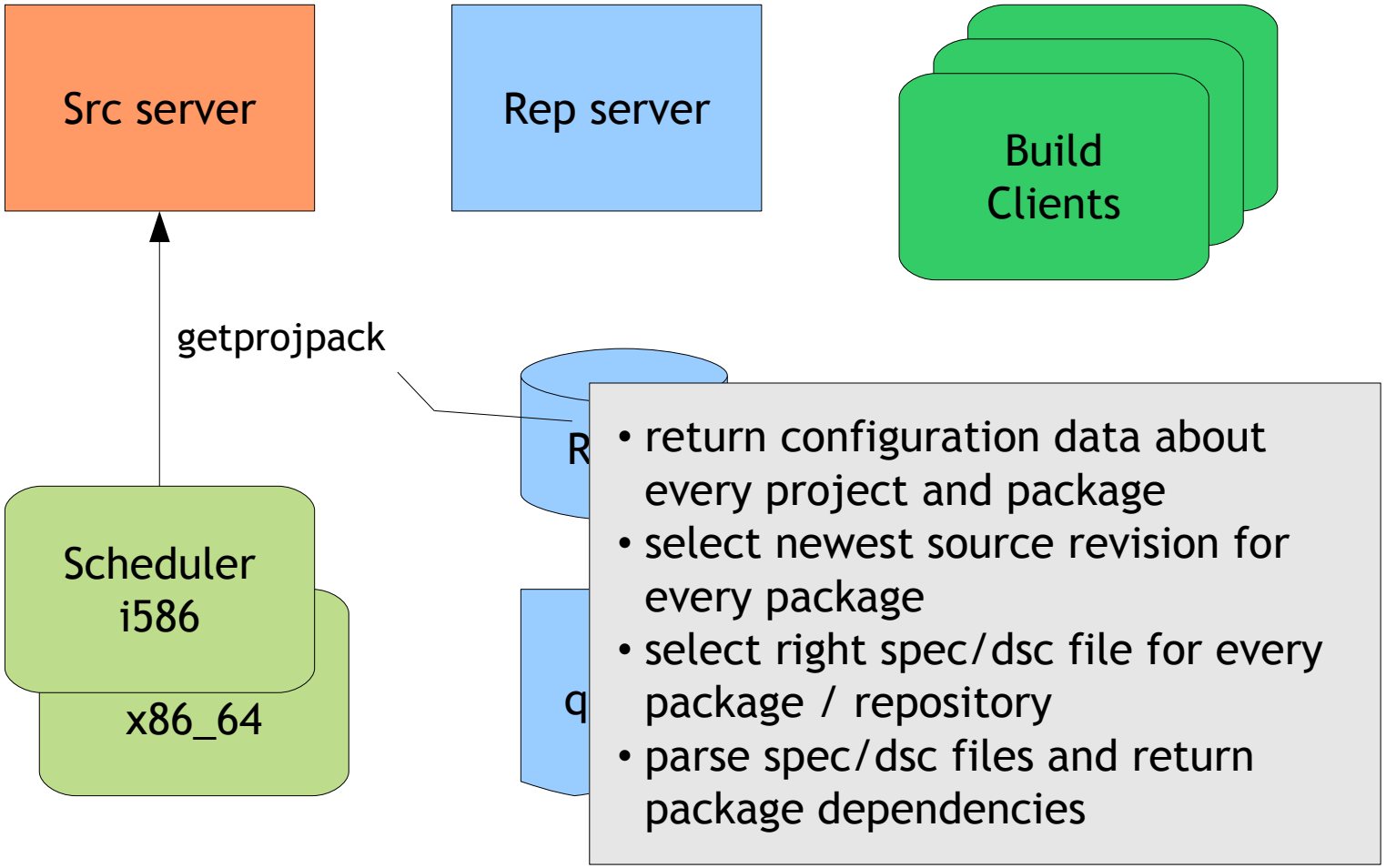
Backend Architecture



