

www.suse.com

Open Build Service



Open Build Service: Best Practice Guide

List of Authors: Adrian Schröter

Copyright © 2006–2012 Novell, Inc. and contributors. All rights reserved.

Permission is granted to copy, distribute and/or modify this document under the terms of the GNU Free Documentation License, Version 1.2 or (at your option) version 1.3; with the Invariant Section being this copyright notice and license. A copy of the license version 1.2 is included in the section entitled “GNU Free Documentation License”.

For Novell trademarks, see the Novell Trademark and Service Mark list <http://www.novell.com/company/legal/trademarks/tmlist.html>. Linux* is a registered trademark of Linus Torvalds. All other third party trademarks are the property of their respective owners. A trademark symbol (®, ™ etc.) denotes a Novell trademark; an asterisk (*) denotes a third party trademark.

All information found in this book has been compiled with utmost attention to detail. However, this does not guarantee complete accuracy. Neither Novell, Inc., SUSE LINUX Products GmbH, the authors, nor the translators shall be held liable for possible errors or the consequences thereof.

Contents

About this Guide	vii
------------------	-----

1	How to use OBS web UI	1
1.1	Start page and Login	1
1.2	Create your home project	7
1.3	My Projects, Server Status	11
1.4	Create a link to a package in your home:	15
1.5	Repository Output: Built Packages	33
2	Basic Concepts and Work Styles	39
2.1	Setup a project re-using other projects binaries	39
2.2	Setup a project reusing other projects sources	39
2.3	Contribute Directly to External Projects	40
2.4	Contribute Indirectly to Foreign Projects	40
3	Publishing upstream binaries	41
3.1	Which instance to use?	41
3.2	Where to place your project?	42
3.3	Creating a package	43
3.4	Getting binaries?	43
4	OBS Local Setup	49
4.1	OBS test run on Microsoft Windows using VMware player	50
4.2	OBS 1 click install on openSUSE 11.3	51
4.3	OBS 1 click install on SLES(SUSE Linux Enterprise Server) 11	53
5	Boot Strapping	55
5.1	The issue	55
5.2	A cheat sheet	55
5.3	Creating my first project	59
6	OSC commands examples	61
6.1	osc, the Python command line client	61
6.2	Package tracking	66
6.3	.oscrc cheatsheet	66
7	Advanced Project Setups	69
7.1	Rebuild an entire project with changes	69
7.2	Integrate Source Handling	69
7.3	Use OBS for automated QA	69
8	Kernel Module Building	71
9	HOW TO -- a list of common questions and solutions	73

A	How to work on this Book	77
----------	---------------------------------	-----------

B	GNU Licenses	79
----------	---------------------	-----------

B.1	GNU General Public License	79
B.2	GNU Free Documentation License	82

About this Guide

This book is part of the official Open Build Service documentation. These books are considered to be reviewed and edited to be the reference documentation of OBS.

These books are not considered to be focused on a special OBS version. They are also not a replacement of the documentation inside of the openSUSE wiki. But content from the wiki may get consolidated and included in these books.

Furthermore these books get written by the OBS community, please check the chapter how to work on these books. We request esp. experienced users and administrators to join and to contribute to these books. It is not required to be a very good or even native English speaker, because we rely on community editors to improve the language.

How to use OBS web UI

This chapter explains and shows how you could use OBS web UI. We will show and use OBS web UI based on <http://build.opensuse.org>. You need to make an account first to follow this chapter contents.

1.1 Start page and Login

Open your favorite browser and navigate to <https://build.opensuse.org>.

Welcome to the openSUSE Build Service

This is the the public instance of the [Open Build Service \(OBS\)](#) used for development distribution and to offer packages from same source for Fedora, Debian, Ubuntu, SUS and other distributions..

Please find further details of this service on our [wiki pages](#)

This instance offers a special [package search interface](#). Users of any distribution can packages for their distribution. For developers it is an efficient place to build up group through its project model.



[All Projects](#)








[Search](#)



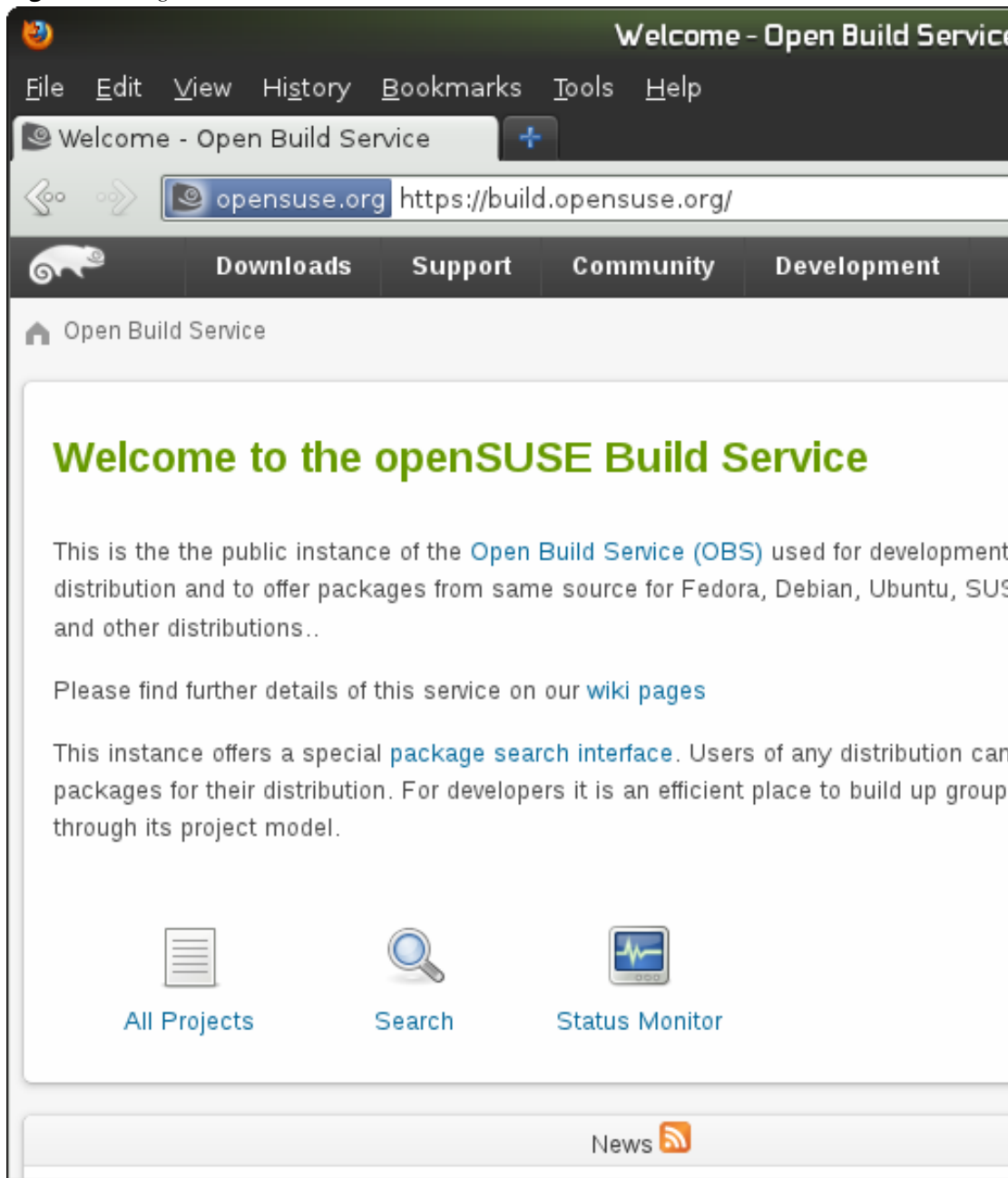
[Status Monitor](#)

News 

 OBS means "Open Build Service" from now on: http://news.opensuse.org/2011/05/26/opensuse-renames-obs/	2 weeks a
 openSUSE 11.2 got moved to DISCONTINUED: space, all old repos in projects get currently removed to free resources. Feel free to re-add from DISCONTINUED: if you want to keep your repo.	4 weeks a
 Ubuntu:11.04 got imported, 9.04 removed from default list.	6 weeks a
 Debian is not using parallel build by default anymore, because the packages are not safe by debian policy.	6 weeks a
 build2x and build3x are running on KVM now	8 weeks a

To proceed, you'll need to log in and authenticate with your username and your password. Click on Login and enter the data in the upper right corner.

Figure 1.2 Login





After successful authentication, you'll end up on the start page again - with new options visible. We'll go through most of them in detail, but first lets create your home: in the next step.

File
Edit
View
History
Bookmarks
Tools
Help

Welcome - Open Build Service
+

opensesuse.org
https://build.opensuse.org/


[Downloads](#)
[Support](#)
[Community](#)
[Development](#)


 Open Build Service


Welcome to the openSUSE Build Service


This is the the public instance of the [Open Build Service \(OBS\)](#) used for development distribution and to offer packages from same source for Fedora, Debian, Ubuntu, SUS and other distributions..


Please find further details of this service on our [wiki pages](#)


This instance offers a special [package search interface](#). Users of any distribution can packages for their distribution. For developers it is an efficient place to build up group through its project model.




[My Projects](#)


[All Projects](#)


[Search](#)


[New Project](#)

News


 OBS means "Open Build Service" from now on: http://news.opensuse.org/2011/05/26/opensuse-renames-obs/	2 weeks a
 openSUSE 11.2 got moved to DISCONTINUED: space, all old repos in projects get currently removed to free resources. Feel free to re-add from DISCONTINUED: if you want to keep your repo.	4 weeks a

6 Open Build Service

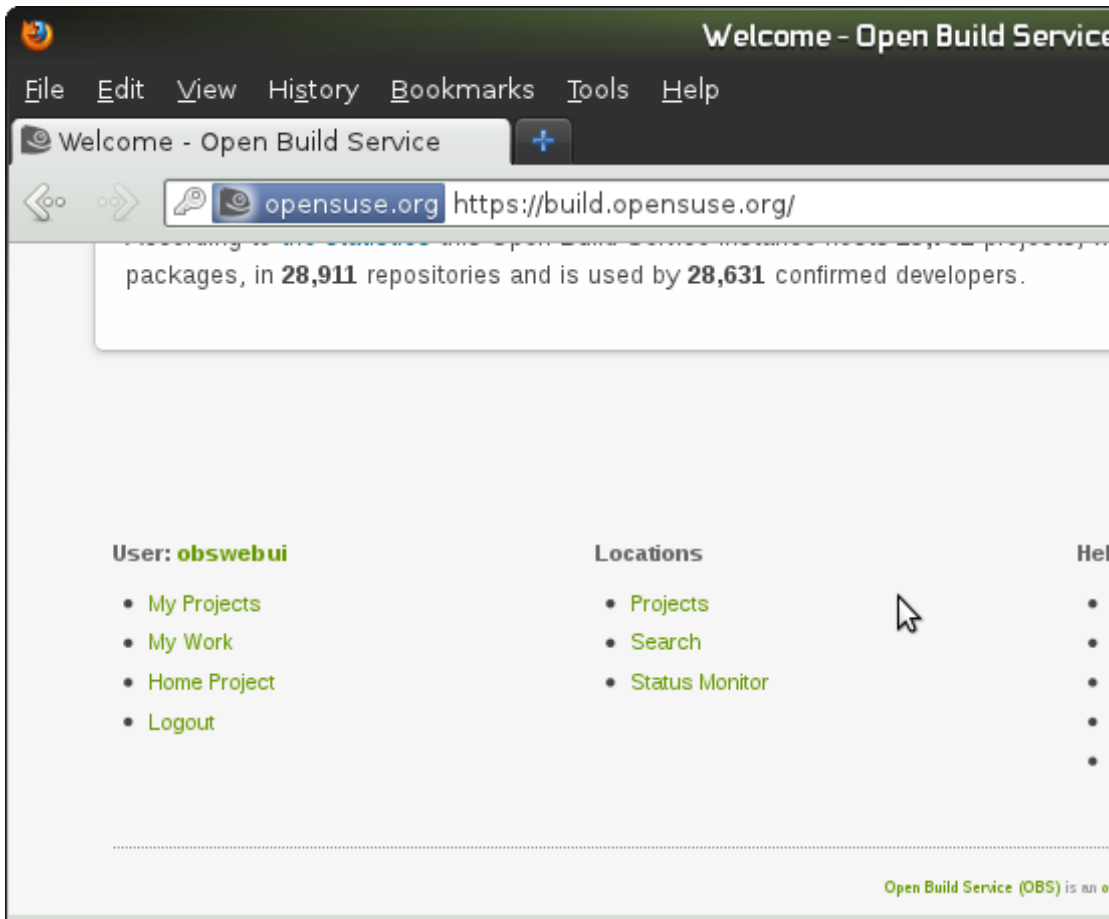
1.2 Create your home project

Every developer has his/her home:[userid] project where he/she has write access by default. This is like your personal project or dashboard where you can experiment and play. But first you need to enter some lines to describe your home project. Click on the link "Home Project" at the bottom left or upper right and answer the questions.

Figure 1.4 *home_project_upper_right*



Figure 1.5 *home_project_bottom_left*



Now you are redirected to your home: . It will be empty for now, but as you see in the picture below, you can add packages containing the sources/build recipes and projects which are the containers for the build targets. As you can see, you're the default maintainer which grants you full write access to this project. You're also the bug owner of your project.

← → opensuse.org https://build.opensuse.org/project/new?project=home%3Aobswebui

Downloads Support Community Development

Open Build Service > Projects > > Projects

Your home project doesn't exist yet. You can create it now by entering some details and clicking the [Create Project](#) button.

Create New Project

All users have a **home:<login>** project by default, and can also create new sub projects. New projects are created in [Bugzilla](#). To discuss the requested project setup, please use the opensuse-buildservice@opensuse.org email address.

