



# Beginner's Guide

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## Open Build Service

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This guide describes basic workflows for working with packages on Open Build Service. This includes checking out a package from an upstream project, creating patches, branching a repository, and more.

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## Contents

- 1 Target Audience 2
- 2 Conceptual Overview 2
- 3 Requirements for Working with the **osc** Command-Line Tool 4
- 4 Configuring Your System for OBS 5
- 5 Covered Scenarios 6
- 6 Setting Up Your Home Project for the First Time 8
- 7 Creating a New Project 8
- 8 Patching Source Code 12
- 9 Branching a Package 15
- 10 Installing Packages from OBS 18
- 11 Other Useful **osc** Commands 19

# 1 Target Audience

This document is intended for users and developers interested in building packages from source code for different platforms and Linux distributions. Basic knowledge of Linux and the command line usage is recommended.

## 2 Conceptual Overview

Created in 2005, the Open Build Service (OBS) is a generic system for building and distributing packages or images from source code in an automatic, consistent, and reproducible way. OBS can create images and installable packages for a wide range of operating systems (SUSE, Debian, Ubuntu, Red Hat, Windows, etc.) and hardware architectures (x86, AMD64, z Systems, POWER etc.).

### 2.1 Build Recipe

To create a package in OBS, you need a *build recipe* which contains the following information:

- **Metadata.** The package name and the description are mandatory. Other data such as the version, the license, the upstream URL is optional.
- **Requirements.** Packages depend on other packages to function properly. There are two types of requirements: *build requirements* and *installation requirements*.  
Build requirements are dependencies which are needed during the build process in OBS. For example, a C++ program needs a C++ compiler.  
Installation requirements are dependencies which are needed when installing the final package.
- **A Package List.** To successfully install and remove a package and all its contents, the package manager needs to know which files and directories belong to which package.

For RPM-based operating systems such as openSUSE, SUSE Linux Enterprise, or Red Hat Enterprise Linux, all the information above is included in a file with the file extension .spec.

## 2.2 Build Hosts and Packages

The OBS server provides a Web interface and an API. The API is used by the `osc` command-line tool.

To build the package, the back end creates a sandbox with the respective distribution. This sandbox is isolated from the rest of the host system. Depending on the build recipe (on RPM-based systems, this is a *spec file*), other packages are downloaded and installed prior to building. The build process executes all the instructions that it finds in the build recipe. If the build is successful, the files which belong to the package are installed into the sandbox. From those sandboxed files, the final RPM package is created and moved into a download area, the *download repository*.

End users can install the package using their preferred package management tools. On a SUSE-based system, you can use YaST or Zypper command-line tool to install an RPM version of the package.

Other OBS-related services (like the notification server, mirror interface, etc.) perform very specific tasks and therefore beyond the scope of this guide.

The schematic in *Figure 1, "Conceptual Overview of Open Build Service"* shows the components in context.

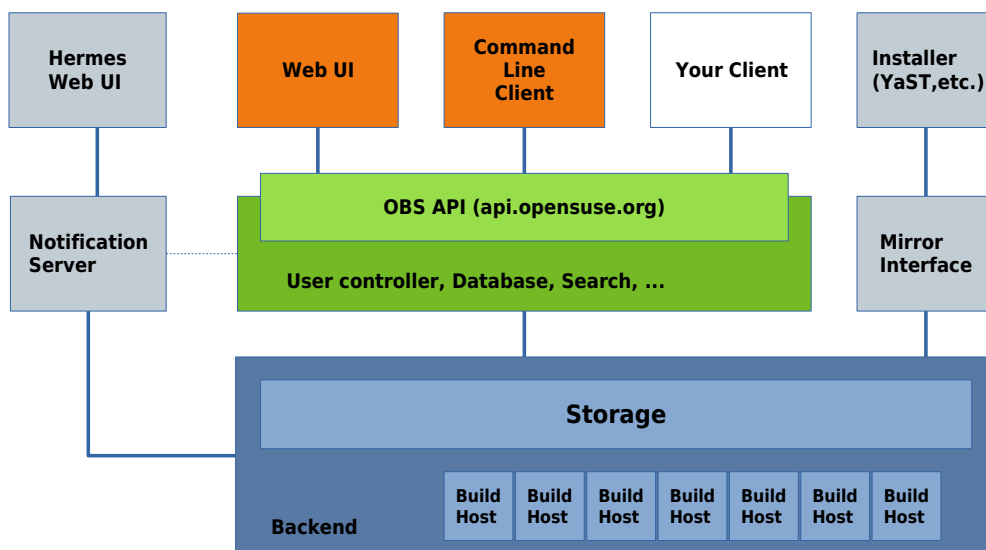


FIGURE 1: CONCEPTUAL OVERVIEW OF OPEN BUILD SERVICE

## 2.3 Projects and Packages

In OBS, packages are organized in *projects*. A single project can contain several packages, and it usually serves a specific organizational purpose. Generic access control, related repositories, and build targets (operating systems and architectures) are all defined on the project level.

