

Get Started with Intel® oneAPI Threading Building Blocks (oneTBB)

Contents

Chapter 1: Get Started with oneAPI Threading Building Blocks (oneTBB)

Install oneTBB on Windows* OS	5
Install oneTBB on Linux* OS	8

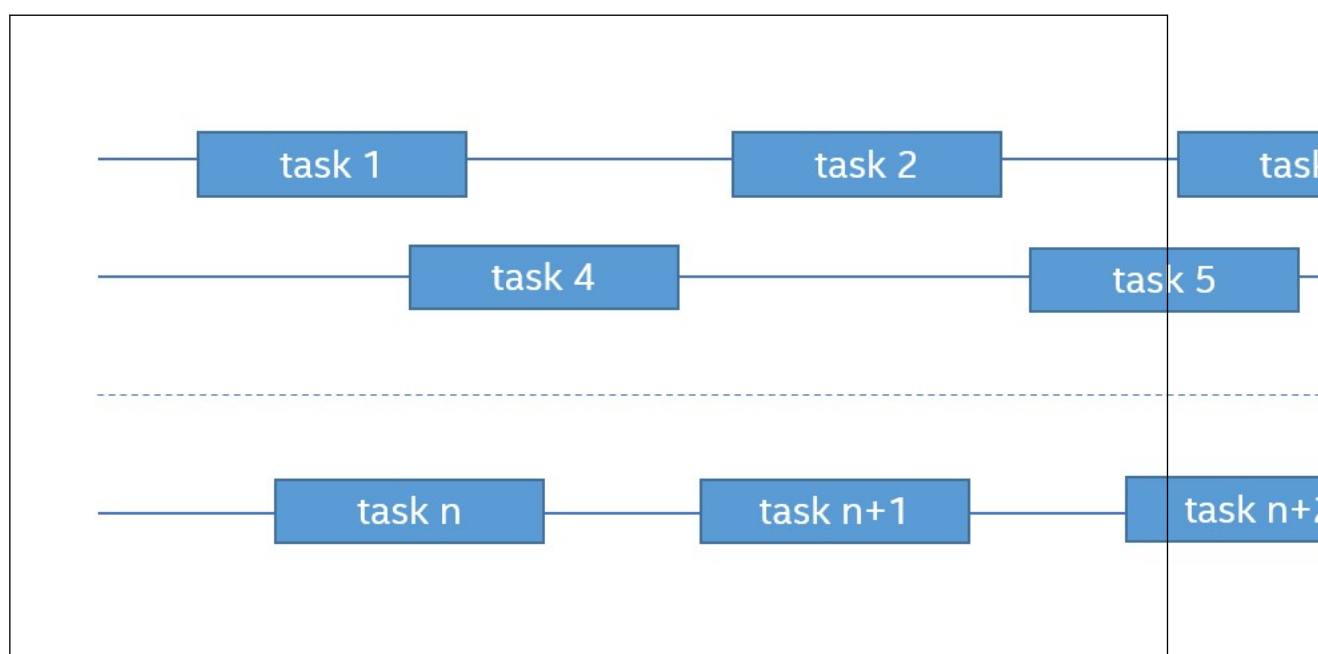
Get Started with oneAPI Threading Building Blocks (oneTBB)

1

oneAPI Threading Building Blocks (oneTBB) is a runtime-based parallel programming model for C++ code that uses threads. It consists of a template-based runtime library to help you harness the latent performance of multi-core processors.

oneTBB enables you to simplify parallel programming by breaking computation into parallel running tasks. Within a single process, parallelism is carried out through threads, an operating system mechanism that allows the same or different sets of instructions to be executed simultaneously.

Here you can see one of the possible executions of tasks by threads.



Use oneTBB to write scalable applications that:

- Specify logical parallel structure instead of threads
- Emphasize data-parallel programming
- Take advantage of concurrent collections and parallel algorithms

oneTBB supports nested parallelism and load balancing. It means that you can use the library without being worried about oversubscribing a system. oneTBB is available as a stand-alone product and as part of the Intel® oneAPI Base Toolkit.

System Requirements

Refer to the [oneTBB System Requirements](#).

Download Intel(R) oneAPI Threading Building Blocks (oneTBB)

Download oneTBB as a [stand-alone product](#) or as a part of the [Intel\(R\) oneAPI Base Toolkit](#). See [Installation Guide](#) for a stand-alone version ([Windows* OS](#) and [Linux* OS](#)) and [Intel\(R\) oneAPI Toolkits Installation Guide](#).