Project Name:
home:obswebui

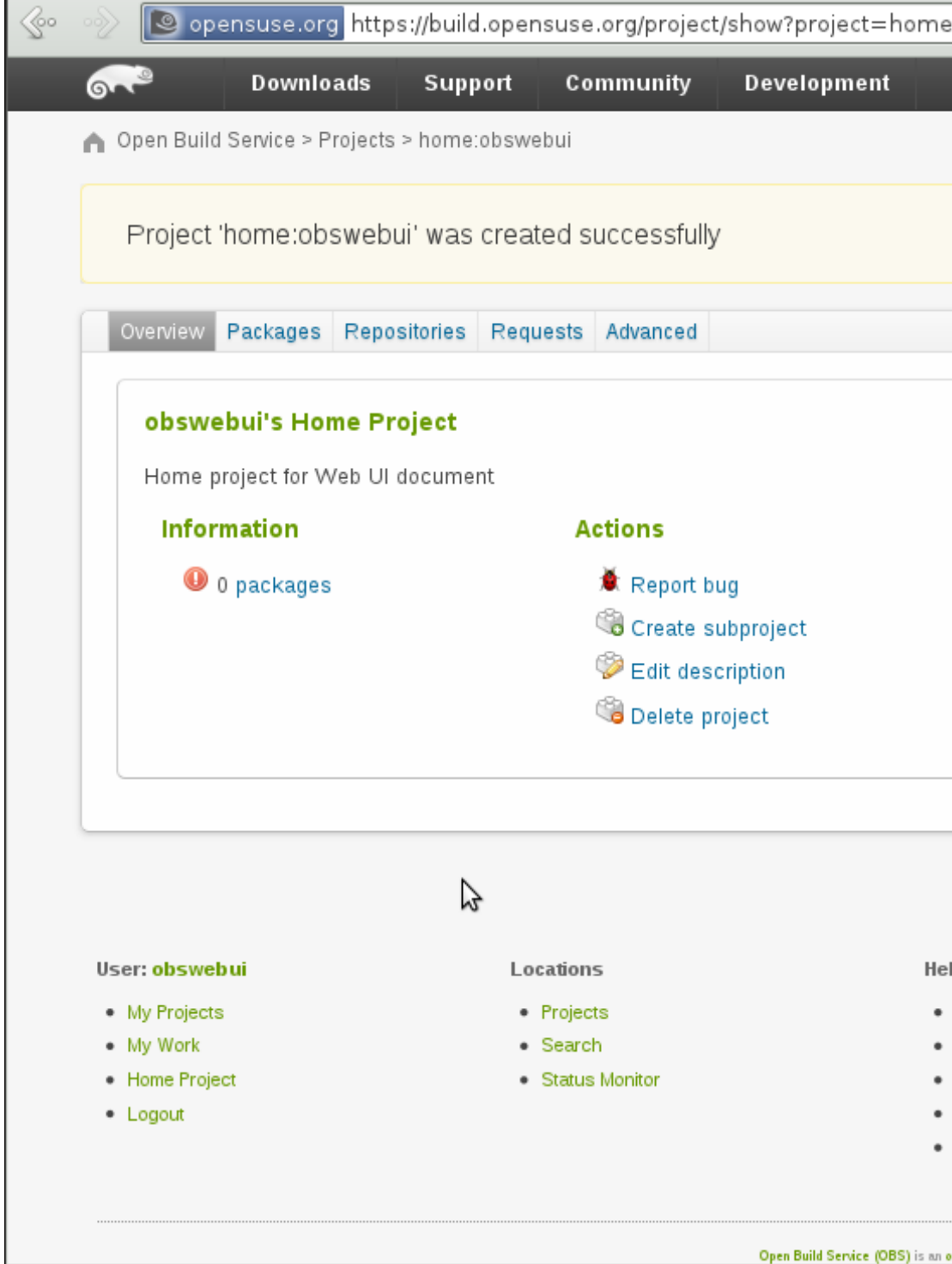
Title:
obswebui's Home Project

Description:
Home project for Web UI document

☐ Disable build results publishing.

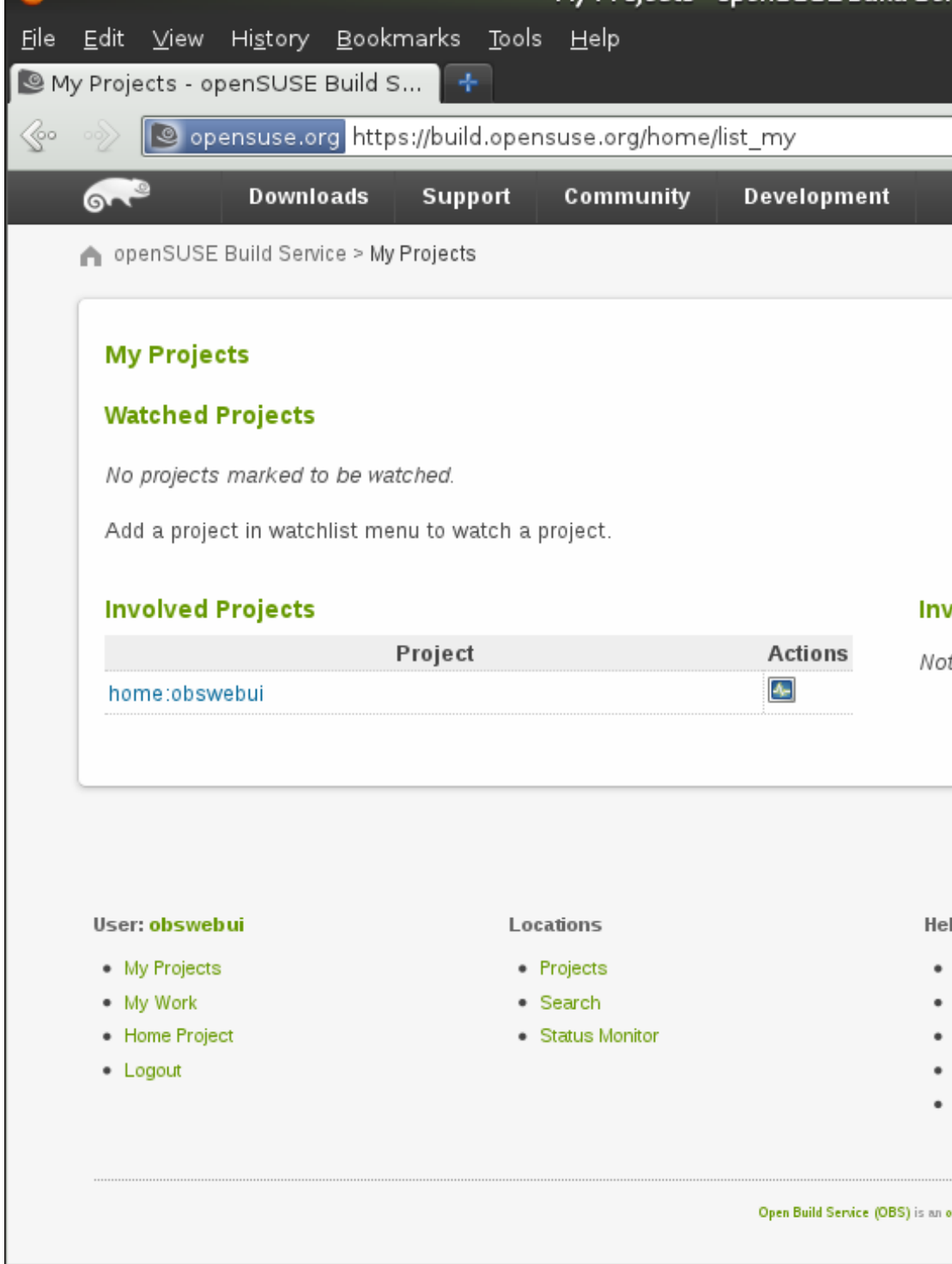
☐ Create as maintenance project.

Create Project



1.3 My Projects, Server Status

Let's leave for now your home: for a bit and explore the build service. Click on "My Projects" on the left at the bottom. This opens a page listing your watched projects and your involvements in projects or packages.












Now, let's visit the main monitor page by clicking on "Status Monitor". You see here the status of the services, some graphs and graphics are showing the currently running and completed jobs and the overall load.

openSUSE.org <https://build.opensuse.org/monitor>

Downloads Support Community Development

openSUSE Build Service > Monitor

Scheduler Status

[armv5el] [armv7el] [i586] [local] [ppc] [ppc64] [x86_64] [dispatcher] [published]

Workers

This shows the single workers and their jobs. The *progress* shown (and color) is not for each worker against each other. The exact percentage shown has no real meaning, just one thing is shown.

The monitor is meant to entertain and not to be exact, if you need to know more details, please look at the worker logs.

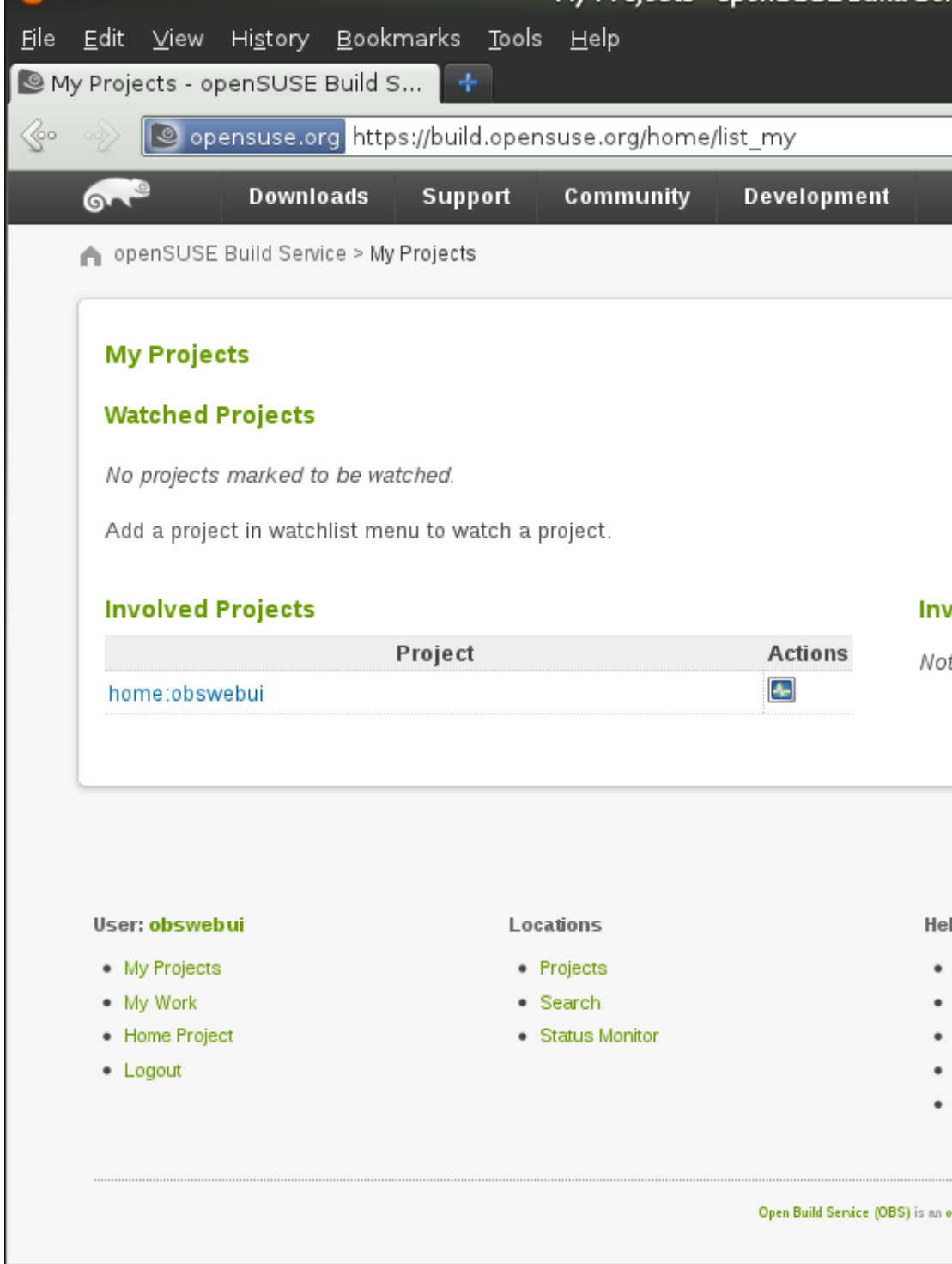
build08 (x86_64)	build09 (x86_64)	build10 (x86_64)
idle	python-numpy	mingw64-boost
kid3-qt	kernel-xen	kernel-ec2
MozillaThunderbird	perl-QVD-L7R-LoadBalancer	libqt4-sql-plugins
kernel-xen	_product:openSUSE-Addon-	abook
php5-pear-Net_DIME	mingw32-evolution-data-service	seamonkey
openclipart	mysql-workbench	dovecot11
systemtap	bb	mingw32-libqt4
Supybot	php5	chromium
excalibur-avalon-logkit	kernel-vmi	
idle	php5-pear-XML_Serializer	

build14 (x86_64)	build15 (x86_64)	build16 (x86_64)
libreoffice-components	pyopenfst	digikam
calligra	mingw64-pidgin	mingw32-libqt4
dovecot12	kdelibs4-apidocs	perl-Email-Address
mingw32-libqt4	libFLIC	mingw32-pidgin

https://build.opensuse.org/package/show/development:mingw:win32&repository=SLE_11

1.4 Create a link to a package in your home:

We'll show you how you can log in and use the web interface hosted at build.opensuse.org. This includes login, adding a link to a package in your personal workspace (home:~) and how to build that package by adding a repository. First, let's enter "My Projects" by clicking on the link at the bottom left.