Projects can also have other projects (subprojects) to structure work. They are isolated from their parent project and can be configured individually.

Each project name is separated by colon. For example, in the openSUSE Build Service, packages for fonts are collected in the project `M17N:fonts` which is a subproject of `M17N`. Packages for the Python programming language are available in the `devel:languages:python` project which is a subproject of `devel:languages` which itself is a subproject of `devel`.

As a user, you will normally build packages in your *home project*, available in OBS as `home:USERNAME`. Home projects serve as a personal working area in OBS to define build targets, upload, build, and download packages. Users are also permitted to create subprojects for temporary subprojects to work on other people's packages.

Sometimes, you will see the `obs://DOMAIN/PROJECT` notation. The `obs://` schema is a shorthand to abbreviate the long URL and needs to be replaced by the real OBS instance URL.

## 3 Requirements for Working with the `osc` Command-Line Tool

Before you start working with Open Build Service, make sure that the following requirements are met.

### Software Requirements

Install the `osc` command line tool from your preferred distributions or from the OBS project `openSUSE:Tools`:

- For SUSE related systems, install the `osc` package with the `zypper` command (replace `DISTRIBUTION` with your distribution):

```
root # zypper ar https://download.opensuse.org/repositories/openSUSE:/  
Tools/DISTRIBUTION/openSUSE:Tools.repo
```

```
root # zypper install osc
```

- For other systems, use your preferred package manager.
- As an alternative, you can use the AppImage file . An AppImage file is a packaged application which can run on many distributions. Download the file from <https://download.opensuse.org/repositories/openSUSE:/Tools/AppImage/>, save it in your `~/bin` directory, and make the file executable.

### Hardware Requirements

Make sure you have a minimum of 1 GB of free disk space. The `osc` command builds all packages locally under `/var/tmp/oscbuild` and caches downloaded packages under `/var/tmp/osbuild-packagecache`.

## 4 Configuring Your System for OBS

While it is possible to use the `osc` tool without any configuration, it is recommended to set up your system as described below.

After all dependencies are downloaded and before the actual build process can start, you need to enter the `root` password. This can be inconvenient when you rebuild packages frequently. The configuration below modifies the `sudo` configuration to allow building packages without entering the `root` password. To maximize security, only specific users can have root privileges. Follow the steps below to customize `sudo`.

### PROCEDURE 1: CONFIGURING `sudo`

To allow all users in the `osc` group to build packages without entering the `root` password, do as follows.

1. Log in as `root` and create a new group `osc`. This group will contain all users which are allowed to build packages:

```
root # groupadd osc
```

2. Add users to your newly created group `osc` which are allowed to build packages:

```
root # usermod -a -G osc geeko
```

Repeat this step to add other users, if necessary.

3. Run `visudo` to create the sudoers file `/etc/sudoers.d/osc`:

```
root # visudo -f /etc/sudoers.d/osc
```

4. Add the following lines to create a command alias that can be executed only by the `osc` group:

```
# sudoers file "/etc/sudoers.d/osc" for the osc group
Cmdnd_Alias OSC_CMD = /usr/bin/osc, /usr/bin/build
%osc ALL = (ALL) NOPASSWD:OSC_CMD
```

5. Log out of your system and log in again to apply the changes.
6. Create a new OBS configuration file:

```
geeko > osc ls home:obsgeeko
```

If you run the command for the first time, you will be prompted to enter your OBS user name and OBS password.



### Note: Alternative Directory Structure

If you prefer to separate projects and subprojects in directories and subdirectories, change the following line in your configuration file `~/.osrc`:

```
checkout_no_colon = 1
```

This will use an alternate layout when checking out a project. For example, setting the option above and checking out the home project will generate the `home/obsgeeko` directory structure instead of the single `home:obsgeeko` directory.

However, this guide uses the default configuration with colons.