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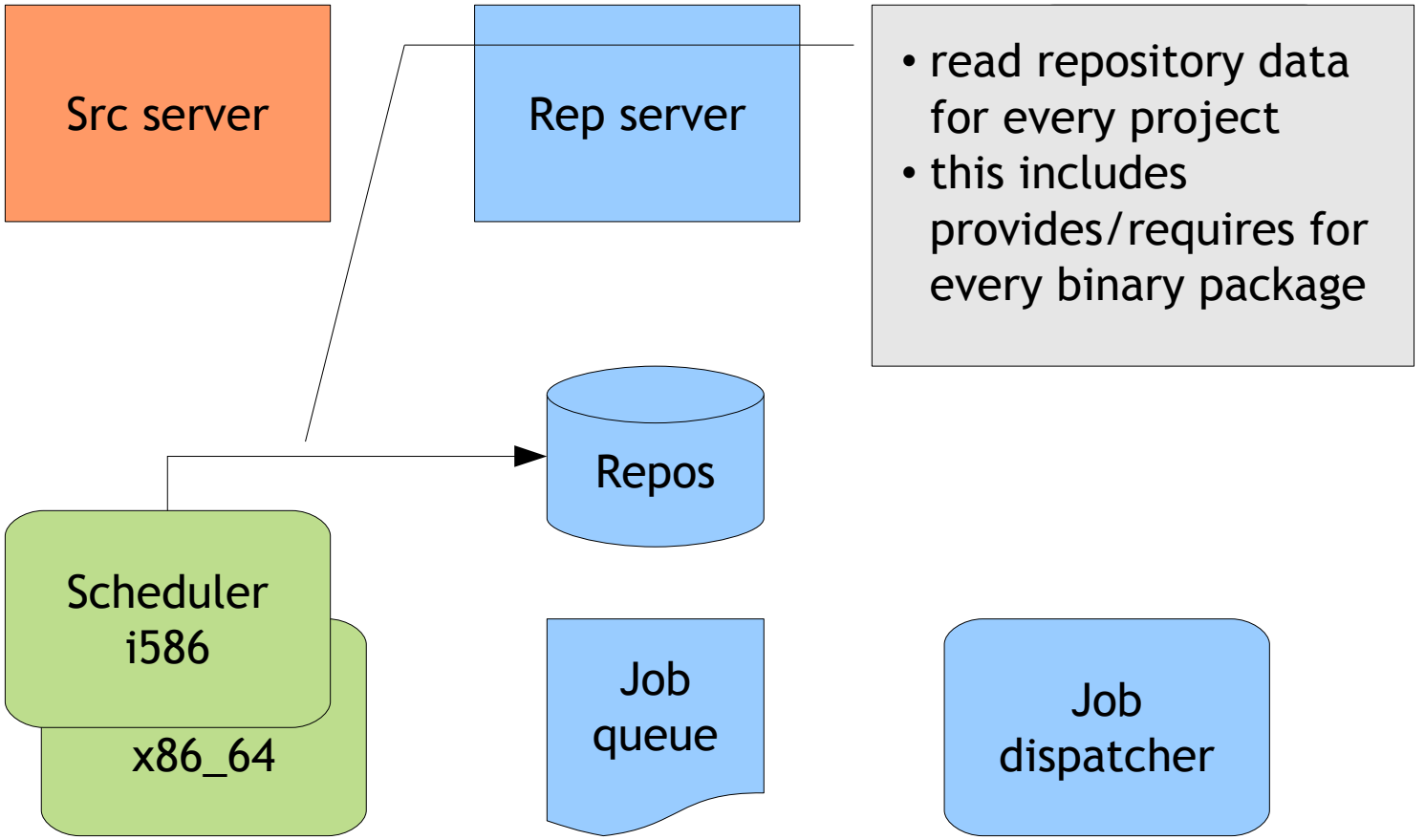