Before You Begin

After installing oneTBB, you need to set the environment variables:

1. Go to the oneTBB installation directory (<install_dir>). By default, <install_dir> is the following:
 - On Linux* OS:
 - For superusers (root): /opt/intel/oneapi
 - For ordinary users (non-root): \$HOME/intel/oneapi
 - On Windows* OS:
 - <Program Files>\Intel\oneAPI
2. Set the environment variables, using the script in <install_dir>, by running
 - On Linux* OS:


```
vars.{sh|csh} in <install_dir>/tbb/latest/env
```
 - On Windows* OS:


```
vars.bat in <install_dir>/tbb/latest/env
```

Example

Below you can find a typical example for a oneTBB algorithm. The sample calculates a sum of all integer numbers from 1 to 100.

```
int sum = oneapi::tbb::parallel_reduce(oneapi::tbb::blocked_range<int>(1,101), 0,
    [](oneapi::tbb::blocked_range<int> const& r, int init) -> int {
        for (int v = r.begin(); v != r.end(); v++) {
            init += v;
        }
        return init;
    },
    [](int lhs, int rhs) -> int {
        return lhs + rhs;
    }
);
```

oneAPI Threading Building Blocks (oneTBB) and pkg-config tool

The pkg-config tool is used to simplify the compilation line by retrieving information about packages from special metadata files. It helps avoid large hard-coded paths and makes compilation more portable.

Compile a program using pkg-config

To compile a test program test.cpp with oneTBB on Linux* OS and macOS*, provide the full path to search for include files and libraries, or provide a simple line like this:

```
g++ -o test test.cpp $(pkg-config --libs --cflags tbb)
```

Where:

--cflags provides oneTBB library include path:

```
$ pkg-config --cflags tbb`
-I<path-to>/tbb/latest/lib/pkgconfig/../../include
```

--libs provides the Intel(R) oneTBB library name and the search path to find it:

```
$ pkg-config --libs tbb
-L<path to>tbb/latest/lib/pkgconfig/../../lib/intel64/gcc4.8 -ltbb
```

NOTE For Windows* OS, additionally use the `--msvc-syntax` option flag that converts the compiling and linking flags in an appropriate mode.

Find more

<ul style="list-style-type: none">• oneTBB Community Forum• Product FAQs• Support requests	Use these resources if you need support with oneTBB.
Release Notes	Find up-to-date information about the product, including detailed notes, known issues, and changes.
Documentation: Developer Guide and API Reference	Learn to use oneTBB.
GitHub*	Find oneTBB implementation in open source.

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Install oneTBB on Windows* OS

This section describes how you can deploy the oneAPI Threading Building Blocks (oneTBB) library on a Windows* OS machine.

- If you plan to install oneTBB as a part of Intel® oneAPI Base Toolkit, refer to the corresponding section of the [Intel\(R\) oneAPI Toolkits Installation Guide](#).
- If you plan to install oneTBB as a standalone product, follow the instructions below, using the installer GUI or a package manager of your choice.

Learn how to install oneTBB with GUI and package manager: * [Install with GUI](#) * [Install with a Package Manager](#)

Install with GUI

Step 1. Select the preferred installer

1. Go to [Download page](#). A list of available installers is displayed.
2. Decide on the Windows installer type that you will use:

- Online installer has a smaller file size but requires a permanent Internet connection while running.
- Offline installer has a bigger file size but requires an Internet connection only to download the installer file, and then runs offline.

3. Having decided on the installer type, click the corresponding link to start the download.
4. Wait for the download to complete.