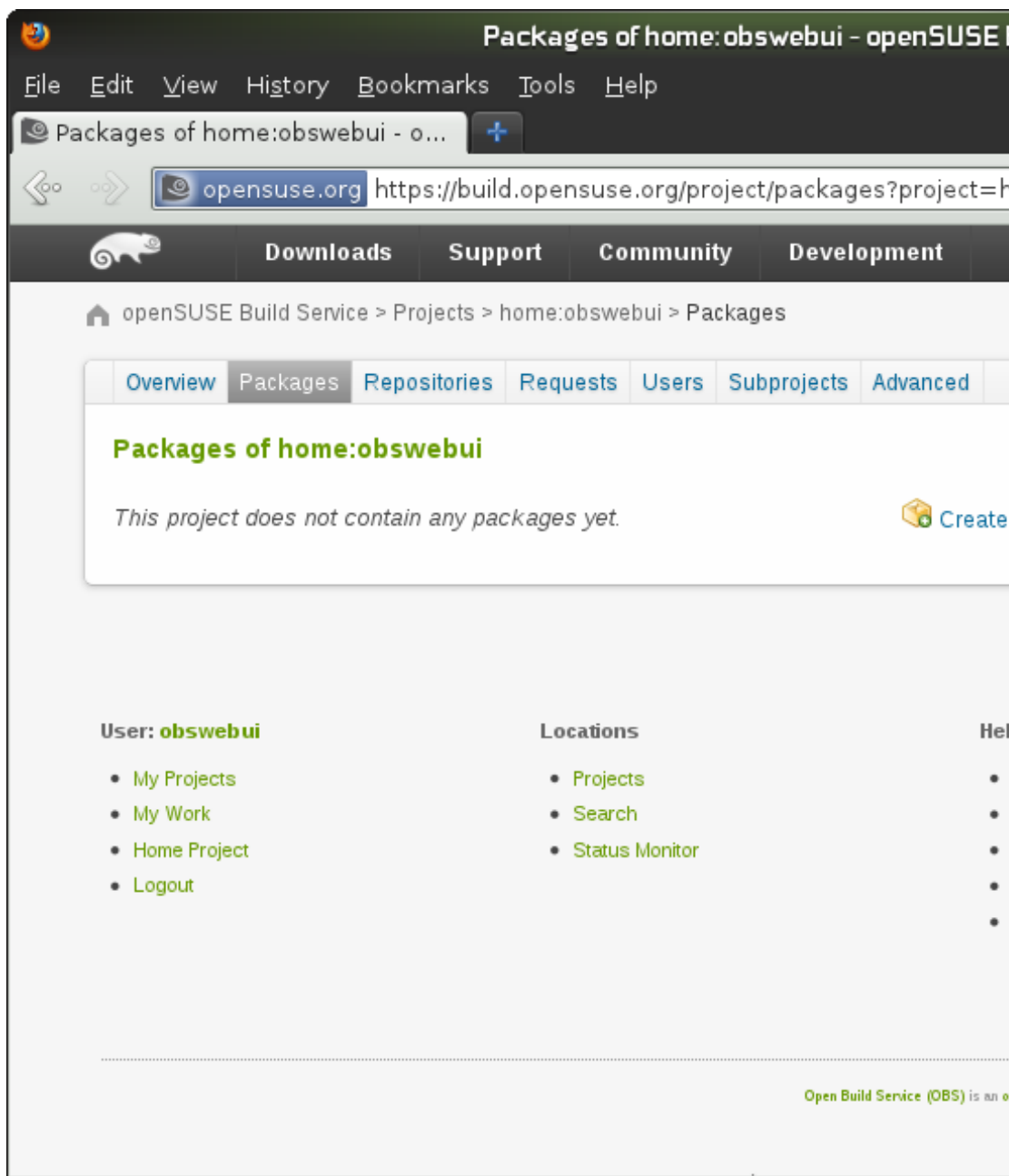


Now let's create a link to a package and add a repository to build against. A link is basically a pointer to sources of an already existing package in another project. By *repository*, we mean a build target - like Trunk/Fedora_12/openSUSE_11.4. Let's follow these steps: 1. Add link to the existing package. 2. Add repository / build target. 3. Enable the build (optional, if not already enabled). 4. Observe the build on the monitor page 5. Look at package's page

1.4.1 Add link to existing package

Right below packages, there's "Branch Package from other Project" .

Figure 1.11 Branch Package



Open that page and enter for

```
Name of original project:  
Apache
```

and for


```
Name of package in original project:  
flood
```

- we'll leave "Name of linked package in target project" empty. This is shown on the next picture:

FileEditViewHistoryBookmarksToolsHelp

Add New Package Branch - opensuse.org

opensuse.orghttps://build.opensuse.org/project/new_package_branch



DownloadsSupportCommunityDevelopment

openSUSE Build Service > Projects > home:obswebui > Add New Package Branch

OverviewPackagesRepositoriesRequestsUsersSubprojectsAdvanced

Add New Package Branch to home:obswebui

By branching a package from another project you add the package and its files to your project. You will also change the files in the branched package in your project.

You can add patches to the branched package without affecting the original package.

Name of original project:

Name of package in original project:

Name of branched package in target project: (Leave blank to use the same name)

☐ Stay on current revision, don't merge future upstream changes automatically

Create Branch

User: **obswebui**

My Projects

My Work

Home Project

Logout

Locations

Projects

Search

Status Monitor

Help

Proceed with "Create Branch" and you'll be redirected to your home again. You'll see a new package "flood" and a notice about the branch being added.

File Edit View History Bookmarks Tools Help

Show Package flood (Project home:obswebui) +

opensuse.org https://build.opensuse.org/package/show?package=flood

Downloads Support Community Development

openSUSE Build Service > Projects > home:obswebui > flood

Branched package home:obswebui / flood

Overview Sources Repositories Revisions Requests Users Advanced

flood

Flood--a Profile-Driven HTTP/HTTPS Load Tester

Flood is a profile-driven HTTP load tester. It can be used to gather important performance metrics for your Web site.

See the FAQ for common questions about flood:
<http://httpd.apache.org/test/flood/faq.html>


Authors:


Aaron Bannert <aaron@clove.org>
Justin Erenkrantz <jerenkrantz@apache.org>
...and other members of the Apache Software Foundation, please see
<<http://www.apache.org/>>

Information

5 files

Actions

 [Report Bug](#)

 [Branch package](#)

Wonderful, we've added a pointer to the sources - now we need a build repository added, so the builder knows the target-distribution.

1.4.2 Add repository / build target

To do this, click on "Add Repository" by clicking "no repositories" in above screen. This will look like:

File Edit View History Bookmarks Tools Help

Add Repository - openSUSE Build Service

opensuse.org https://build.opensuse.org/project/add_repository_from


Downloads Support Community Development

openSUSE Build Service > Projects > home:obswebui > Add Repository


Overview Packages Repositories Requests Users Subprojects Advanced

Add Repositories to Project home:obswebui


Please choose the repositories that your packages will be built for by following default

 **openSUSE distributions**


☐ openSUSE Factory ☐ openSUSE 11.4 ☐ openSUSE 11.3 ☐ openSUSE Tu

 **SUSE distributions**


☐ SUSE SLE-11 SP 1 ☐ SUSE SLE-11 ☐ SUSE SLE-10 ☐ SUSE SLES-9

 **Debian distributions**

☐ Debian 6.0 ☐ Debian 5.0

 **Fedora distributions**

☐ Fedora 15 ☐ Fedora 14

 **RedHat distributions**

Now select "openSUSE Factory" as target repository and press Add selected repositories button which is located at bottom side of screen:

File Edit View History Bookmarks Tools Help

Add Repository - openSUSE Build Service

opensuse.org https://build.opensuse.org/project/add_repository_from


Downloads Support Community Development

openSUSE Build Service > Projects > home:obswebui > Add Repository


Overview Packages Repositories Requests Users Subprojects Advanced

Add Repositories to Project home:obswebui


Please choose the repositories that your packages will be built for by following default