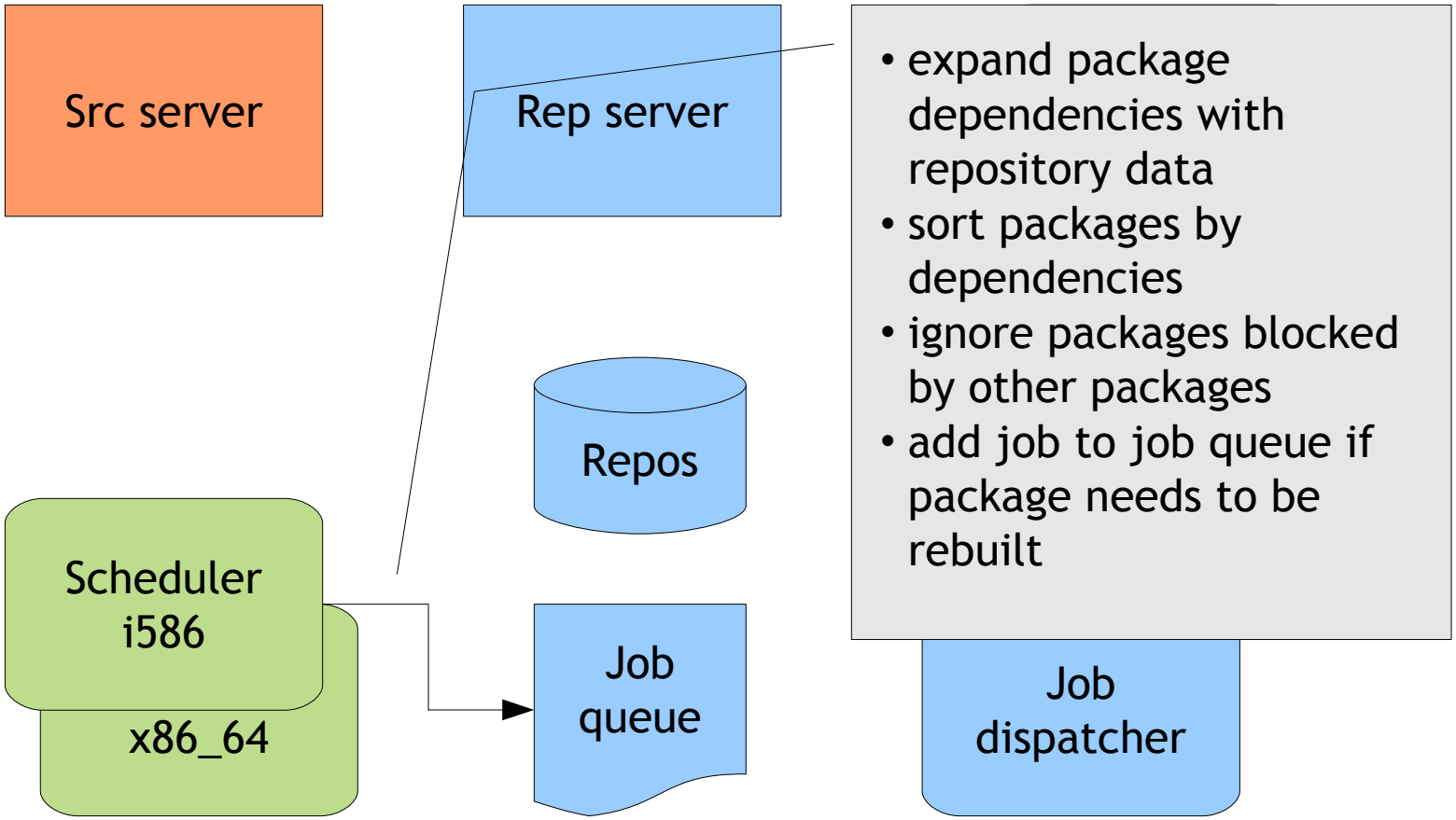
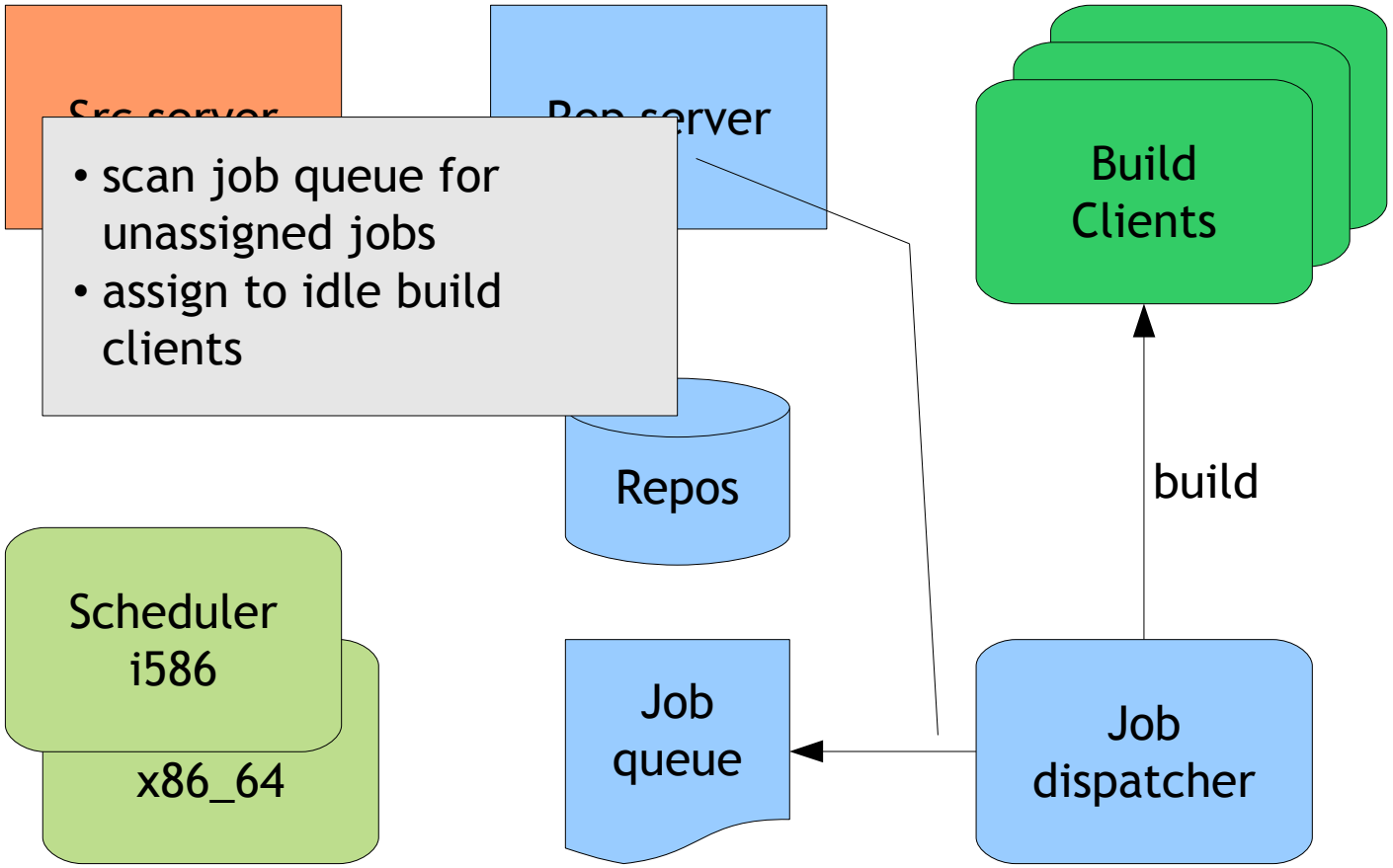
Backend Architecture