## 5 Covered Scenarios

This guide is based on the following assumptions.

- Since Git is used throughout this guide, and many OBS concepts are modeled after their Subversion (SVN) equivalents, you have a working knowledge of version control systems such as Git and Subversion (SVN).
- You are using the openSUSE Build Service at <https://build.opensuse.org>. If you are using another OBS instance, some commands may differ.
- You have an account on an Open Build Service instance.
- You are running an RPM-based operating system like openSUSE or SUSE Linux Enterprise.
- You are using a customized system as shown in *Section 4, "Configuring Your System for OBS"*.

All examples use the following elements.

- A user on a local machine (you) called `geeko`. This user builds packages on their own machine.
- An OBS user called `obsgeeko` with home `home:obsgeeko` on the Open Build Service. This user is the same as the system user `geeko`, that is, you.
- An OBS user `obstux` and their home `home:obstux` on Open Build Service. This user acts as a collaborator.
- An example upstream open source project available at <https://github.com/obs-example/my-first-obs-package>. This project contains source code in the C++ programming language.

This guide describes the following common tasks:

#### *Section 6, "Setting Up Your Home Project for the First Time"*

Setting up a home project using the OBS Web UI.

#### *Section 7, "Creating a New Project"*

Creating packages from a basic project hosted on GitHub.

#### *Section 8, "Patching Source Code"*

Patching source code without touching the original source.

#### *Section 9, "Branching a Package"*

Branching a project, making changes, and submitting back the changes to the original project.

#### *Section 10, "Installing Packages from OBS"*

Integrating the download repository into your system and installing your built package.

## 6 Setting Up Your Home Project for the First Time

This section shows how to set up your home project after creating an openSUSE account.

When you log in to your home project for the first time, it will be empty. To build packages, you need to select build targets (operating systems and architectures) first. Build targets are defined project-wide and every package in a project is built for each build target. However, you can disable build targets for a specific package.

Setting up a home project is done as shown below.

### PROCEDURE 2: ADDING GLOBAL BUILD TARGETS TO YOUR HOME PROJECT

1. Log in to the Open Build Service instance.
2. Click the *Home Project* link in the upper-right corner.
3. Click the *Repositories* tab, then the *Add Repositories* link.
4. Select the distributions you want to build for.  
OBS shows several Linux distributions. For SUSE distributions, it is recommended to activate at least openSUSE Tumbleweed and the latest openSUSE Leap release. To enable package builds for SUSE Linux Enterprise, mark one of the *openSUSE Backports for SLE 12*. When you select a distribution, OBS shows a message that the distribution has been successfully added it to your home project.
5. Click the *Overview* tab to see the available build targets on the right side.

To add more build targets, repeat the procedure above.

To fine tune your build targets, click the *Repositories* tab, find the respective build target, and click the *Edit repository* link. This shows the available architectures and additional package repositories you can add.

## 7 Creating a New Project

This section demonstrates how to create packages from a simple C++ project hosted on GitHub (the “upstream project”). We assume that this project contains source code which you want to package for different SUSE distributions.





## Note: Check the License First

Before building, go to the homepage of the upstream project and check the license.

For example, in the openSUSE Build Service, you must only redistribute packages which are available under an open source license. If you are submitting a package to openSUSE, its source code will be checked for license compliance. If your package is not released under an open source license, it will be rejected.

You can find a list of already used licenses in OBS at <https://license.opensuse.org>. For more details and a comparison of open source licenses in general, see [https://en.wikipedia.org/wiki/Comparison\\_of\\_free\\_and\\_open-source\\_software\\_licenses](https://en.wikipedia.org/wiki/Comparison_of_free_and_open-source_software_licenses).

To create a package from the upstream project, follow the steps below.

1. Set up your project as shown in *Section 6, "Setting Up Your Home Project for the First Time"*.
2. In the terminal, choose or create a directory on a local partition that has enough space to hold the package sources.
3. Check out your home project:

```
geeko > osc checkout home:obsgeeko
```

This creates an empty `home:obsgeeko` directory in the current directory.

4. Create a new package in your local *working directory*:

```
geeko > cd home:obsgeeko
geeko > osc mkpac example-osc
```

5. Get the source code of the upstream project and save it in `home:obsgeeko/my-first-obs-package`.

Download a TAR archive of the sources.

In our example, the project is hosted on GitHub and you can use the following URL: <https://github.com/obs-example/my-first-obs-package/releases>. If there is no published release of a project, click the *Clone or download* button and download the latest sources using the *Download ZIP* link.