 **openSUSE distributions**


☒ openSUSE Factory ☐ openSUSE 11.4 ☐ openSUSE 11.3 ☐ openSUSE Tu

 **SUSE distributions**


☐ SUSE SLE-11 SP 1 ☐ SUSE SLE-11 ☐ SUSE SLE-10 ☐ SUSE SLES-9

 **Debian distributions**

☐ Debian 6.0 ☐ Debian 5.0

 **Fedora distributions**

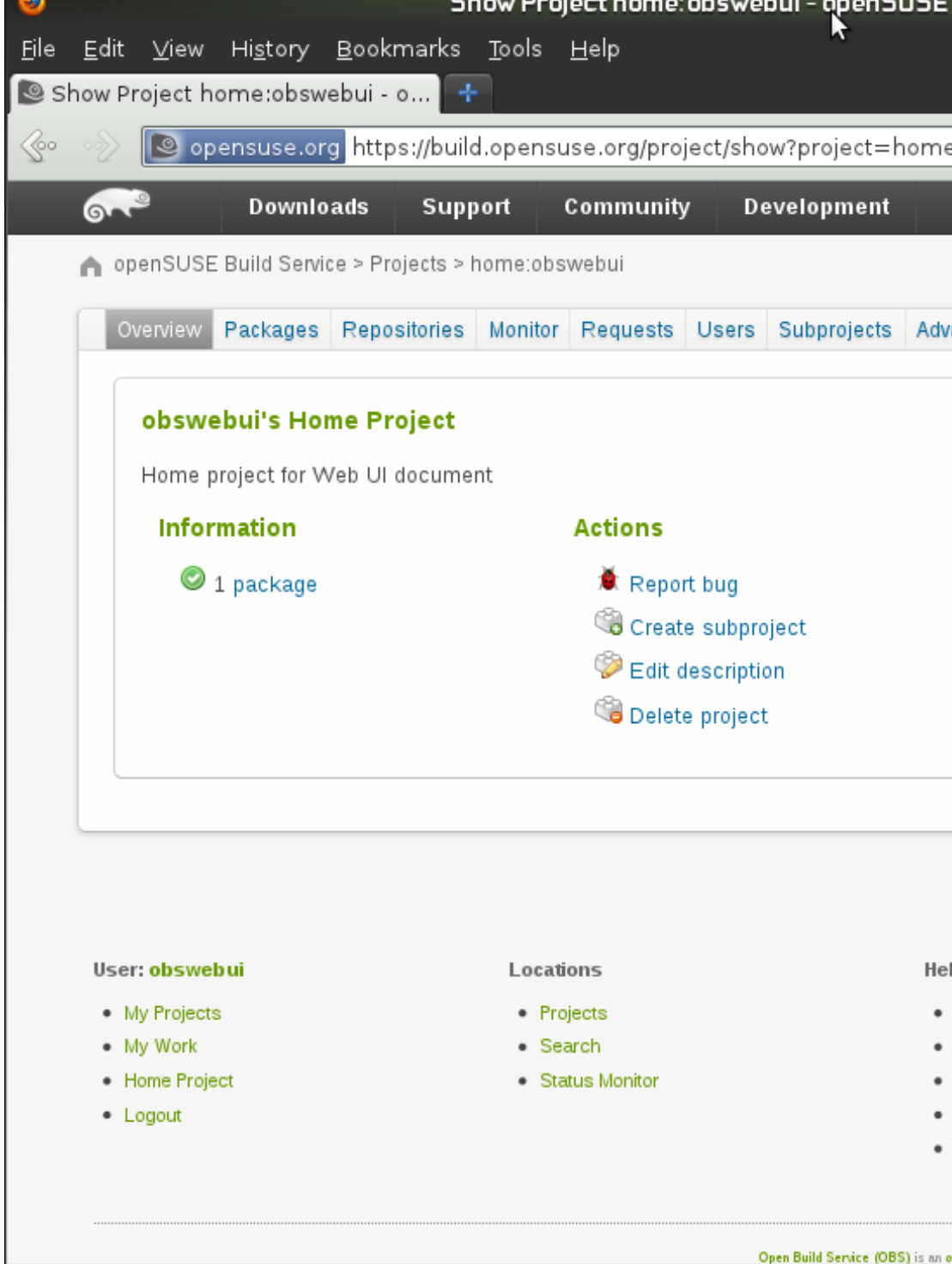
☐ Fedora 15 ☐ Fedora 14

 **RedHat distributions**

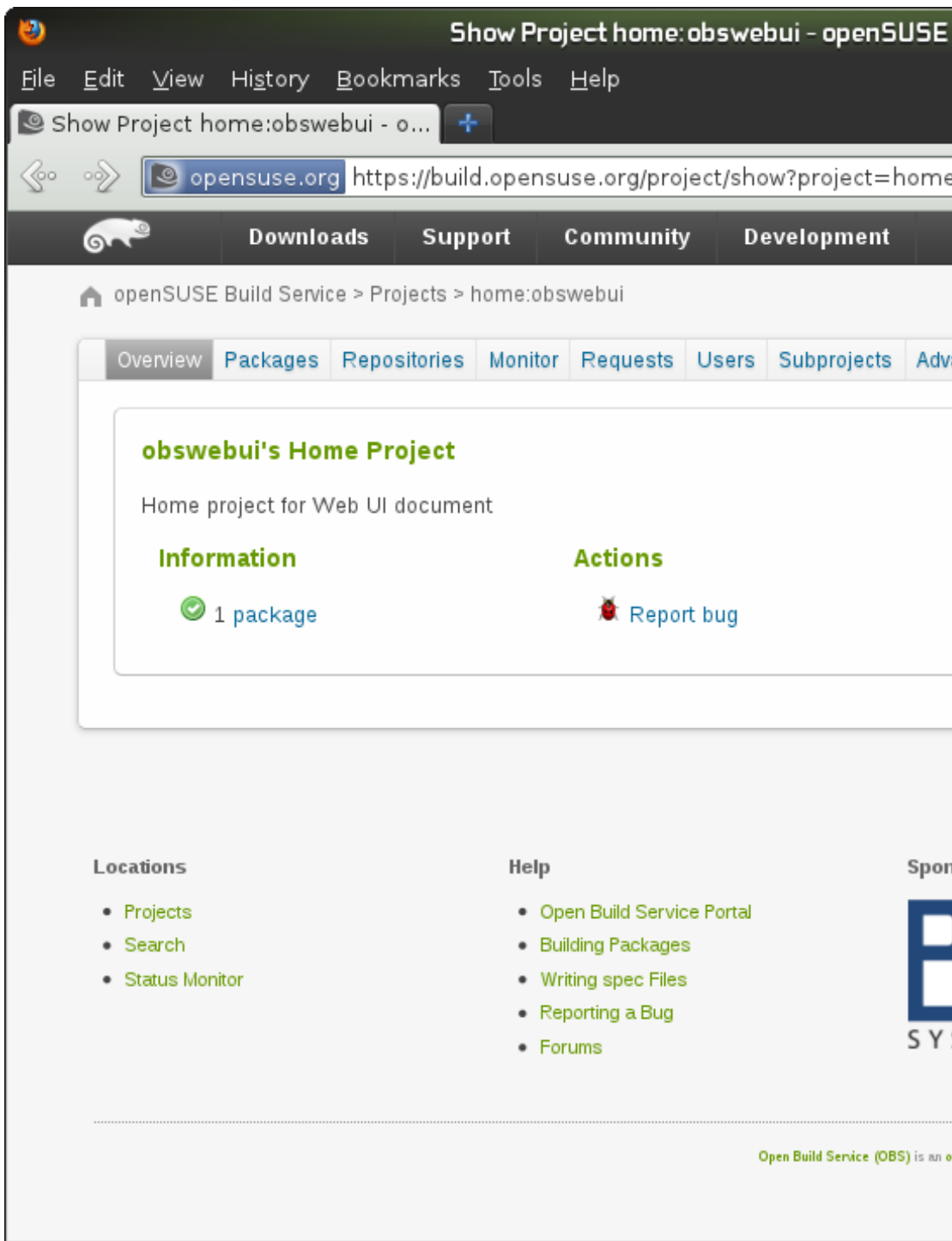
(If it is not in the initial list, see if there is an Advanced link to a more comprehensive list). This will take you back to your home: project. The build repository might be disabled: if so, click on the cogwheel to enable it. Congratulations, it is configured. On a heavily loaded server, it can sometimes take a few minutes for your changes to become effective, but your linked package will automatically begin building.

1.4.3 Package page, build log and project monitor page

Next, it is time to explore the Monitor page, the package detail page and the build log. Just click on the links and explore the web interface. I recommend starting with your home project's top level 'overview' page - click on the Overview tab and you may see something like this:



If you wait a bit, you would see the below building success screen



please try to click blue "succeeded" message, then you could see the build log as below.

Live Build Log - openSUSE Build Service

File Edit View History Bookmarks Tools Help

Live Build Log - openSUSE Build ...

opensuse.org https://build.opensuse.org/package/live_build_log?arch

Downloads Support Community Development



openSUSE Build Service > Projects > home:obswebui > flood > Build Log

Overview Sources Repositories Revisions Requests Users Advanced

Build Log for Package flood (Project home:obswebui)

Repository: openSUSE_Factory **Architecture:** i586

Status: Build finished

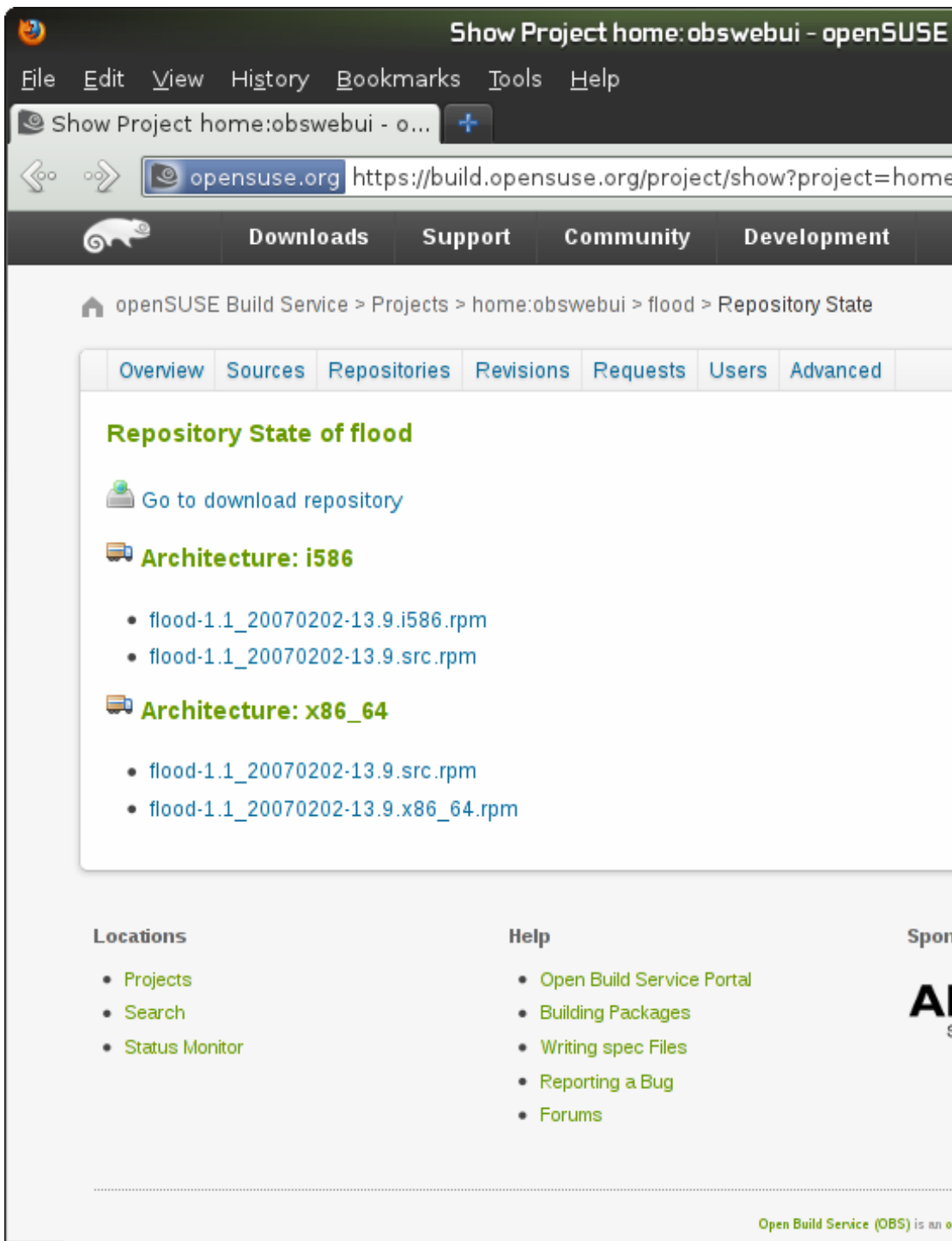
 Start refresh  Download logfile

```
de77e30e44c9506bca6318678c3e'
```

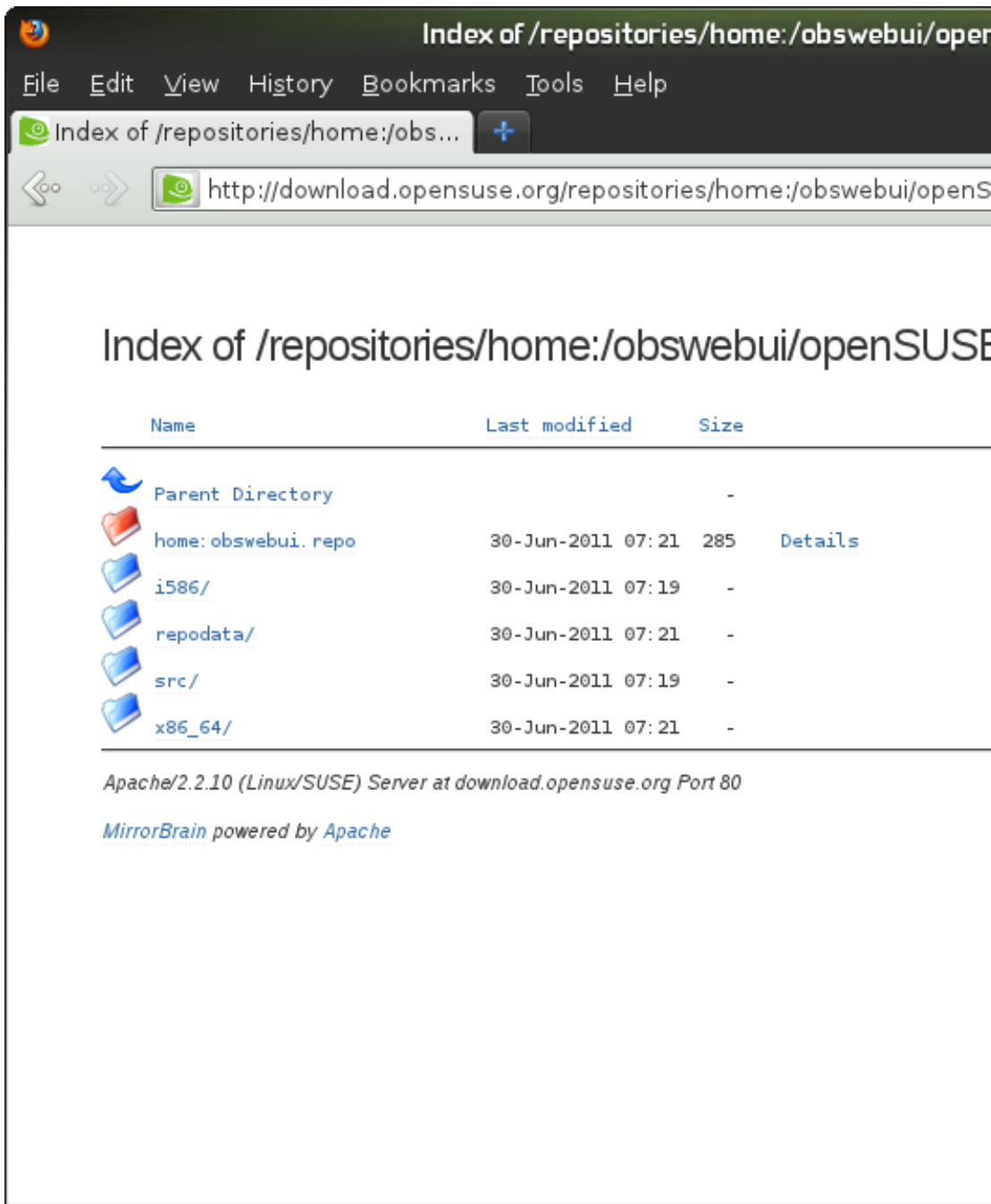
```
processing specfile /var/cache/obs/worker//root_12/.build-srcdir/flood.spec ...
running changelog2spec --target rpm --file /var/cache/obs/worker//root_12/.build-s
init_buildsystem --cachedir /var/cache/build --prepare --clean --rpmlist /var/cach
/.build-srcdir/flood.spec build rpmlint-Factory ...
preinstalling aaa_base...
preinstalling acl...
preinstalling attr...
preinstalling bash...
preinstalling coreutils...
preinstalling diffutils...
preinstalling filesystem...
preinstalling fillup...
preinstalling glibc...
preinstalling grep...
```


1.5 Repository Output: Built Packages

To find the RPMs you built, go to your home project page and click Repositories. From there click on the blue repository name. For example, openSUSE_Factory:



And from there, click on Go to download repository. You'll see something like this:



Your rpms can be found in the subdirectories, and the .repo file is suitable for use with zypper, yum or other repository-friendly package management tools.

Basic Concepts and Work Styles

These best practices should be known by every OBS user. They describe how to setup projects, working with own or foreign sources.

2.1 Setup a project re-using other projects binaries

Binaries (page 75) are the

2.2 Setup a project reusing other projects sources

You can also setup your own project using the sources, spec files and patches from another project and develop within this project.

```
#osc copypac SOURCEPRJ SOURCEPAC DESTPRJ
```

By default, Open Build Service will strip the maintainer info and now make it part of your own project. To clarify, when we speak of a project, it can mean just one package or a complete set of packages with their own build dependencies.

2.3 Contribute Directly to External Projects

In case a user does not have commit permissions to a project, he can request maintainership permissions for this project. This makes sense if the user is already known to the project owners and they trust him as a maintainer. There is a way to do this via the request system of OBS, but only via osc so far:

```
# osc createrequest -a add_me maintainer PROJECT
```

2.4 Contribute Indirectly to Foreign Projects

Users who are new to a given project, either because they are new users with Open Build Service or packaging or don't have any deeper knowledge about a certain project won't have direct commit permissions. However, they can still create a copy of any package source and ask back to merge their changes. Open Build Service has support to make this easy.

Wiki reference: User comment page [http://en.opensuse.org/openSUSE:Build_Service_Collaboration]

Publishing upstream binaries

This chapter covers main step of using OBS to publish binaries of your project for multiple distributions.

3.1 Which instance to use?

3.1.1 Private OBS instance

OBS is open source project and therefore you can setup your own instance and run it by your own. The main advantage of this approach is that you can keep all your sources and recepies unpublished if you need to (for example because of NDA). Obvious downside of this approach is that you need to maintain your own server/servers for running builds, publishing and mirroring. Also making your project public may attract some potential contributors.

More information about setting up your own private OBS instance can be found in Chapter 4, *OBS Local Setup* (page 49) .

3.1.2 openSUSE Build Service

Other option is to use some publically available instance of OBS. One good example is openSUSE Build Service - <http://build.opensuse.org> . This OBS instance can be used by anybody to freely create binaries for any of the supported distributions. Big advanatage is that somebody is already taking care of all the infrastruc-

ture. You can store your sources there, build your packages and got them mirrored around the world. You don't need to get your own server a configure it, you can start using it right a way.

3.2 Where to place your project?

This part helps you to decide on how to name and where to place your project and what project structure to create. This is more important if you are sharing your OBS instance with other people like in openSUSE Build Service [<http://build.opensuse.org>].