Backend Architecture



Backend Architecture



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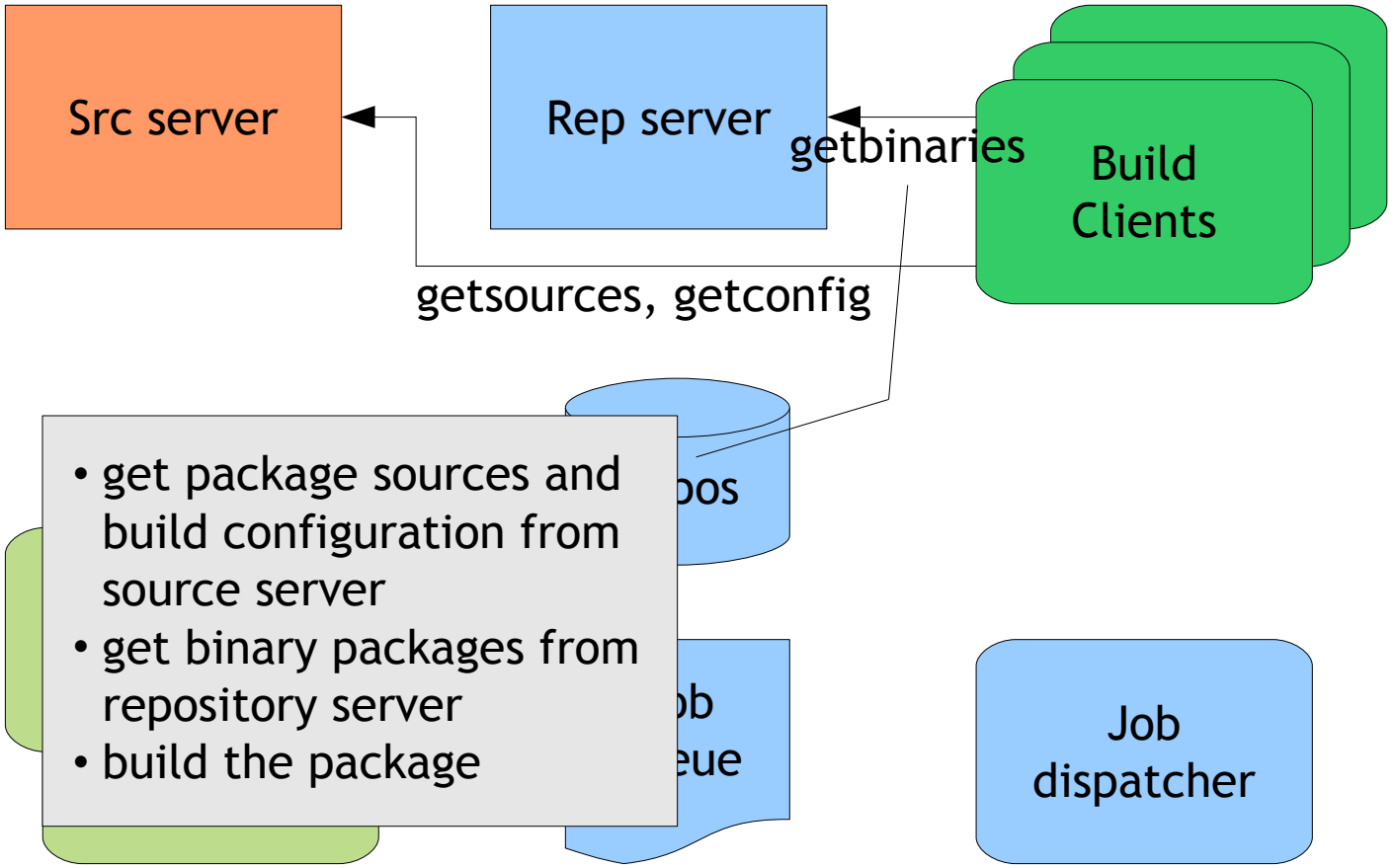
Backend Architecture