6. Create the build recipe. This file contains metadata and build instructions.

In this example, we are building an RPM for openSUSE. For RPM-based distributions, we create a *spec file*. The skeleton of such a spec file looks like this:

#### EXAMPLE 1: SKELETON OF A SPEC FILE

```
#
# spec file for package my-first-obs-package
#
# -- Copyright omitted --

Name:          my-first-obs-package ①
Version:       0.1.0 ①
Release:       0 ①
License:       GPL-3.0 ①
Group:         Documentation ①
Summary:       Frobnication Tool ①
Url:           https://github.com/obs-example/my-first-obs-package ①
Source:        my-first-obs-package-%{version}.tar.gz ①
BuildRequires: gcc ②
BuildRequires: cmake ②
BuildRoot:     %{_tmppath}/%{name}-%{version}-build

%description ③
This tool frobnicates the bar with the foo when choosing the baz.

%prep ④
%setup -q -n %{name}-%{version}

%build ⑤

%install ⑥

%files ⑦
%defattr(-,root,root,-)
%doc README LICENSE *.txt
%{_bindir}/*
```

```
%changelog 8
```

- 1 **The Header.** Metadata like package name, version, release, license, the RPM group, a brief summary, the upstream URL, and the name of the source file.
- 2 **Build Requirements.** Lists package dependencies that are required for building. The listed packages are downloaded and installed before building the package.
- 3 **The Description Section.** Describes the purpose of the package and gives a comprehensive explanation.
- 4 **The Preparation Section.** Prepares the sources for building. This usually includes unpacking them with the `%setup` macro and patching them using the `%patch` macro. (For more information about patching, see [Section 8, "Patching Source Code"](#).)
- 5 **The Build Section.** Contains commands or RPM macros for building the package.
- 6 **The Install Section.** Contains commands or RPM macros which create directories or copy files to the installation location.
- 7 **The Files Section.** Lists all files and directories which belong to the package. Documentation-related files are marked with `%doc`, and they are automatically installed in the default documentation directory.
- 8 **The Changelog Section.** This section is usually empty. Instead, OBS searches for a file with the extension `.changes`. If such a file exists in the project directory, it will be automatically included as a changelog. The changelog file itself contains a high level overview of the history of the package.

For the complete spec file, see <https://github.com/obs-example/my-first-obs-package>.

## 7. Create a changelog file:

```
geeko > osc vc
```

This command opens a text file with the following content in the default editor:

```
-----  
Fri Aug 23 12:31:41 UTC 2017 - geeko@example.com
```

Add a short summary of your changes. Usually, a changelog entry contains a high-level overview such as the version of the software in the package, which patches you applied, and other changes in your project.

Save the file and leave the editor. `osc` then creates the file `my-first-obs-package.changes`.

8. Add all the files to your working directory:

```
geeko > osc add *.spec *.changes *.tar.gz
```

9. Build the package for the default build target:

```
geeko > osc build --local-package
```

The option `--local-package` is used here, because the package is not yet submitted to OBS.

The default build target is set in the `osc` configuration file `~/.osrc` using the variable `build_repository`. On openSUSE Build Service this is usually openSUSE Tumbleweed. To build the package for another build target, use the following command:

```
geeko > osc build --local-package openSUSE_Tumbleweed x86_64 *.spec
```

10. Check whether your build was successful. If everything was fine, commit the files to your package to your home project on OBS:

```
geeko > osc commit
```

If you encounter build errors, use the `osc buildlog` command to review them, as described below.

To watch the current build of a specific build target, use the `buildlog` (alias `bl`) subcommand inside your working directory:

```
geeko > osc buildlog openSUSE_Tumbleweed x86_64
```

## 8 Patching Source Code

This section describes how to patch an upstream project. We use the same project as shown in [Section 7, "Creating a New Project"](#).

There are different reasons for patching a package.

- **You Do Not Have Permission to Commit Upstream.** Often, you cannot commit changes directly to the upstream project. If you send changes to the upstream project, they may be integrated late or even be rejected.  
Patch files allow making changes while keeping source code clean and also allow independence from an upstream project's release cycle, coding style, and internal workings.
- **Apply Security and Bug Fixes or Distribution-Specific Fixes.**
- **Change the Source Code, So It Builds on OBS.**
- **Improve Security and Traceability.** Untouched source code in OBS is easier to check for changes than a modified one. The check is usually done with a checksum (MD5 or SHA).
- **Improve Structure and Consistency.** From an organizational point of view, it is better when changes are separated from the source code. With the changes inside the patch file, everybody can see *what* was changed and which files changes were applied to.