3.2.1 Base project

If there are more packages in OBS, like for example in openSUSE Build Service [<http://build.opensuse.org>], these packages needs to be somehow divided into projects so it is easier to find what people are looking for and it isn't all just one big mess.

In openSUSE Build Service, packages are divided into categories regarding their function. MySQL is in *server:database* repository, lighttpd in *server:http* and for example KMyMoney has it's own subproject in *KDE:Apps*. So it is a good idea to think about in what category available on the OBS your application will fit the best.

If you need whole project for yourself - for example some of your dependencies is being built in the same project, you need to request creating subproject. In openSUSE Build Service, this is done through asking OBS admins for it on opensuse-buildservice mailing list [<mailto:opensuse-buildservice+subscribe@opensuse.org>]. It's archive and link for subscribing can be found at <http://lists.opensuse.org/opensuse-buildservice/> .

If you need to just put your package somewhere, you can create it in your home project and then send submitrequest to the project you want your package to get included in.

3.2.2 More supported versions?

If you want to support more than just one version of your program, you will need to use several projects for that. There can't be same packages with.

Stable and development version

Let's assume that you have found project suitable for your program. Some projects already have something like *STABLE* and *UNSTABLE* subprojects. So you can use these, if you discuss it with maintainers of these project. Other way is to ask somebody from the maintainers of the project to create either these subprojects (if they don't exist) or something similar. Always try to discuss it with the maintainers of the project. They might have good ideas, suggestions and may help you in various ways.

Multiple stable versions

If you want to support multiple version, you would need more projects than just two as suggested in previous section. These special project should contain version they are supposed to support in their name. If you are creating them under some project you are sharing with other packages, having your package name in the name of projects is a good idea as well. Good example can be Gnome. It has *GNOME* project and many subprojects projects. Among them are for example *GNOME:STABLE:2.30*, *GNOME:STABLE:2.32* and *GNOME:STABLE:3.0*. These projects hold different stable versions of Gnome with latest fixes.

3.3 Creating a package

Packaging is quite a complex topic. Instead of trying to cover it in this book, it is a good idea to start with available internet documentation. One of the recommended online resource is Portal:Packaging on openSUSE wiki. You can find it at <http://en.opensuse.org/Portal:Packaging>. It contains links to several packaging tutorials and other packaging related documentation.

3.4 Getting binaries?

NOTE

This section discusses a feature available only in openSUSE Build Service - one of the freely available instances of OBS.

If you want a nice download page for your software published on openSUSE Build Service, you can use openSUSE download page. You can include it for example using

either `iframe` or `object` on newer webs . Example of download page can be following one <http://software.opensuse.org/download.html?project=openSUSE:Tools&package=osc> . You can see how it looks like in Figure 3.1, “openSUSE download page for package from OBS” (page 45). It contains links to the packages and instructions how to install them.

Select Your Operating System



CentOS



Debian



Fedora



Mandriva



openSUSE



RHEL



SLC

Install using One Click Install

openSUSE Factory

openSUSE Factory PPC

openSUSE 11.4

openSUSE 11.1 Evergreen

Add repository and install manually

Grab binary packages directly

Packages for **openSUSE Factory**:

- [osc-0.132.5-56](#)
- [osc-0.132.5-56](#)

Packages for **openSUSE Factory PPC**:

- [osc-0.132.5-56](#)
- [osc-0.132.5-56](#)

Packages for **openSUSE 11.4**:

- [osc-0.132.5-56](#)
- [osc-0.132.5-56](#)

Packages for **openSUSE 11.3**:

- [osc-0.132.5-56](#)
- [osc-0.132.5-56](#)

Url always has to start with <http://software.opensuse.org/download.html?> .You can attach any number of '&'-seperated parameters. But at least two of them - *project* and *package* - are required. All parameters with descriptions can be found in Table 3.1, “Possible parameters for download page” (page 46).

Table 3.1 Possible parameters for download page

parameter	description
project	Project in which your package is located

3.4.1 Examples

Now we will take a look at how to include the download page into your project pages. As example we will use *osc* client from *openSUSE:Tools* project. To demonstrate the colors change, we will use theme that would match Midnight Commander.

First we will start with recent web page supporting new standart. On such a website, we would use `object` to include download code:

```
<object type="text/html"
  data="http://software.opensuse.org/download.html?
project=openSUSE:Tools&package=osc&bcolor=004&acolor=ff0&fcolor=fff&
width="100%" height="100%">
  <param name="src"
    value="http://software.opensuse.org/download.html?
project=openSUSE:Tools&package=osc&bcolor=004&acolor=ff0&fcolor=fff&
  >
    Your browser doesn't support objects, please continue to the
    <a href="http://software.opensuse.org/download.html?
project=openSUSE:Tools&package=osc&bcolor=004&acolor=ff0&fcolor=fff&
    download page</a>
</object>
```

If you are using php on your server, you can make it easier by using following code:

```
<?php
  $url = "http://software.opensuse.org/download.html?
project=openSUSE:Tools&package=osc&bcolor=004&acolor=ff0&fcolor=fff&
```

```

    echo '
<object type="text/html"
  data="' . $url . '"
  width="100%" height="100%">
  <param name="src"
    value="' . $url . '" />
  Your browser doesn't support objects, please continue to the
  <a href="' . $url . '">download page</a>
</object>
';
?>

```

If you are running some legacy website, you might have to use `iframe`:

```

<iframe src="http://software.opensuse.org/download.html?
project=openSUSE:Tools&package=osc&bcolor=004&acolor=ff0&fcolor=fff&hcolor=
">

```


OBS Local Setup

This chapter explains how you could setup/Install/test OBS in your system. This chapter is written for those who are not so familiar with Linux and OBS. So in case you are confident to setup OBS, please skip this chapter. Following would be explained in this chapter.

- OBS Manual setup and 1 click install in openSUSE 11.3
- OBS Manual setup and 1 click install in SLES11
- OBS test run on Microsoft Windows using VMware player.

Unfortunately, didn't have a chance to install OBS in other Linux distribution yet.

How you could install and purchase openSUSE 11.3 and SLES11 would not be explained in this chapter. VMware player install and purchase also wouldn't be explained. For these topics, you could visit below for help.

```
http://software.opensuse.org/113/en  
http://www.novell.com/products/server/  
http://downloads.vmware.com/d/info/desktop_downloads/  
vmware_player/3_0
```

4.1 OBS test run on Microsoft Windows using VMware player

Those who are not familiar with Linux can run and test OBS. To run and test OBS in Windows, you could use a virtual machine program such as VMware or VirtualBox, etc. This chapter explains, how you can run OBS using VMware player. To check and test with VirtualBox or another virtual machine, please check in below. After you are done installing VMware player on Windows, you need to download the OBS appliance program. You could get OBS appliance program in SUSE gallery.

<http://susegallery.com>

Type and Search OBS in SUSE gallery. you could find the latest OBS appliance program there. Under [Download], Click [Virtual]. You could see VMware / Virtual-Box / KVM image. It would be good that you read install instructions using [View install instructions...] link. And Download this VMware Image to the directory where you could remember. You need to decompress downloaded "OBS_x.x.x.i686-x.x.x.vmx.tar" file.

Check and remember where decompressed "OBS_x.x.x-x.x.x" directory exists. Now, open VMware Player application and Select [File] - [Open a Virtual Machine] or you could press Ctrl+O directly. Search decompressed "OBS_x.x.x-x.x.x" directory in [Open Virtual Machine] dialog box. You would see "OBS_x.x.x.i686-x.x.x.vmx" file icon under this directory and select it. You could see VMware player detect VMware Configuration files and OBS_x.x.x.i686-x.x.x is setup as Virtual Machine in VMware player. Click on "Play virtual machine" icon or hyper link in VMware player and then you could see below screen.

For Linux prompt, you could login using "root" as a login name and "opensuse" as a password. Now, OBS local instance should be already loaded and running in your system. To make sure OBS webui is successfully up and running, you probably want to see OBS web ui.

To access OBS web ui, open your web browser and try <http://localhost> . in case <http://localhost> doesn't work, please try http://YOUR_IP. You could check IP address using `$ifconfig` Linux command or control panel on Windows. Now, you probably could see below like screen in your Windows.

To login your local OBS instance, you could use default login name as "Admin" and password as "opensuse". Check if you could login properly by clicking "Login" on your local OBS instance web UI. Welcome to the Open Build Service ;-)

4.2 OBS 1 click install on openSUSE 11.3

This section explains, how you can install OBS on top of openSUSE 11.3. Open your web browser and copy below URL in URL window of your web browser.

```
http://download.opensuse.org/repositories/openSUSE:/Tools/  
openSUSE\_11.3/OBS\_Server.ymp
```

This YaST Meta Package file lets you install OBS by 1 click. In case you are using openSUSE 11.2 or below version, please check if you could find 1 click install file in below URL.

```
http://en.opensuse.org/openSUSE:Build\_Service\_Installation\_SUSE
```

After you type above URL, you would see "Opening OBS_Server.ymp" window, Select default selection which is "Open with YaST Meta Package Handler" and press OK button. then "OBS_Server Installation - YaST" window will appear. Select Next button after that till you get successful OBS setup message.

TIPS : In case you didn't install libMagickCore.so.2 in openSUSE, you might face dependency warning. In that case, stop the OBS install by pressing "Abort" button in "OBS_Server Installation - YaST" window. Then search and install libMagickCore using a search engine like Google or others and repeat above processes. Then you will get an OBS setup message.

Now, OBS Server is installed in your openSUSE. To run OBS server, you need to work on several further steps. Open /usr/share/doc/packages/obs-api/README.SETUP file. To run OBS server, you need to follow each step of README.SETUP carefully based on your system situation. You could also find this README.SETUP file online using below URL.

```
http://gitorious.org/opensuse/build-service/blobs/raw/master/  
dist/README.SETUP
```

If you follow instructions from README.SETUP file, you should be able to run OBS server in your system. There are several tips that I would like to comment regarding README.SETUP file.

TIP #1 : Check "3.1 Initialize fresh Database". It might be described as

```
# cd /srv/www/obs/api/  
# sudo RAILS_ENV="production" rake db:setup  
# sudo chown lighttpd.lighttpd log/*  
  
# cd /srv/www/obs/webui/  
# sudo RAILS_ENV="production" rake db:setup  
# sudo chown lighttpd.lighttpd log/*
```

but it should be

```
# cd /srv/www/obs/api/  
# sudo RAILS_ENV="production" rake db:migrate  
# sudo chown lighttpd.lighttpd log/*  
  
# cd /srv/www/obs/webui/  
# sudo RAILS_ENV="production" rake db:migrate  
# sudo chown lighttpd.lighttpd log/*
```

You could check this Tip in below URL also.

http://en.opensuse.org/openSUSE:Build_Service_Installation_SUSE

You would find same description in above URL for this TIP #1.

TIP #2 : If you get fail message because of "apisrv" in "6. Using osc with your local build service:", please try apiurl instead.

You might face some issues during process to follow README.SETUP file. If you read and follow instructions carefully, you could run OBS local instance on your system successfully.

4.3 OBS 1 click install on SLES(SUSE Linux Enterprise Server) 11

1 click install for OBS in SLES11. This section explains how you install OBS in SLES11. Installation of OBS in SLES11 is quite similar to OBS install method on openSUSE. I would skip some contents so you might need to have a look for prior section "OBS 1 click install on openSUSE 11.3".

Before you install OBS on SLES11, you need to download and install SLES11 SDK first. you could download SLES11 SDK in here.

`http://download.novell.com`

After you download and install SLES11 SDK, We could use YMP file for OBS 1 click install like openSUSE 11.3. Open your web browser and copy below URL in URL window of your web browser.

`http://download.opensuse.org/repositories/openSUSE:/Tools/SLE_11/OBS_Server.ymp`

Like openSUSE 11.3, I referenced above URL from below.

`http://en.opensuse.org/openSUSE:Build_Service_Installation_SUSE`

After you typed "`http://download.opensuse.org/repositories/openSUSE:/Tools/SLE_11/OBS_Server.ymp`", you would see "Opening OBS_Server.ymp" window as described in the previous openSUSE 11.3 section. Press "OK" button and "Next" button after YaST2 window pops up. If YaST lets you know successful install of OBS server, then you are ready to activate and run OBS on SLES11.

To run OBS server on SLES11, you need to follow instructions based on `/usr/share/doc/packages/obs-api/README.SETUP` file as described in prior section. From here, you could refer to prior section for successful OBS run on your SLES11.

Boot Strapping

This chapter explains Boot strapping. In this chapter, You would learn how you could have other OBS projects and packages to your local OBS instance after your OBS install. There are some useful OSC commands examples and OBS working mechanism explanation in this chapter also. Basically this chapter is a copy from Build Service portal. please check below for OBS bootstrap from Build Service portal.

[http://en.opensuse.org/
openSUSE:Build_Service_private_instance_boot_strapping](http://en.opensuse.org/openSUSE:Build_Service_private_instance_boot_strapping)

5.1 The issue

If you create a private instance of an OBS it is likely to be fully independent. This means that your OBS needs to build its full reference tools chain. This process - called Bootstrap - presents the same problem as the Chicken and the Egg, which one came first ! In other words, you need to create a tool chain with the tool chain that you want to create.

5.2 A cheat sheet

5.2.1 Create your first project

Log on to the Web API. The default user Admin, with the password opensuse is available. Create your own login and password and set yourself as Admin. Log on to the Web UI as Admin and click on the Icon "Setup OBS". Accept the default. It

should work. Select from under 'Locations' -> 'Projects'. At the end of the list click on 'Add_Project'. Give it a name (e.g. Meego-test) Select your new project and create a sub-project 0.1. You have now a project Meego-test:1.0 Sub projects are handy to propagate Access Control Lists (acl) and for creating the version as a sub project simplifies the user and project administration.

5.2.2 Import your base Linux project

We are now going to import the base project. I will describe two methods, one where you have a login on a remote OBS instance, one where you have only access to the rpm repository. In both cases you will need access to binary and source rpm.