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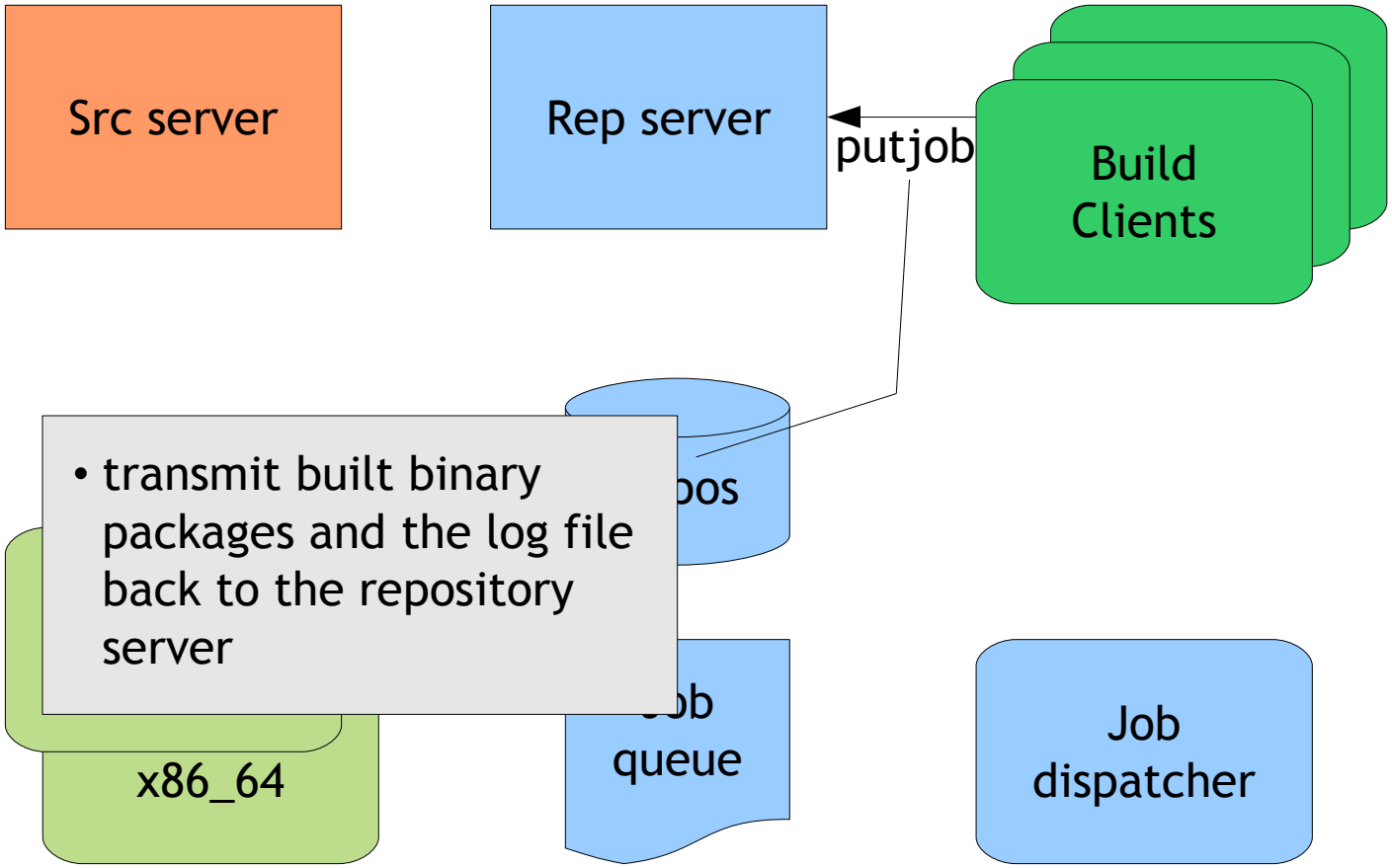
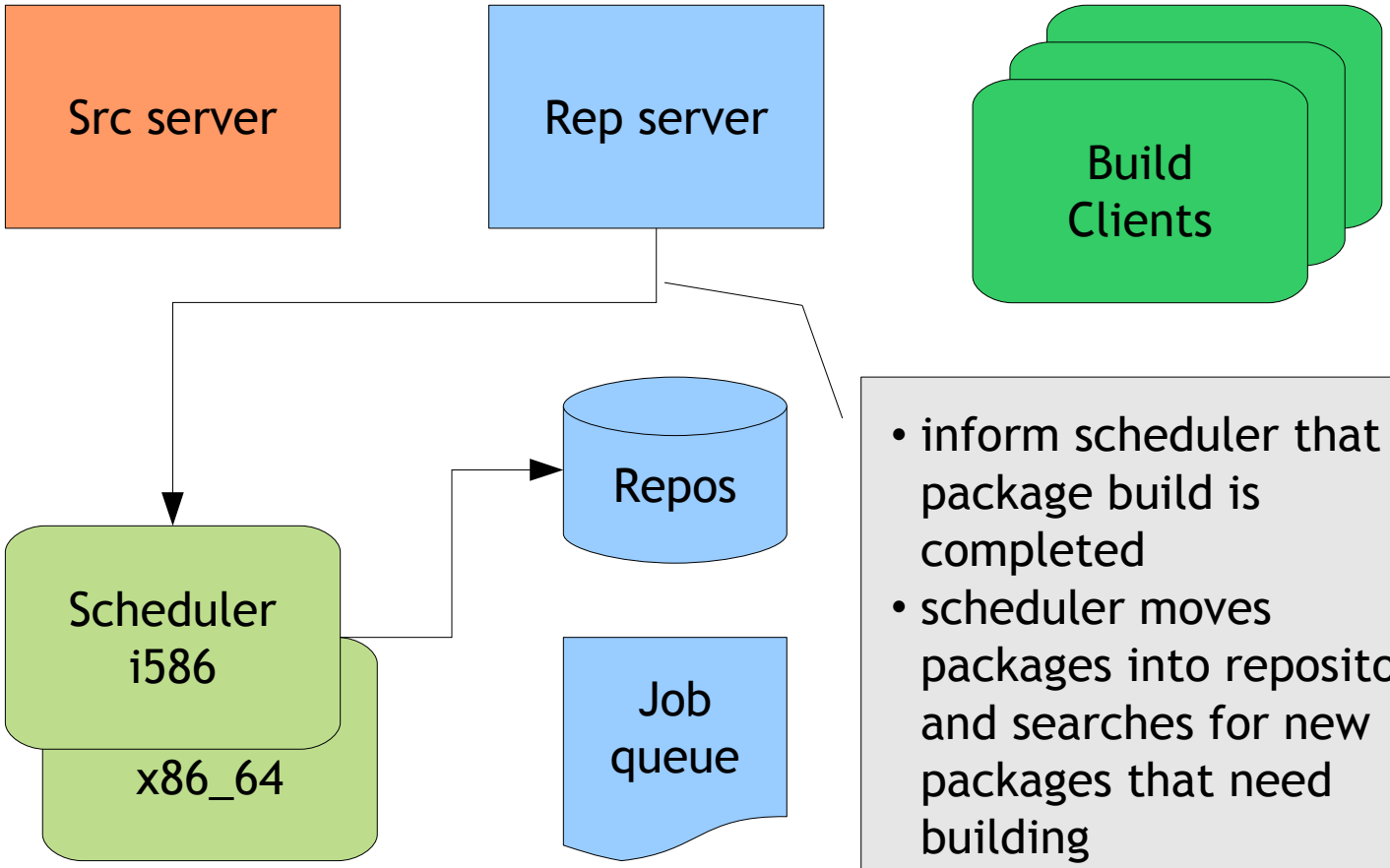
Backend Architecture