We assume that you already have a project as described in [Section 7, "Creating a New Project"](#). The project directory should look similar to this:

```
project directory
├─ my-first-obs-package-0.1.0.tar.gz
├─ my-first-obs-package.changes
└─ my-first-obs-package.spec
```

In our case, we want to modify the source code under `src/main.cpp` to change the greeting message.

### PROCEDURE 3: PATCHING

1. In the terminal, switch to your working directory.
2. Prepare a patch file:
  - a. Unpack the source code:

```
geeko > tar xvf my-first-obs-package-*.tar.gz
```

If you have downloaded the archive from GitHub, the archive contains a directory in the form `NAME-VERSION`. In our case, unpacking the downloaded archive results in the `my-first-obs-package-0.1.0/` directory.

- b. Switch to the directory `my-first-obs-package-0.1.0/` and make a copy of the original C++ source file:

```
geeko > cd my-first-obs-package-0.1.0/
geeko > cp src/main.cpp src/main.cpp.orig
```

- c. Make your changes in `src/main.cpp`.
- d. Create a diff and carefully inspect your changes:

```
geeko > diff -u src/main.cpp.orig src/main.cpp
```

The output should look like this:

```
--- src/main.cpp.orig    2017-08-09 16:28:31.407449707 +0200
+++ src/main.cpp        2017-08-09 16:28:49.131541230 +0200
@@ -2,7 +2,7 @@

int main()
{
-   std::cout<<"Hello OBS!\n";
+   std::cout<<"Hello Alice!\n";

    return 0;
}
```

- e. Redirect the diff into a file:

```
geeko > diff -u src/main.cpp.orig src/main.cpp \
> ../my-first-obs-package_main.diff
```

You can use an arbitrary name for the patch file. However, we recommend giving the file a descriptive name and adding the name of the upstream project. If there is a bug or issue number associated with the patch, add it to the file name as well. You can either use `.diff` or `.patch` as the file extension.

- f. You can now remove the directory `my-first-obs-package-0.1.0/`, as it is not needed anymore.

3. Open your spec file and add the following line in the header under the Source line like this:

```
Source:          my-first-obs-package-%{version}.tar.gz
Patch0:         my-first-obs-package_main.diff
```

4. In the %prep section, add the %patch macro:

```
%prep
%setup -q -n %{name}-%{version}
%patch0
```

5. Add your patch file to the local repository:

```
geeko > osc add my-first-obs-package_main.diff
```

6. Rebuild your package:

```
geeko > osc build
```

7. If everything was successful, commit your changes:

```
geeko > osc commit
```

When prompted, specify and save a commit message.

If you are dealing with a lot of patches, you might find the quilt tool useful. For more information about quilt, see <https://savannah.nongnu.org/projects/quilt>.

## 9 Branching a Package

This section describes how to collaborate between projects. You can *branch* any package in OBS into any project that you have write permission for. By default, new branches are created as a subproject of your home project. These default branches have names beginning with home:obsgeeko:branches.

There are different reasons to branch a package:

- To modify the source code, building it, trying the effect of the changes, and submitting back changes to the original project. Usually, you use this workflow when you do not have write permissions for a project.
- To make changes without affecting the original project.
- To apply temporary changes to try out a different path of development.

We assume that you have checked out the project `home:obsgeeko/my-first-obs-package` on OBS and the user `obstux` wants to change the code to change the welcome message. The code should then be submitted to the original project.

User `obstux` has to perform the following steps.

#### PROCEDURE 4: BRANCHING FROM A PROJECT

1. In the terminal, choose or create a directory on a local partition with enough free space.
2. Create a branch from geeko's home project:

```
tux > osc branchco home:obsgeeko my-first-obs-package
```

This creates a branched package in OBS at `home:obstux:branches/my-first-obs-package` and checks out a directory `home:obstux:branches:home:obsgeeko:my-first-obs-package`.