With a login on a remote OBS

The osc copypac (I assume that you have installed the osc package on your workstation) has an option -t which enables copying towards a remote target OBS instance. osc help and osc help command will advise on how to use these. First you need to import the project configuration.

```
$ export PROJECT=MeeGo-test:0.1
$ osc -A http://api-url-source-obs meta prjconf $PROJECT >
my_project.conf
$ osc -A http://api-url-target-obs meta prjconf -F
my_project.conf $PROJECT
```

Then import the project. As you might have some Links in the project that you import, it is a good idea to keep the source and target project names identical.

```
$ PRJ=ProjectToCopy; for i in `osc -A http://api.source.obs.domain
ls $PRJ`; do \
osc -A http://api.source.obs.domain \
copypac -t http://api.target.obs.domain $PRJ $i $PRJ ;done
```

Without a Login on a remote OBS

If you have access only to the repositories of your source reference target, then your life will be a bit more difficult. My advice would be to recheck if you find you can-

not get a login on a public OBS service - such as provided by openSUSE or MeeGo - before proceeding this way. You will not be able to import the project config and you will have to create it by hand. This is too long to be covered in this HowTo. For more explanation about Build Service project config, please visit below.

```
http://en.opensuse.org/openSUSE:Build\_Service\_prjconf
```

Then you need to download all your rpm source on to a local machine and import it into your project with the command.

```
$ osc importsrcpkg
```

Bootstrapping

To initiate the build process, we will copy the rpm binary from the source OBS of the source project. These binary rpms, from which we will remove any reference to release and version, will be used to trigger the first build. The OBS appliance will recompile all the rpms until all rpms in the project have been compiled only with packages compiled from their source code. Some base packages (e.g. tool chains) will be compiled several times during that process. Alternative You can build a first time against a target which is similar to the base that you need to boot strap in lieu of building against your own base and change the build reference to your bootstrap base once that the first build has been successful. Remember that you can also build against remote baseline. Double check that the preliminary step have been executed correctly. You must have already : copied a Linux base distribution in an OBS project defined a build target for that base project. Note : If you have not defined a build target the need directory structure will not exist. It's a preliminary mandatory step. stop the scheduler as it will create a mess if the system is not stable

```
# rcobsscheduler stop
```

* Add binaries to the :full directory of the Project ssh onto the OBS server. Now go to the project's build directory, and create a directory called ":full". Note : standard is the default name of your Build repository as defined in your project. It might change depending of who created the initial build repo.

```
# cd /obs/build/$PROJECT/standard/i586
```

This directory structure should already exist. If not, there is a problem (note that /obs is link and the target may vary with your implementation). Now create the ":full" directory. \$ mkdir :full Copy over all the binary rpms of the project you are trying to build from scratch. These rpms should have the release and version numbers stripped from them. e.g. alsa-utils-1.0.22-2.7.i586.rpm -- should be -- alsa-utils.rpm Note : If

the original project has a :full directory you can copy from there to avoid the issue of stripping version and release numbers. * Add binaries to the :full directory of the Project. Change all user/group privileges under /srv/obs/build/ to “obsrun”

```
# chown -R obsrun:obsrun /srv/obs/build
```

If you leave root as owner of :full, it will still build but the scheduler will fail (almost silently) to upgrade :full with the latest built packages. Except in very special cases, it is very unlikely that you want to do so. * Start the OBS scheduler

```
# rcobsscheduler start
```

* Force the obs to reindex your new :full directory. It will send an event to the scheduler which will create a file named :full.solv

```
# obs_admin --rescan-repository $OBS-PROJECT $REPO $ARCH
```

Troubleshooting

At that time you should see your project restarting to build. If that would not be the case. * check that your files in your target :full directory are all own by the user obsrun. The following command should not return any file name.

```
#find /obs/build ! -user obsrun
#chown -R obsrun:obsrun /obs/build (will correct ownership
issue)
```

* Force the obs to reindex your new :full directory. It will create a file named :full.solv

```
$obs_admin --rescan-repository $OBS-PROJECT $REPO $ARCH
```

* Check that your rpm are valid (e.g. not damaged during transfer)

```
#cd /obs/build/$PROJECT/standard/i586:full
#for I in `ls *.rpm` ; do rpm -qlp $I >/dev/null; if [ $? -ne
0 ] ;then echo $I >>../error.lst ; fi ; done
#cat ../error.lst (must be empty, all rpm in error needs re-
installation)
```

* Still not working, get a look in the log files in the directory /obs/log. You can start by having a look at /obs/log/scheduler_TARGET_ARCH.log and search from the end for the string "expanding dependencies". You will find from there why the scheduler fails.

```
#tail -f /obs/log/scheduler_i586.log
```

5.3 Creating my first project

After creating a dedicated user via the web API, relog onto the web UI with your new login. Open your home project and create a sub project called "MyTest". To add a package in your new Home project, simply create a link [link Package from other Project] with one of the packages recently copied in your new OBS instance (see previous chapter Import your base project). Pick up a small one to speed compilation time. Click on the "+" near Build Repositories to add a repository. Move to the end of the page where all the standard Linux distributions are listed and click on [Advance]. Give a name to your repo, e.g. my-test and pick from the list the project/repo that you have just imported and rebuilt. This will request the OBS to build your new Home project against that repository. You can now check out your Home project with the ocs command, modify a file or two and at your next check-in, the OBS will rebuild your Home project. If your reference project changes, the OBS will also rebuild your Home project.

OSC commands examples

This chapter explains and shows OSC commands examples. You could use OBS much more efficiently with OSC commands. `$man OSC` will show you [GLOBALOPTS], SUBCOMMAND, [OPTS][ARGS....]. You also could find some OSC commands examples from OBS Build Service portal. This chapter will take every OSC command examples from OBS Build Service portal and describes it in here. You could visit Build Service portal OSC command explanation via below described URL.

http://en.opensuse.org/Build_Service/CLI

6.1 osc, the Python command line client

osc is written in Python, and in addition to the commandline interface it also provides a Python module, for use by other Python programs. Packages can be found at <http://download.opensuse.org/repositories/openSUSE:/Tools/> for various distributions (openSUSE, SLES, Fedora, Mandriva, Debian, etc.). If you want to check out the latest source code, you can do so with Git:

```
git clone git://gitorious.org/opensuse/osc.git
```

osc is a subversion-like client. It serves as client for the source code repository part of the build service, and it is used to edit metadata or query about build results. Introductory usage examples are shown below. Note the Build Service Tutorial, which gives a more systematic introduction. osc is extensible. You can modify the behavior or write your own commands. osc will ask you for your credentials when you use it

for the first time, and store them in ~/.osrc. The password is stored in plain text. Protect your ~/.osrc file and your filesystem appropriately.

Show usage info on a command

```
osc help
osc help [cmd]
```

List existing content on the server

```
osc ls                                #list projects
osc ls Apache                        #list packages in a project
osc ls Apache flood                  #list files of package of a
project
```

"osc ls" shows you a list of projects on OBS. But which OBS it would show? it depends on your .osrc setting. please have a look on your .osrc file. If it is set as "api-url = https://api.opensuse.org". osc ls would show build.opensuse.org OBS projects list to you. So what if you would like to list projects of another OBS?

```
osc -A http://localhost:81 ls        #list your local OBS
instance projects
osc -A https://api.opensuse.org ls    #list build.opensuse.org
projects
```

Check out content

```
osc co Apache                        #entire project
osc co Apache flood                  #a package
osc co Apache flood flood.spec      # single file
```

Update a working directory

```

osc up
osc up [directory]
osc up *          # from within a project dir, update all
packages
osc up           # from within a project dir, update all
packages AND check out all newly added packages

```

Upload changed content

Upload changed content

```

osc ci           # current dir
osc ci [file1] [file2] # only specific files
osc ci [dir1] [dir2] ... # multiple packages
osc ci -m "updated foobar" # specify a commit message

```

See the commit log

```
osc log
```

Show the status (which files have been changed locally)

```
osc st
osc st [directory]

```

If an update cannot be merged automatically, a file is in 'C' (conflict) state, and conflicts are marked with special lines. After manually resolving the problem, use

```
osc resolved [file]
```

Mark files to be added or removed on the next 'checkin'

```
osc add foo
osc rm foo

```

Add all new files in local copy and removes all disappeared files.

```
osc addremove
```

Generate a diff to view the changes

```
osc diff [file]
```

Show the build results of the package

```
osc results  
osc results [platform]
```

Show the log file of a package (you need to be inside a package directory)

```
osc buildlog [platform] [arch]
```

Show the URLs of .repo files which are packages sources for Yum/YaST/smart

```
osc repourls [dir]
```

Trigger a package rebuild for all repositories/architectures of a package

```
osc rebuildpac [dir]
```

Build a package on your local platform


```
osc build [platform] [arch] [specfile] [--clean|--noinit|...]
```

Show the configured platforms/build targets.

```
osc platforms [project]
```

Show the possible build targets for your project.

```
osc repos
```

Show meta information

```
osc meta prj [project]
osc meta pkg [project] [package]
osc meta user [username]
osc meta prjconf [project]
```

Edit meta information. Creates new package/project if it doesn't exist. It will open an Editor with the raw XML metadata. If unsure about XML, you can use the web client instead.

```
osc meta prj -e [project]
osc meta pkg -e [project] [package]
osc meta prjconf -e [project]
```

(The project configuration (prjconf) may well be empty. It is needed in special cases only.) Update package meta data with metadata taken from spec file

```
osc updatepacmetafromspec [dir]
```

6.2 Package tracking

With osc it is also possible to manage packages in a svn like way. This feature is called package tracking and has to be enabled in ~/.osrc's [general] section

```
# manage your packages in a svn like way
do_package_tracking = 1
```

Add a new package to a project

```
osc mkpac [package]
```

Add an already existing directory and its files to a project

```
osc add [directory]
```

Remove a package and its files from a project

```
osc deletepac [package]
```

All the commands above only change your local working copy. To submit your changes to the buildservice you have to commit them (osc ci -m [message]). The status command also displays the state of the packages

```
osc st
```

6.3 .osrc cheatsheet

The [general] section Storage:

```
# Downloaded packages are cached here. Must be writable by you.
# default:
packagecachedir = /var/tmp/osbuild-packagecache
```

```
# rootdir to setup the chroot environment
# can contain %(repo)s and/or %(arch)s for replacement
# /[path]/%(repo)s-%(arch)s-%(project)s-%(package)s
# default:
```

```
build-root = /var/tmp/build-root/
```

API communication:

```
# use this API server (hostname[:port])
# (it needs a section [api.opensuse.org] with the credentials)
# default:
apiurl = api.opensuse.org
```

```
# use this protocol to access the API server (http or https)
# default:
scheme = https
```

API host:

```
# API hosts can be referenced by aliases, e.g. 'osc -A
alias ...'
# List aliases for API hosts under the API host section.
# https://api.opensuse.org
# user=jdoe
# aliases=
```

Local build:

```
# Wrapper to call build as root (sudo, su -, ...)
# default:
su-wrapper = su -c
# no password required with:
#su-wrapper = sudo
#with entry in sudoers file:
# [username] ALL = NOPASSWD: /usr/bin/build

# For convenience/debugging, osc adds internally vim gdb
strace to
```

```
not set to: # the packages installed in the build chroot if extra-pkgs is
#extra-pkgs=
```

```
# build type - possible values:
# * empty -> chroot
# * xen -> xen VM
# * kvm -> kvm VM (testing needed)
# default: not set/chroot
#build-type=xen
```

```
# build-device - root filesystem to use for VM
# default: not set
#build-device=/tmp/FILE.root
```

```
# build-swap - swap filesystem to use for VM
# default: not set
#build-swap=/tmp/FILE.swap
```

```
# build-memory - amount of memory for VM
# default: not set
#build-memory=512
```

Advanced Project Setups

These best practices describe more complex setups, for example how to rebuild an entire stack with minimal effort.

7.1 Rebuild an entire project with changes

To be written...

7.2 Integrate Source Handling

To be written...

7.3 Use OBS for automated QA

To be written...

8

Kernel Module Building

Ann Davis wants to write this ...

HOW TO -- a list of common questions and solutions

This currently an unsorted list of asked questions.

9.1 How to work best with limited bandwidth

Packages can contain large files, esp. some tar balls can become quite large, in some real life examples several hundred mega bytes. This can be a problem when you need to work on the package via a slow connection.

9.1.1 Use the web interface

The web interface is the easiest way to edit simple things without the need of the checkout.

Disadvantages are

- Not the preferred solution for power packagers
- No local build possible
- Still a significant bandwidth is needed compared to the size of the edited file.

9.1.2 Use osc with size limit

`osc` offers to skip files with a certain size (specified with `-l` switch) on checkout. The limit is stored locally and you can also run an update later without downloading any large files. All other files can be edited, diffed and committed as usual.

Disadvantages are

- The checkout is incomplete
- No local build possible

9.1.3 Use download_url

Manage your large files via source services. The easiest way is to use

```
osc add $URL
```

which just stores a small `_service` file. The check will not contain the large files by default, but they get downloaded when needed via the service. However, they will never get committed, so this is the best approach when you have a fast downstream, but slow upstream like with standard DSL connections. Also other users can trust your tar ball, esp. important when you do version upgrades on foreign packages.

Disadvantages are

- The generated files have the `_service:` prefix in check out (but not during build).

9.1.4 Use source service in trylocal mode

Manage your large files via source services in try local mode for example with `download_url` or `download_files` service. This means you can be flexible depending on your current connection without changing the setup. The service is generating the file on the server side when you decide not to commit it, but you can also decide to commit it and avoid the `_service:` prefix on the files. Also other users can trust your tar ball, esp. important when you do version upgrades on foreign packages.

Disadvantages are

- A checkout may still need the size limit switch when last commit contained the large files.

Glossary

Open Build Service

The Open Build Service and its acronym OBS is used to speak about the server part of the build service. When speaking about OBS all possible instances are affected.

openSUSE Build Service

The openSUSE Build Service is the concrete instance of Open Build Service (page 75) from the openSUSE project at <http://build.opensuse.org>.