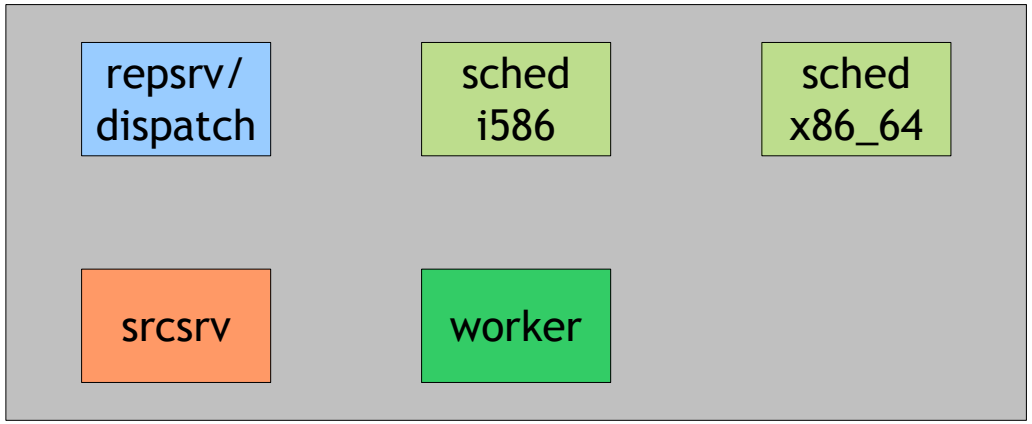
Backend Architecture



- inform scheduler that package build is completed
- scheduler moves packages into repository and searches for new packages that need building

Scalability

Simplest configuration: everything on one host



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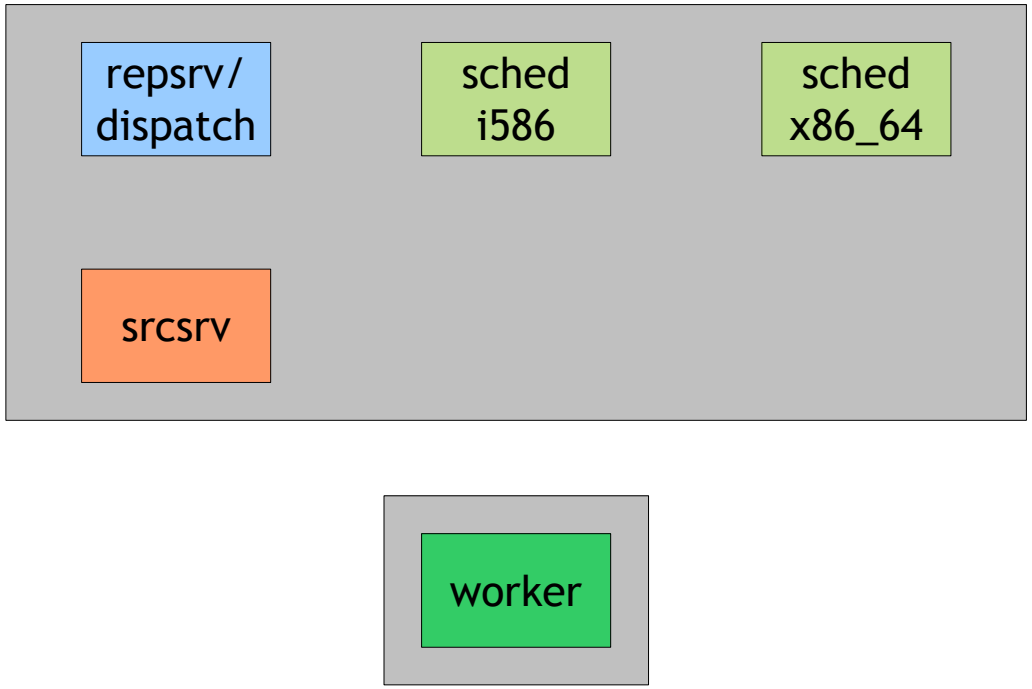
Scalability