3. Change the working directory to your checked-out branch:

```
tux > cd home:obstux/branches/home/obsgeeko/my-first-obs-package
```

4. Make changes as shown in [Section 8, "Patching Source Code"](#).
5. Build the package for the default build target:

```
geeko > osc build
```

6. Review the build log:

```
geeko > osc buildlog openSUSE_Tumbleweed x86_64
```



7. Make sure all included and removed files are added to the OBS repository:

```
tux > osc addremove
```

8. If everything was successful, commit your changes:

```
geeko > osc commit
```

When prompted, specify and save a commit message.

9. Create a submit request and finish it by adding a comment:

```
tux > osc submitreq
```

Used without any options, the **submitreq** command submits back to the package where you branched from. Note that with the submit request, you submit a specific version of the source. Later changes do not get automatically fetched by default.

If there are multiple packages in a branch, all packages will be submitted together. To avoid that, specify the names of the source and destination projects and the package name:

```
tux > osc submitreq home:obstux:branches:home:obsgeeko my-first-obs-package
home:obsgeeko
```

User obstux has finished the task now and the submit request is assigned to obsgeeko. User obsgeeko can now either accept or decline the submit request.

- **Accept the Submit Request.** The changes from user obstux will be integrated into the home:obsgeeko project. The accepted submit request will be closed. To make further changes, obstux needs to create a new submit request.
- **Decline the Submit Request.** The changes from user obstux are not integrated into the home:obsgeeko project.

Reasons for declining a submit request can be build errors or style issues. The reviewer usually gives a reason when declining the submit request. User obstux can then 1) correct their submission using a new submit request that supersedes the previous one, 2) disagree and reopen the request, or 3) accept the decline and revoke the request.

User obsgeeko is responsible for the following.

#### PROCEDURE 5: DEALING WITH SUBMIT REQUESTS

1. Show all submit requests that belong to your home project

```
geeko > osc request list -s new -P home:obsgeeko
```

2. Find the correct submit request. If you know the correct number you can use:

```
geeko > osc request show 246
```

3. Review the request and decide:

- Accept the submit request:

```
geeko > osc request accept 246 --message="Reviewed OK."
```

- Decline the request and give a reason:

```
geeko > osc request decline 256 --message="Declined, because of missing  
semicolon."
```

If the submit request has been accepted, the changes will be integrated into the home project home:obsgeeko.

If the submit request has been declined, you can fix the issues and resubmit the package. When creating a new submit request, osc will prompt to supersede the previous request.

## 10 Installing Packages from OBS

OBS provides a place containing all the distribution-specific and architecture-specific versions of successfully built packages. When you create a package in your OBS home project, all successfully built packages appear under the <https://download.opensuse.org/repositories/home:/obsgeeko> URL.

However, this is only true for the home project itself and manually created subprojects, but not for subprojects created as a result of branching a package. Branched projects are not published by default. If you need the build results, download the binaries manually with [osc getbinaries](#).

For example, if you have enabled the openSUSE Tumbleweed distribution, all packages for openSUSE Tumbleweed will be published at [https://download.opensuse.org/repositories/home:/obsgeeko/openSUSE\\_Tumbleweed](https://download.opensuse.org/repositories/home:/obsgeeko/openSUSE_Tumbleweed). This *download repository* is used as an installation source for Zypper or YaST.

To install the `my-first-obs-package` package from your home project, use the following steps:

1. Inside your working directory, determine the download repository URLs:

```
geeko > osc repourls
https://download.opensuse.org/repositories/home:/obsgeeko/openSUSE_Tumbleweed/
home:obsgeeko.repo
https://download.opensuse.org/repositories/home:/obsgeeko/openSUSE_42.2/
home:obsgeeko.repo
```

2. Copy the desired URL of your preferred distribution. In our case, that is the line containing `openSUSE_Tumbleweed`.
3. Use `zypper` and add the copied URL:

```
root # zypper addrepo https://download.opensuse.org/repositories/home:/
obsgeeko/openSUSE_Tumbleweed/home:obsgeeko.repo
```

When prompted, accept the GPG key of the download repository.

4. Install the package:

```
root # zypper install my-first-obs-package
```

To update the package again, run *Step 4*. You do not need to execute *Step 1*, as the repository is already configured in your system.

## 11 Other Useful `osc` Commands

The following list gives you a short overview of frequently used `osc` subcommands that were not mentioned in this guide. For an overview of their syntax, use `osc SUBCOMMAND --help`.

### `osc diff`

Generates a diff, comparing local changes against the remote OBS project.

**osc list**

Shows source or binaries on an OBS server.

**osc prjresults**

Shows project-wide build results.

**osc status**

Shows the status of files in your working directory