Appliance

A software appliance is a preconfigured combination of an application (for example, a Web server) and its configuration, and includes an operating system (for example, SUSE Linux Enterprise Server). All these parts are integrated into a single image and can be deployed on industry hardware or on a virtual environment.

EULA

End User License Agreement. For software that needs a special license (usually non-open source) which the user has to agree to before installing.

KIWI

KIWI provides a complete operating system image solution. It can create images for Linux supported hardware platforms or for virtualization systems.

Overlay Files

Files which are created, removed, or modified in your testdrive are considered as *overlay files*. These files can be added later as a supplement to your appliance.

Binaries

Binaries are considered as build results of OBS Projects. Binaries can be reused in an environment to build further binaries. Currently OBS is supporting rpm, deb and all formats generated by KIWI (page 75).

GA Project

The GA project builds an initial release of a product. It gets frozen after releasing the product. All further updates get released via the Update Project (page 76) of this project.

Update Project

The update project is a Release Project (page 76) which provides official updates for the products generated in the GA Project (page 75). The Update project is usually linking (sources and repositories) against the GA Project (page 75).

Maintenance Project

The maintenance project is a project without sources and binaries, defined by the maintenance team. Incident (page 76)s are created as sub projects of this project.

Incident

The maintenance incident describes a concrete problem and the required updates. If the problem exists for multiple code streams, one incident covers all of them. An incident is started by creating a maintenance incident project and the update get built here.

Release Project

A release project is hosting a release repository which is not building any packages ever. It is just used to copy sources and binaries to this project on a release event.



How to work on this Book

These books are written with docbook and can be converted to html or pdf documentation. Please use the following command to checkout the current source of this book:

```
svn co https://svn.opensuse.org/svn/opensuse-doc/trunk/documents/obs/en OBS-  
documentation
```

Please check the README file for descriptions how to validate and generate them.

We ask every experienced OBS user or admin to join to work on these books. Subversion commit permissions will be granted after the first submitted patch. It is even possible to host instance specific content in the official subversion repository, it is just a matter to tag them correctly. Special parts of this documentation are tagged as `<para os="opensuse;meego">` for example. In this case the paragraph will become only visible when creating the openSUSE or MeeGo book.



GNU Licenses

This appendix contains the GNU General Public License version 2 and the GNU Free Documentation License version 1.2.

GNU General Public License

Version 2, June 1991

Copyright (C) 1989, 1991 Free Software Foundation, Inc. 59 Temple Place - Suite 330, Boston, MA 02111-1307, USA

Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed.

Preamble

The licenses for most software are designed to take away your freedom to share and change it. By contrast, the GNU General Public License is intended to guarantee your freedom to share and change free software--to make sure the software is free for all its users. This General Public License applies to most of the Free Software Foundation's software and to any other program whose authors commit to using it. (Some other Free Software Foundation software is covered by the GNU Library General Public License instead.) You can apply it to your programs, too.

When we speak of free software, we are referring to freedom, not price. Our General Public Licenses are designed to make sure that you have the freedom to distribute copies of free software (and charge for this service if you wish), that you receive source code or can get it if you want it, that you can change the software or use pieces of it in new free programs; and that you know you can do these things.

To protect your rights, we need to make restrictions that forbid anyone to deny you these rights or to ask you to surrender the rights. These restrictions translate to certain responsibilities for you if you distribute copies of the software, or if you modify it.

For example, if you distribute copies of such a program, whether gratis or for a fee, you must give the recipients all the rights that you have. You must make sure that they, too, receive or can get the source code. And you must show them these terms so they know their rights.

We protect your rights with two steps: (1) copyright the software, and (2) offer you this license which gives you legal permission to copy, distribute and/or modify the software.

Also, for each author's protection and ours, we want to make certain that everyone understands that there is no warranty for this free software. If the software is modified by someone else and passed on, we want its recipients to know that what they have is not the original, so that any problems introduced by others will not reflect on the original authors' reputations.

Finally, any free program is threatened constantly by software patents. We wish to avoid the danger that redistributors of a free program will individually obtain patent licenses, in effect making the program proprietary. To prevent this, we have made it clear that any patent must be licensed for everyone's free use or not licensed at all.

The precise terms and conditions for copying, distribution and modification follow.

GNU GENERAL PUBLIC LICENSE TERMS AND CONDITIONS FOR COPYING, DISTRIBUTION AND MODIFICATION

0. This License applies to any program or other work which contains a notice placed by the copyright holder saying it may be distributed under the terms of this General Public License. The “Program”, below, refers to any such program or work, and a “work based on the Program” means either the Program or any derivative work under copyright law: that is to say, a work containing the Program or a portion of it, either verbatim or with modifications and/or translated into another language. (Hereinafter, translation is included without limitation in the term “modification”.) Each licensee is addressed as “you”.

Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of running the Program is not restricted, and the output from the Program is covered only if its contents constitute a work based on the Program (independent of having been made by running the Program). Whether that is true depends on what the Program does.

1. You may copy and distribute verbatim copies of the Program’s source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice and disclaimer of warranty; keep intact all the notices that refer to this License and to the absence of any warranty; and give any other recipients of the Program a copy of this License along with the Program.

You may charge a fee for the physical act of transferring a copy, and you may at your option offer warranty protection in exchange for a fee.

2. You may modify your copy or copies of the Program or any portion of it, thus forming a work based on the Program, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:

- a)** You must cause the modified files to carry prominent notices stating that you changed the files and the date of any change.
- b)** You must cause any work that you distribute or publish, that in whole or in part contains or is derived from the Program or any part thereof, to be licensed as a whole at no charge to all third parties under the terms of this License.
- c)** If the modified program normally reads commands interactively when run, you must cause it, when started running for such interactive use in the most ordinary way, to print or display an announcement including an appropriate copyright notice and a notice that there is no warranty (or else, saying that you provide a warranty) and that users may redistribute the program under these conditions, and telling the user how to view a copy of this License. (Exception: if the Program itself is interactive but does not normally print such an announcement, your work based on the Program is not required to print an announcement.)

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Program, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Program, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Program.

In addition, mere aggregation of another work not based on the Program with the Program (or with a work based on the Program) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

3. You may copy and distribute the Program (or a work based on it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you also do one of the following:

- a)** Accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange; or,
- b)** Accompany it with a written offer, valid for at least three years, to give any third party, for a charge no more than your cost of physically performing source distribution, a complete machine-readable copy of the corresponding source code, to be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange; or,
- c)** Accompany it with the information you received as to the offer to distribute corresponding source code. (This alternative is allowed only for noncommercial distribution and only if you received the program in object code or executable form with such an offer, in accord with Subsection b above.)

The source code for a work means the preferred form of the work for making modifications to it. For an executable work, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the executable. However, as a special exception, the source code distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

If distribution of executable or object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place counts as distribution of the source code, even though third parties are not compelled to copy the source along with the object code.

4. You may not copy, modify, sublicense, or distribute the Program except as expressly provided under this License. Any attempt otherwise to copy, modify, sublicense or distribute the Program is void, and will automatically terminate your rights under this License. However, parties who have received copies, or rights, from you under this License will not have their licenses terminated so long as such parties remain in full compliance.

5. You are not required to accept this License, since you have not signed it. However, nothing else grants you permission to modify or distribute the Program or its derivative works. These actions are prohibited by law if you do not accept this License. Therefore, by modifying or distributing the Program (or any work based on the Program), you indicate your acceptance of this License to do so, and all its terms and conditions for copying, distributing or modifying the Program or works based on it.

6. Each time you redistribute the Program (or any work based on the Program), the recipient automatically receives a license from the original licensor to copy, distribute or modify the Program subject to these terms and conditions. You may not impose any further restrictions on the recipients' exercise of the rights granted herein. You are not responsible for enforcing compliance by third parties to this License.

7. If, as a consequence of a court judgment or allegation of patent infringement or for any other reason (not limited to patent issues), conditions are imposed on you (whether by court order, agreement or otherwise) that contradict the conditions of this License, they do not excuse you from the conditions of this License. If you cannot distribute so as to satisfy simultaneously your obligations under this License and any other pertinent obligations, then as a consequence you may not distribute the Program at all. For example, if a patent license would not permit royalty-free redistribution of the Program by all those who receive copies directly or indirectly through you, then the only way you could satisfy both it and this License would be to refrain entirely from distribution of the Program.

If any portion of this section is held invalid or unenforceable under any particular circumstance, the balance of the section is intended to apply and the section as a whole is intended to apply in other circumstances.

It is not the purpose of this section to induce you to infringe any patents or other property right claims or to contest validity of any such claims; this section has the sole purpose of protecting the integrity of the free software distribution system, which is implemented by public license practices. Many people have made generous contributions to the wide range of software distributed through that system in reliance on consistent application of that system; it is up to the author/donor to decide if he or she is willing to distribute software through any other system and a licensee cannot impose that choice.

This section is intended to make thoroughly clear what is believed to be a consequence of the rest of this License.

8. If the distribution and/or use of the Program is restricted in certain countries either by patents or by copyrighted interfaces, the original copyright holder who places the Program under this License may add an explicit geographical distribution limitation excluding those countries, so that distribution is permitted only in or among countries not thus excluded. In such case, this License incorporates the limitation as if written in the body of this License.

9. The Free Software Foundation may publish revised and/or new versions of the General Public License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns.

Each version is given a distinguishing version number. If the Program specifies a version number of this License which applies to it and "any later version", you have the option of following the terms and conditions either of that version or of any later version published by the Free Software Foundation. If the Program does not specify a version number of this License, you may choose any version ever published by the Free Software Foundation.

10. If you wish to incorporate parts of the Program into other free programs whose distribution conditions are different, write to the author to ask for permission. For software which is copyrighted by the Free Software Foundation, write to the Free Software Foundation; we sometimes make exceptions for this. Our decision will be guided by the two goals of preserving the free status of all derivatives of our free software and of promoting the sharing and reuse of software generally.

NO WARRANTY

11. BECAUSE THE PROGRAM IS LICENSED FREE OF CHARGE, THERE IS NO WARRANTY FOR THE PROGRAM, TO THE EXTENT PERMITTED BY APPLICABLE LAW. EXCEPT WHEN OTHERWISE STATED IN WRITING THE COPYRIGHT HOLDERS AND/OR OTHER PARTIES PROVIDE THE PROGRAM "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE PROGRAM IS WITH YOU. SHOULD THE PROGRAM PROVE DEFECTIVE, YOU ASSUME THE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION.

12. IN NO EVENT UNLESS REQUIRED BY APPLICABLE LAW OR AGREED TO IN WRITING WILL ANY COPYRIGHT HOLDER, OR ANY OTHER PARTY WHO MAY MODIFY AND/OR REDISTRIBUTE THE PROGRAM AS PERMITTED ABOVE, BE LIABLE TO YOU FOR DAMAGES, INCLUDING ANY GENERAL, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE PROGRAM (INCLUDING BUT NOT LIMITED TO LOSS OF DATA OR DATA BEING RENDERED INACCURATE OR LOSSES SUSTAINED BY YOU OR THIRD PARTIES OR A FAILURE OF THE PROGRAM TO OPERATE WITH ANY OTHER PROGRAMS), EVEN IF SUCH HOLDER OR OTHER PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

END OF TERMS AND CONDITIONS

How to Apply These Terms to Your New Programs

If you develop a new program, and you want it to be of the greatest possible use to the public, the best way to achieve this is to make it free software which everyone can redistribute and change under these terms.

To do so, attach the following notices to the program. It is safest to attach them to the start of each source file to most effectively convey the exclusion of warranty; and each file should have at least the "copyright" line and a pointer to where the full notice is found.

one line to give the program's name and an idea of what it does.
Copyright (C) yyyy name of author

This program is free software; you can redistribute it and/or
modify it under the terms of the GNU General Public License
as published by the Free Software Foundation; either version 2
of the License, or (at your option) any later version.

This program is distributed in the hope that it will be useful,
but WITHOUT ANY WARRANTY; without even the implied warranty of
MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the
GNU General Public License for more details.

You should have received a copy of the GNU General Public License
along with this program; if not, write to the Free Software
Foundation, Inc., 59 Temple Place - Suite 330, Boston, MA 02111-1307, USA.

Also add information on how to contact you by electronic and paper mail.

If the program is interactive, make it output a short notice like this when it starts in an interactive mode:

Gnomovision version 69, Copyright (C) year name of author
Gnomovision comes with ABSOLUTELY NO WARRANTY; for details
type `show w'. This is free software, and you are welcome
to redistribute it under certain conditions; type `show c'
for details.

The hypothetical commands `show w' and `show c' should show the appropriate parts of the General Public License. Of course, the commands you use
may be called something other than `show w' and `show c'; they could even be mouse-clicks or menu items--whatever suits your program.

You should also get your employer (if you work as a programmer) or your school, if any, to sign a "copyright disclaimer" for the program, if neces-
sary. Here is a sample; alter the names:

Yoyodyne, Inc., hereby disclaims all copyright
interest in the program `Gnomovision'
(which makes passes at compilers) written
by James Hacker.

signature of Ty Coon, 1 April 1989
Ty Coon, President of Vice

This General Public License does not permit incorporating your program into proprietary programs. If your program is a subroutine library, you may
consider it more useful to permit linking proprietary applications with the library. If this is what you want to do, use the GNU Lesser General Public
License [<http://www.fsf.org/licenses/lgpl.html>] instead of this License.

GNU Free Documentation License

Version 1.2, November 2002

Copyright (C) 2000,2001,2002 Free Software Foundation, Inc. 59 Temple Place, Suite 330, Boston, MA 02111-1307 USA

Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed.

PREAMBLE

The purpose of this License is to make a manual, textbook, or other functional and useful document "free" in the sense of freedom: to assure everyone
the effective freedom to copy and redistribute it, with or without modifying it, either commercially or noncommercially. Secondly, this License pre-
serves for the author and publisher a way to get credit for their work, while not being considered responsible for modifications made by others.