Put build client on extra host



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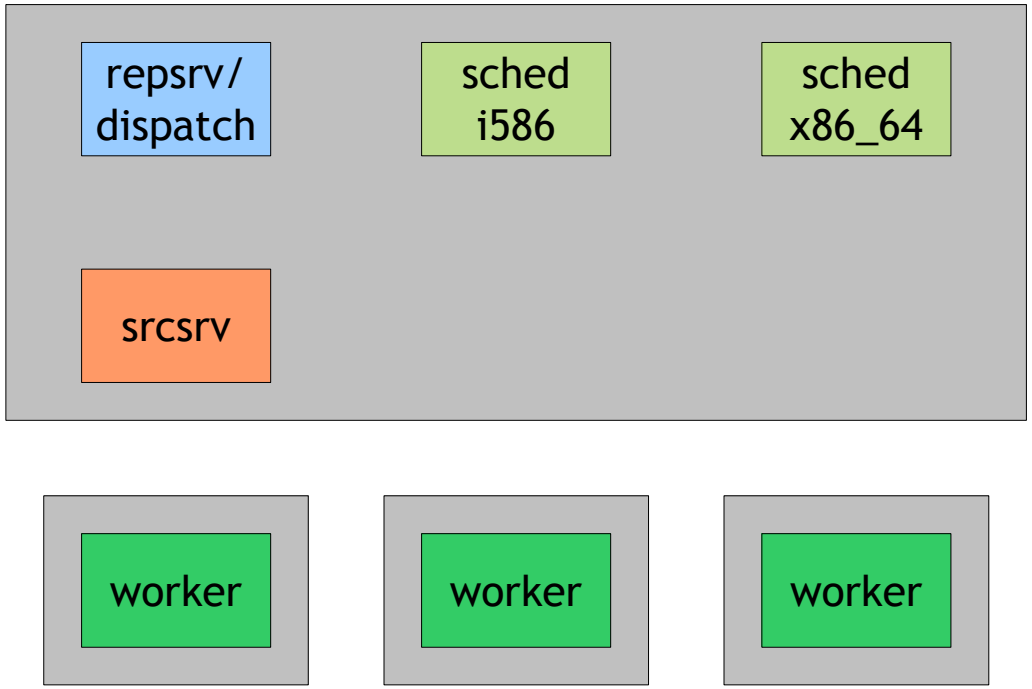
Scalability

Add more clients



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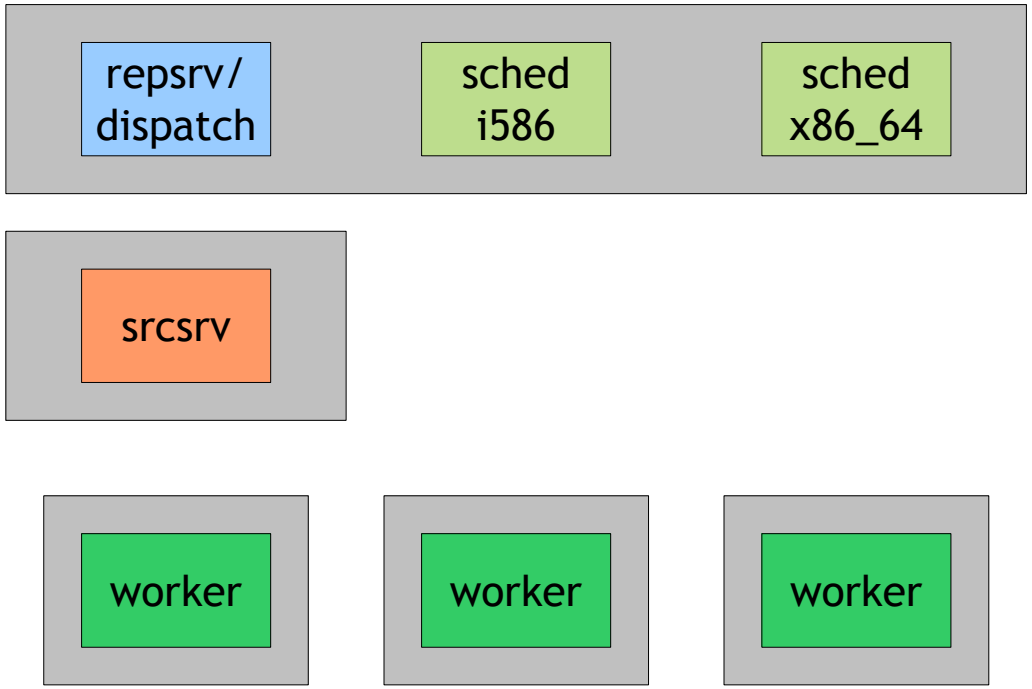
Scalability