Step 2. Prepare the installer

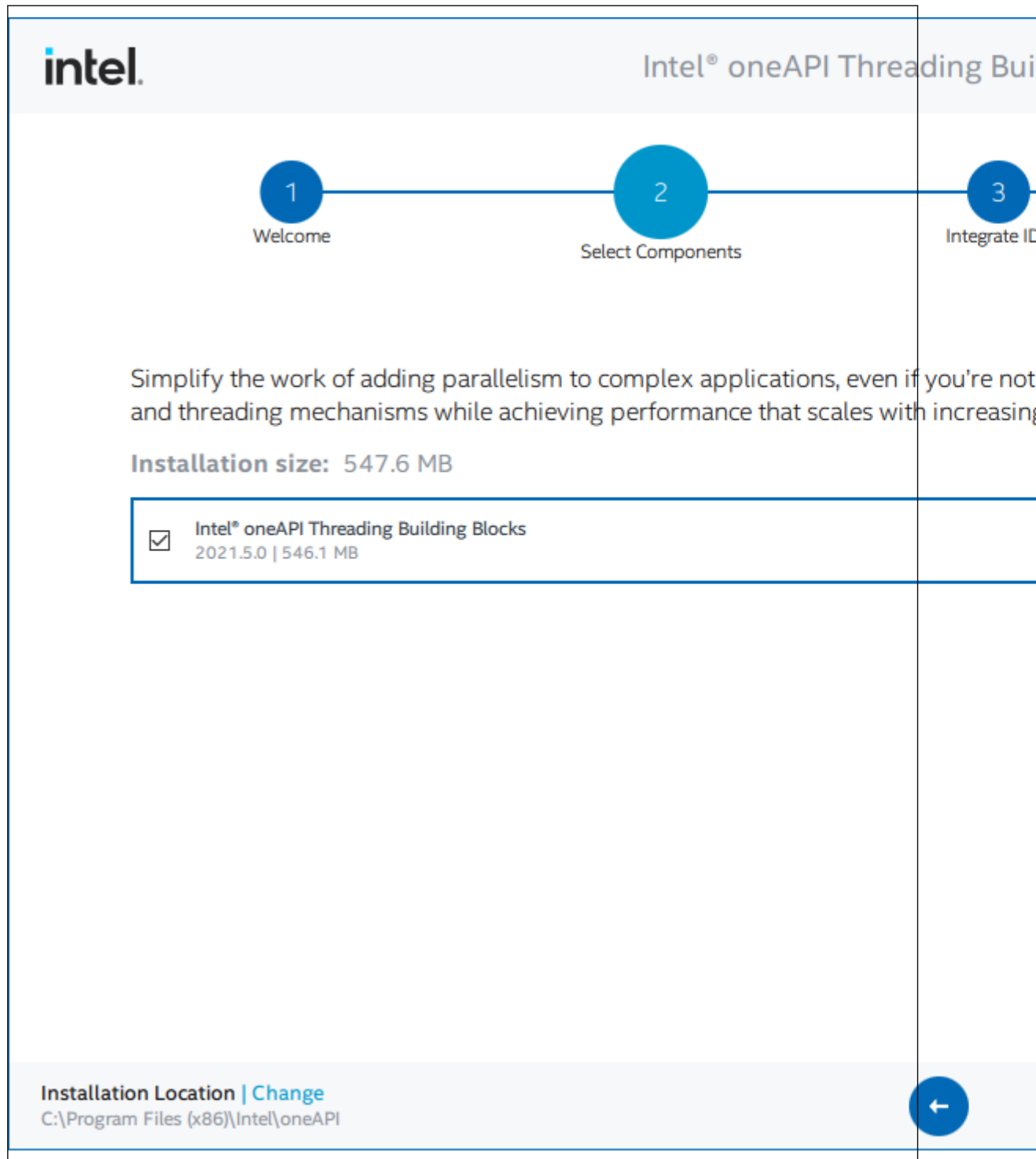
For offline installer:

1. Run the .exe file you have downloaded. The installation package extractor will be launched.
2. Specify the path where to extract the package - default is C:\Users\<user>\Downloads\w_tbb_oneapi_p_<product_version>_offline.
3. If necessary, select the **Remove temporary extracted files after installation** checkbox.
4. Click **Extract**.

For the online installer, the download starts automatically after you run the .exe file.

Step 3. Run the setup

1. If you are running the offline installer, click **Continue** to proceed. The online installer will proceed automatically.
2. In the **Summary** step, select the **I accept the terms of the license agreement** checkbox.
3. Select the installation mode:
 - To use default installation settings, select **Recommended Installation**. oneTBB will be installed in the default location: %Program Files (x86)%\Intel\oneAPI\. Click **Continue** and proceed to the **Integrate IDE** step.
 - To modify installation settings, select **Custom Installation** and click **Customize**. You will proceed to the **Select Components** step. However, no components other than oneTBB can be selected due to solution nature. In this mode, you can change the default installation location by clicking **Change** in the bottom-left corner of the window.