This License is a kind of “copyleft”, which means that derivative works of the document must themselves be free in the same sense. It complements the GNU General Public License, which is a copyleft license designed for free software.

We have designed this License in order to use it for manuals for free software, because free software needs free documentation: a free program should come with manuals providing the same freedoms that the software does. But this License is not limited to software manuals; it can be used for any textual work, regardless of subject matter or whether it is published as a printed book. We recommend this License principally for works whose purpose is instruction or reference.

APPLICABILITY AND DEFINITIONS

This License applies to any manual or other work, in any medium, that contains a notice placed by the copyright holder saying it can be distributed under the terms of this License. Such a notice grants a world-wide, royalty-free license, unlimited in duration, to use that work under the conditions stated herein. The “Document”, below, refers to any such manual or work. Any member of the public is a licensee, and is addressed as “you”. You accept the license if you copy, modify or distribute the work in a way requiring permission under copyright law.

A “Modified Version” of the Document means any work containing the Document or a portion of it, either copied verbatim, or with modifications and/or translated into another language.

A “Secondary Section” is a named appendix or a front-matter section of the Document that deals exclusively with the relationship of the publishers or authors of the Document to the Document’s overall subject (or to related matters) and contains nothing that could fall directly within that overall subject. (Thus, if the Document is in part a textbook of mathematics, a Secondary Section may not explain any mathematics.) The relationship could be a matter of historical connection with the subject or with related matters, or of legal, commercial, philosophical, ethical or political position regarding them.

The “Invariant Sections” are certain Secondary Sections whose titles are designated, as being those of Invariant Sections, in the notice that says that the Document is released under this License. If a section does not fit the above definition of Secondary then it is not allowed to be designated as Invariant. The Document may contain zero Invariant Sections. If the Document does not identify any Invariant Sections then there are none.

The “Cover Texts” are certain short passages of text that are listed, as Front-Cover Texts or Back-Cover Texts, in the notice that says that the Document is released under this License. A Front-Cover Text may be at most 5 words, and a Back-Cover Text may be at most 25 words.

A “Transparent” copy of the Document means a machine-readable copy, represented in a format whose specification is available to the general public, that is suitable for revising the document straightforwardly with generic text editors or (for images composed of pixels) generic paint programs or (for drawings) some widely available drawing editor, and that is suitable for input to text formatters or for automatic translation to a variety of formats suitable for input to text formatters. A copy made in an otherwise Transparent file format whose markup, or absence of markup, has been arranged to thwart or discourage subsequent modification by readers is not Transparent. An image format is not Transparent if used for any substantial amount of text. A copy that is not “Transparent” is called “Opaque”.

Examples of suitable formats for Transparent copies include plain ASCII without markup, Texinfo input format, LaTeX input format, SGML or XML using a publicly available DTD, and standard-conforming simple HTML, PostScript or PDF designed for human modification. Examples of transparent image formats include PNG, XCF and JPG. Opaque formats include proprietary formats that can be read and edited only by proprietary word processors, SGML or XML for which the DTD and/or processing tools are not generally available, and the machine-generated HTML, PostScript or PDF produced by some word processors for output purposes only.

The “Title Page” means, for a printed book, the title page itself, plus such following pages as are needed to hold, legibly, the material this License requires to appear in the title page. For works in formats which do not have any title page as such, “Title Page” means the text near the most prominent appearance of the work’s title, preceding the beginning of the body of the text.

A section “Entitled XYZ” means a named subunit of the Document whose title either is precisely XYZ or contains XYZ in parentheses following text that translates XYZ in another language. (Here XYZ stands for a specific section name mentioned below, such as “Acknowledgements”, “Dedications”, “Endorsements”, or “History”.) To “Preserve the Title” of such a section when you modify the Document means that it remains a section “Entitled XYZ” according to this definition.

The Document may include Warranty Disclaimers next to the notice which states that this License applies to the Document. These Warranty Disclaimers are considered to be included by reference in this License, but only as regards disclaiming warranties: any other implication that these Warranty Disclaimers may have is void and has no effect on the meaning of this License.

VERBATIM COPYING

You may copy and distribute the Document in any medium, either commercially or noncommercially, provided that this License, the copyright notices, and the license notice saying this License applies to the Document are reproduced in all copies, and that you add no other conditions whatsoever to those of this License. You may not use technical measures to obstruct or control the reading or further copying of the copies you make or distribute. However, you may accept compensation in exchange for copies. If you distribute a large enough number of copies you must also follow the conditions in section 3.

You may also lend copies, under the same conditions stated above, and you may publicly display copies.

COPYING IN QUANTITY

If you publish printed copies (or copies in media that commonly have printed covers) of the Document, numbering more than 100, and the Document’s license notice requires Cover Texts, you must enclose the copies in covers that carry, clearly and legibly, all these Cover Texts: Front-Cover Texts on the front cover, and Back-Cover Texts on the back cover. Both covers must also clearly and legibly identify you as the publisher of these copies. The front cover must present the full title with all words of the title equally prominent and visible. You may add other material on the covers in addition.

Copying with changes limited to the covers, as long as they preserve the title of the Document and satisfy these conditions, can be treated as verbatim copying in other respects.

If the required texts for either cover are too voluminous to fit legibly, you should put the first ones listed (as many as fit reasonably) on the actual cover, and continue the rest onto adjacent pages.

If you publish or distribute Opaque copies of the Document numbering more than 100, you must either include a machine-readable Transparent copy along with each Opaque copy, or state in or with each Opaque copy a computer-network location from which the general network-using public has access to download using public-standard network protocols a complete Transparent copy of the Document, free of added material. If you use the latter option, you must take reasonably prudent steps, when you begin distribution of Opaque copies in quantity, to ensure that this Transparent copy will remain thus accessible at the stated location until at least one year after the last time you distribute an Opaque copy (directly or through your agents or retailers) of that edition to the public.

It is requested, but not required, that you contact the authors of the Document well before redistributing any large number of copies, to give them a chance to provide you with an updated version of the Document.

MODIFICATIONS

You may copy and distribute a Modified Version of the Document under the conditions of sections 2 and 3 above, provided that you release the Modified Version under precisely this License, with the Modified Version filling the role of the Document, thus licensing distribution and modification of the Modified Version to whoever possesses a copy of it. In addition, you must do these things in the Modified Version:

- A.** Use in the Title Page (and on the covers, if any) a title distinct from that of the Document, and from those of previous versions (which should, if there were any, be listed in the History section of the Document). You may use the same title as a previous version if the original publisher of that version gives permission.
- B.** List on the Title Page, as authors, one or more persons or entities responsible for authorship of the modifications in the Modified Version, together with at least five of the principal authors of the Document (all of its principal authors, if it has fewer than five), unless they release you from this requirement.
- C.** State on the Title page the name of the publisher of the Modified Version, as the publisher.
- D.** Preserve all the copyright notices of the Document.
- E.** Add an appropriate copyright notice for your modifications adjacent to the other copyright notices.
- F.** Include, immediately after the copyright notices, a license notice giving the public permission to use the Modified Version under the terms of this License, in the form shown in the Addendum below.
- G.** Preserve in that license notice the full lists of Invariant Sections and required Cover Texts given in the Document's license notice.
- H.** Include an unaltered copy of this License.
- I.** Preserve the section Entitled "History", Preserve its Title, and add to it an item stating at least the title, year, new authors, and publisher of the Modified Version as given on the Title Page. If there is no section Entitled "History" in the Document, create one stating the title, year, authors, and publisher of the Document as given on its Title Page, then add an item describing the Modified Version as stated in the previous sentence.
- J.** Preserve the network location, if any, given in the Document for public access to a Transparent copy of the Document, and likewise the network locations given in the Document for previous versions it was based on. These may be placed in the "History" section. You may omit a network location for a work that was published at least four years before the Document itself, or if the original publisher of the version it refers to gives permission.
- K.** For any section Entitled "Acknowledgements" or "Dedications", Preserve the Title of the section, and preserve in the section all the substance and tone of each of the contributor acknowledgements and/or dedications given therein.
- L.** Preserve all the Invariant Sections of the Document, unaltered in their text and in their titles. Section numbers or the equivalent are not considered part of the section titles.
- M.** Delete any section Entitled "Endorsements". Such a section may not be included in the Modified Version.
- N.** Do not retitle any existing section to be Entitled "Endorsements" or to conflict in title with any Invariant Section.
- O.** Preserve any Warranty Disclaimers.

If the Modified Version includes new front-matter sections or appendices that qualify as Secondary Sections and contain no material copied from the Document, you may at your option designate some or all of these sections as invariant. To do this, add their titles to the list of Invariant Sections in the Modified Version's license notice. These titles must be distinct from any other section titles.

You may add a section Entitled "Endorsements", provided it contains nothing but endorsements of your Modified Version by various parties—for example, statements of peer review or that the text has been approved by an organization as the authoritative definition of a standard.

You may add a passage of up to five words as a Front-Cover Text, and a passage of up to 25 words as a Back-Cover Text, to the end of the list of Cover Texts in the Modified Version. Only one passage of Front-Cover Text and one of Back-Cover Text may be added by (or through arrangements made by) any one entity. If the Document already includes a cover text for the same cover, previously added by you or by arrangement made by the

same entity you are acting on behalf of, you may not add another; but you may replace the old one, on explicit permission from the previous publisher that added the old one.

The author(s) and publisher(s) of the Document do not by this License give permission to use their names for publicity for or to assert or imply endorsement of any Modified Version.

COMBINING DOCUMENTS

You may combine the Document with other documents released under this License, under the terms defined in section 4 above for modified versions, provided that you include in the combination all of the Invariant Sections of all of the original documents, unmodified, and list them all as Invariant Sections of your combined work in its license notice, and that you preserve all their Warranty Disclaimers.

The combined work need only contain one copy of this License, and multiple identical Invariant Sections may be replaced with a single copy. If there are multiple Invariant Sections with the same name but different contents, make the title of each such section unique by adding at the end of it, in parentheses, the name of the original author or publisher of that section if known, or else a unique number. Make the same adjustment to the section titles in the list of Invariant Sections in the license notice of the combined work.

In the combination, you must combine any sections Entitled “History” in the various original documents, forming one section Entitled “History”; likewise combine any sections Entitled “Acknowledgements”, and any sections Entitled “Dedications”. You must delete all sections Entitled “Endorsements”.

COLLECTIONS OF DOCUMENTS

You may make a collection consisting of the Document and other documents released under this License, and replace the individual copies of this License in the various documents with a single copy that is included in the collection, provided that you follow the rules of this License for verbatim copying of each of the documents in all other respects.

You may extract a single document from such a collection, and distribute it individually under this License, provided you insert a copy of this License into the extracted document, and follow this License in all other respects regarding verbatim copying of that document.

AGGREGATION WITH INDEPENDENT WORKS

A compilation of the Document or its derivatives with other separate and independent documents or works, in or on a volume of a storage or distribution medium, is called an “aggregate” if the copyright resulting from the compilation is not used to limit the legal rights of the compilation’s users beyond what the individual works permit. When the Document is included in an aggregate, this License does not apply to the other works in the aggregate which are not themselves derivative works of the Document.

If the Cover Text requirement of section 3 is applicable to these copies of the Document, then if the Document is less than one half of the entire aggregate, the Document’s Cover Texts may be placed on covers that bracket the Document within the aggregate, or the electronic equivalent of covers if the Document is in electronic form. Otherwise they must appear on printed covers that bracket the whole aggregate.

TRANSLATION

Translation is considered a kind of modification, so you may distribute translations of the Document under the terms of section 4. Replacing Invariant Sections with translations requires special permission from their copyright holders, but you may include translations of some or all Invariant Sections in addition to the original versions of these Invariant Sections. You may include a translation of this License, and all the license notices in the Document, and any Warranty Disclaimers, provided that you also include the original English version of this License and the original versions of those notices and disclaimers. In case of a disagreement between the translation and the original version of this License or a notice or disclaimer, the original version will prevail.

If a section in the Document is Entitled “Acknowledgements”, “Dedications”, or “History”, the requirement (section 4) to Preserve its Title (section 1) will typically require changing the actual title.

TERMINATION

You may not copy, modify, sublicense, or distribute the Document except as expressly provided for under this License. Any other attempt to copy, modify, sublicense or distribute the Document is void, and will automatically terminate your rights under this License. However, parties who have received copies, or rights, from you under this License will not have their licenses terminated so long as such parties remain in full compliance.

FUTURE REVISIONS OF THIS LICENSE

The Free Software Foundation may publish new, revised versions of the GNU Free Documentation License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns. See <http://www.gnu.org/copyleft/>.

Each version of the License is given a distinguishing version number. If the Document specifies that a particular numbered version of this License “or any later version” applies to it, you have the option of following the terms and conditions either of that specified version or of any later version that has been published (not as a draft) by the Free Software Foundation. If the Document does not specify a version number of this License, you may choose any version ever published (not as a draft) by the Free Software Foundation.

ADDENDUM: How to use this License for your documents

To use this License in a document you have written, include a copy of the License in the document and put the following copyright and license notices just after the title page:

Copyright (c) YEAR YOUR NAME.
Permission is granted to copy, distribute and/or modify this document
under the terms of the GNU Free Documentation License, Version 1.2
or any later version published by the Free Software Foundation;
with no Invariant Sections, no Front-Cover Texts, and no Back-Cover Texts.
A copy of the license is included in the section entitled “GNU
Free Documentation License”.

If you have Invariant Sections, Front-Cover Texts and Back-Cover Texts, replace the “with...Texts.” line with this:

with the Invariant Sections being LIST THEIR TITLES, with the
Front-Cover Texts being LIST, and with the Back-Cover Texts being LIST.

If you have Invariant Sections without Cover Texts, or some other combination of the three, merge those two alternatives to suit the situation.

If your document contains nontrivial examples of program code, we recommend releasing these examples in parallel under your choice of free software license, such as the GNU General Public License, to permit their use in free software.