Put source server on extra host



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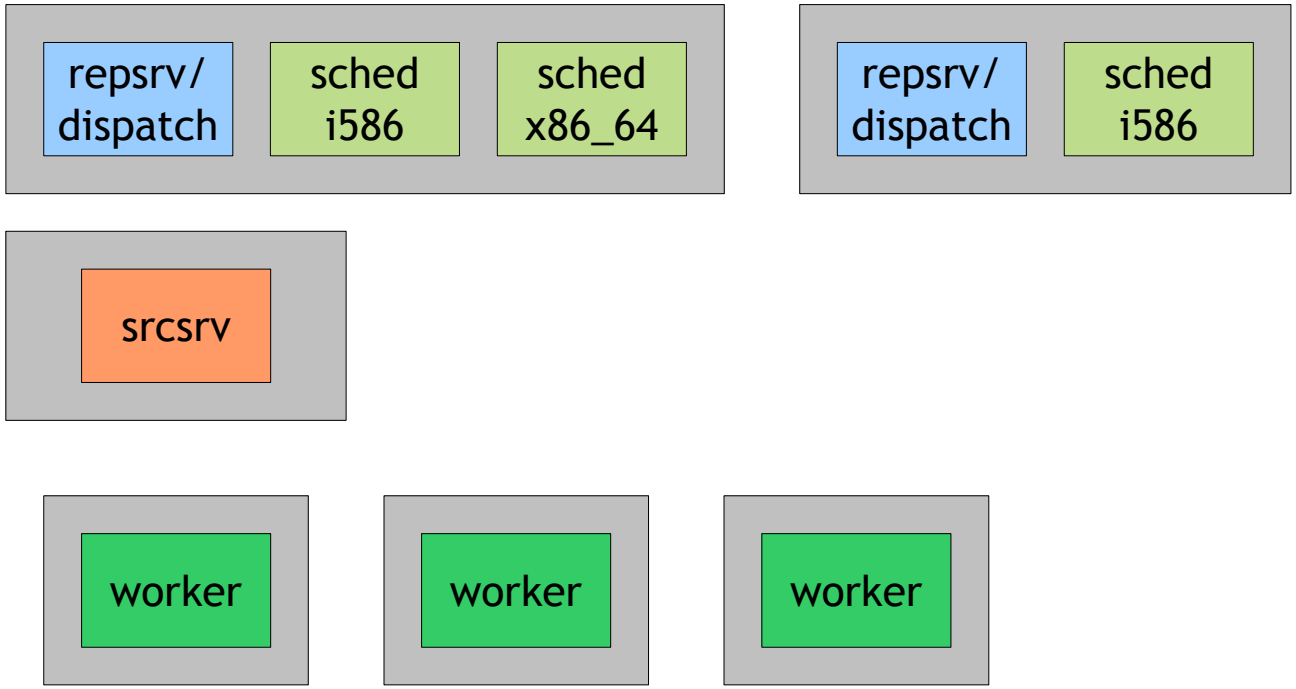
Scalability

Partition repositories



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Rebuild triggering

Packages automatically get rebuild if a package they depend on is changed

- naïve implementation that just looks for changed binary packages would lead to endless builds in case of dependency cycles
- Example:
  - gnome-keyring: BuildRequires: CASA-devel
  - CASA: BuildRequires: gtk-sharp
  - gtk-sharp: BuildRequires gtkhtml2-devel → gtkhtml2 → libgnome-keyring.so.0
- Solution: use source identifiers, track change propagation, and cut cycles

The dependency meta file

The dependency meta file consists of all package source identifiers used (direct and indirect)

Example: CASA package

- level 0: own source identifier
  ```
  e71a2f9181669e4c787e6fbf7ce63414 CASA
  ```
- level 1: source md5 of direct dependencies
  ```
  ...
  8e72d8e96df97cbea7707ba26a3fc31d gtk-sharp
  ...
  ```
- level 2: source md5 of dependencies over one hop
  ```
  ...
  0724adba09a56cea17d41fdb35450d45 gtk-sharp/gnome-keyring
  ...
  ```

Packages are triggered for rebuild *iff* the meta file of the last build is different from the calculated one

Conclusion

Data storage

- project and package data is stored in simple xml files
- the source repository stores package files in an efficient way, nothing gets deleted

Server Framework

- new functions can be added with just a couple of lines of perl code

Package building

- scheduler → dispatcher → build client → repository
- all data is transferred via http, no NFS

Rebuild triggering

- works by comparing meta files containing source md5sums

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