1. At the **Integrate IDE** step, the program checks if it is possible to deploy oneTBB fully integrated with Microsoft Visual Studio IDE - for that, the supported IDE version must be installed on the target machine. If not installed, you can exit the setup and restart it after installing the IDE, or proceed without integration.
2. At the **Software Improvement Program** step, select the option you prefer. Then click **Install** to start the installation.
3. Wait for the process to complete. Then click **Finish** to close the installer or **Go to Installed Products** to check for updates or take other actions.

NOTE Remember to configure environment variables after installation. See the Before You Begin section to learn about it.

Install with a Package Manager

To install oneTBB with a package manager, run the corresponding command described in the documentation:

- [Conda](#)
- [Pip](#)
- [NuGet](#)

NOTE Remember to configure environment variables after installation. See Before You Begin section to learn about it.

Upgrading oneTBB

The seamless upgrade is supported for oneTBB 2021.1 and later versions. To upgrade oneTBB to the latest version, run the setup, as described above.

If you used to work with older versions (TBB), consider that the new versions of oneTBB do not provide backward compatibility. See [TBB Revamp: Background, Changes, and Modernization](#) for details. Also, refer to [Migrating from TBB](#) for more information on migrating to oneTBB.

Uninstalling oneTBB

To uninstall oneTBB, use **Applications and Features** or **Programs and Features**.

Install oneTBB on Linux* OS

This section describes how you can deploy the oneAPI Threading Building Blocks (oneTBB) library on a Linux* machine. Choose the preferred way:

- Install oneTBB Using Command Line
- Install oneTBB Using Package Managers of choice:

- Conda
 - APT
 - YUM
 - PIP
 - NuGet

NOTE You can also install oneTBB on a Linux* OS machine using GUI. See [Intel\(R\) oneAPI Installation Guide](#) to learn more.

Install oneTBB Using Command Line

To install oneTBB, run one of the following commands according to your role:

- root:

```
sh ./1_[Toolkit Name]Kit_[version].sh --silent --eula accept --components  
intel.oneapi.lin.tbb.devel
```

- user:

```
sudo sh ./l_[Toolkit Name]Kit_[version].sh -a --silent --eula accept --components  
intel.oneapi.lin.tbb.devel
```

Where:

- `--silent` - Run the installer in non-interactive (silent) mode.
- `--eula` - Accept or decline End User License Agreement (EULA), supported values: `accept` or `decline` (default).
- `--components` - Let you custom installed components.

For example:

```
sudo sh ./l_BaseToolKit_2021.1.sh --silent --eula accept --components intel.oneapi.lin.tbb.devel
```

Install oneTBB Using Package Managers

Follow the instructions, using a package manager of your choice.

Conda

This section provides general instructions on installing the oneAPI Threading Building Blocks (oneTBB) via the Conda* package manager. For additional installation notes, refer to the [Conda documentation](#).

To install oneTBB, run the following command:

```
conda install -c intel tbb-devel
```

You can also use: `conda install -c intel/label/intel tbb-devel`

NOTE See [Intel\(R\) oneAPI Installation Guide](#) to learn how to configure Conda.

APT

To install oneTBB using APT*, run:

```
sudo apt-get install intel-tbb-<VERSION>.<UPDATE>-<BUILD_NUMBER>
```

For example:

```
sudo apt-get install intel-tbb-2021.5-1.738
```

NOTE See [Intel\(R\) oneAPI Installation Guide](#) to learn how to configure APT.

YUM

To install oneTBB using YUM*, run:

```
yum install intel-tbb-<VERSION>.<UPDATE>-<BUILD_NUMBER>
```

For example:

```
yum install intel-tbb-2021.5-1.738
```

NOTE See [Intel\(R\) oneAPI Installation Guide](#) to learn how to configure YUM.

PIP

To install oneTBB using PIP*, run:

```
pip install -c intel tbb==<version>
```

For example:

```
pip install -c intel tbb==2021.5
```

NuGet

To install oneTBB from NuGet* using the command line, do the following:

1. Go to nuget.org
2. Run:

```
nuget install intel_tbb.devel.linux
```

NOTE See [Intel\(R\) oneAPI Installation Guide](#) to learn how to configure NuGet*.

NOTE Remember to configure environment variables after installation. See the Before You Begin section to learn about it.

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