

Getting Started with the Intel(R) C++ Compiler Professional Edition 11.1 for Windows* OS

This guide shows you how to start Intel® C++ Compiler Professional Edition, use Intel® Libraries with your project, and begin debugging code using Intel® Parallel Debugger Extension.

The guide suggests common scenarios for selecting a threading technique that best fits your application performance goals and gives directions for finding more user and reference information.

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1 *Start Intel® C++ Compiler Professional Edition*

The Intel® C++ Compiler Professional Edition 11.1 for Windows* OS integrates into the following versions of the Microsoft Visual Studio* IDE:

- Microsoft Visual Studio 2008*.
- Microsoft Visual Studio 2005*.
- Microsoft Visual Studio .NET 2003*.



To start the Intel® Compiler Professional Edition from Microsoft Visual Studio* IDE, perform the following steps:

1. Launch Microsoft Visual Studio*.
2. Open or create a Visual Studio solution in the **Solution Explorer** pane.
3. From the **Project** menu, or project context menu, select **Intel C++ Compiler Pro > Use Intel C++**.
4. Click **Yes** in the **Confirmation** dialog box. This configures the solution to use the Intel® C++ Compiler (you may configure the solution to use the Intel® C++ compiler by clicking  on the toolbar too).
5. Select **Rebuild Solution** from the Visual Studio **Build** menu.

The results of the compilation are displayed in the **Output** window.

See Intel® C++ Compiler Professional Edition online help for more information on building applications. See [User and Reference Documentation](#) to help locate additional information and help.

Start the Compiler from the Command Line

To start the compiler from the Windows command line, use the Windows program menu to select:

```
Intel(R) Software Development Tools >  
Intel(R) C++ Compiler Professional 11.1.xxx >  
Build Environment for...
```

This method opens a Windows command prompt and sets the environment variables for the Intel compiler. To compile a C++ language source file (for example, `my_source_file.cpp`), use this command:


```
icl my_source_file.cpp
```

Following successful compilation, an executable named `my_source_file.exe` is created in the current directory.

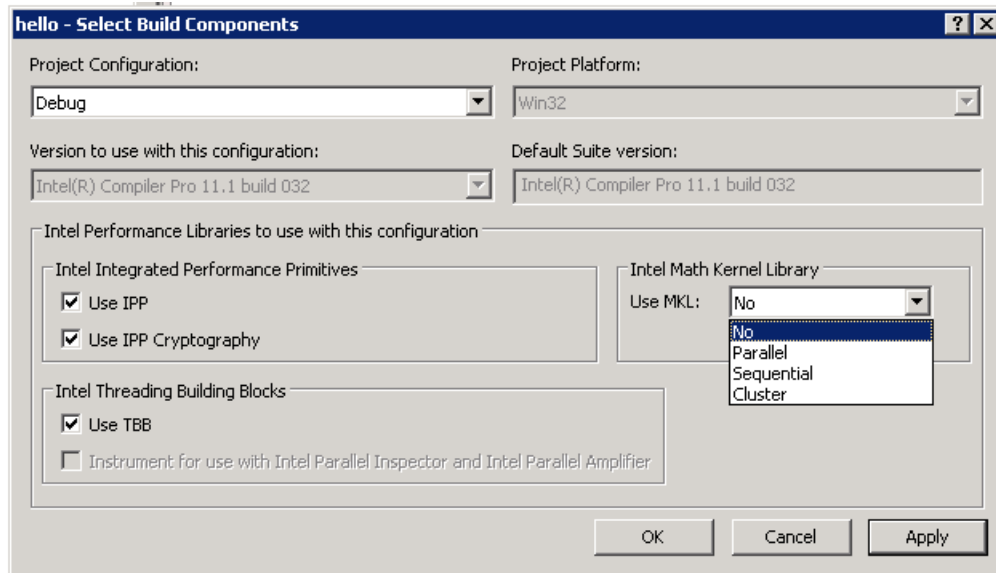


2 Use Intel® Performance Libraries

To use the Intel® C++ project with the Intel® Integrated Performance Primitives, Intel® Threading Building Blocks, or Intel® Math Kernel Library, do the following:

1. Open your project in the Solution Explorer.
2. On the menu bar, select **Project > Intel C++ Compiler Pro > Select Build Components** (or click  on the toolbar).

The **Select Build Components** dialog box opens:



The dialog box allows you to enable Intel Performance Libraries:

Action	Result
Check Use IPP	Enable the Common Intel® IPP libraries only.
Check Use IPP Cryptography	Enable both Cryptography Intel® IPP libraries and Common Intel® IPP libraries.
Uncheck Use IPP	Disable Intel® IPP libraries.
Check Use TBB	Enable Intel® TBB libraries.
Uncheck Use TBB	Disable Intel® TBB libraries.
Check Use MKL:	Enable Intel® MKL libraries.
Select Parallel	Use parallel Intel® MKL libraries.
Select Sequential	Use sequential Intel® MKL libraries.
Select Cluster	Use cluster Intel® MKL libraries.
Select No	Disable all Intel® MKL libraries.



Once you click **OK** or **Apply** in the **Select Build Components** dialog box, the appropriate Intel® IPP, Intel® TBB, or Intel® MKL include paths and link libraries for the selected architecture will be added to the project property settings.

If your target platform is IA-64 or Intel® 64, an additional, **Use ILP64 interfaces**, switch box appears. If switched on, corresponding `ilp` MKL libraries will be added to the linker command line and `MKL_ILP64` preprocessor definition will be added to the compiler command line, otherwise `lp` MKL libraries will be used by default.

NOTE: See the *Intel® MKL User's Guide* for explanation of the difference between LP and ILP64 versions of the library.

3 Select a Threading Method

Parallel Method	Benefits	Considerations
Intel® IPP	Highest performance, scalable for certain multimedia application domains; does not expose parallelism in your code.	Cryptography, image, audio, video, compression, and the like. Best for multimedia.
Auto-parallel	Automatic parallelization; does not expose explicit parallel syntax in your code.	Limited to well-formed loops.
New Parallel Extensions	Good for rapid prototyping, easy syntax, maps to OpenMP* 3.0 runtime.	Does not have the controls for shared/private variables like OpenMP* or Intel® TBB.
OpenMP* 3.0	Well-known standard, efficient runtime, scalable. OpenMP 3.0 support for <code>task</code> construct helps function-level parallelism; Intel support for OpenMP* is compatible with Microsoft implementation.	Pragma use is not common for some C++ developers; can be difficult for C++ objects/data; Microsoft Visual Studio* 2008 supports OpenMP* 2.5.
Intel® TBB	Natural C++ solution, efficient, scalable runtime.	Need to understand C++ Object Oriented Programming: templates and containers.
Intel® MKL	Highly optimized, extensively threaded math routines for science, engineering, and financial applications that require maximum performance; does not expose parallelism in your code.	Extensively threaded math functions: BLAS, LAPACK, Sparse Solvers, Fast Fourier Transforms, Vector Math, Vector Statistics.



4 Debug Your Code with Intel® Parallel Debugger Extension

Open Samples

Intel® C++ Compiler Professional Edition provides several sample applications, located at:

`<install-dir>\Samples\<locale>\C++\<solution name>.zip`

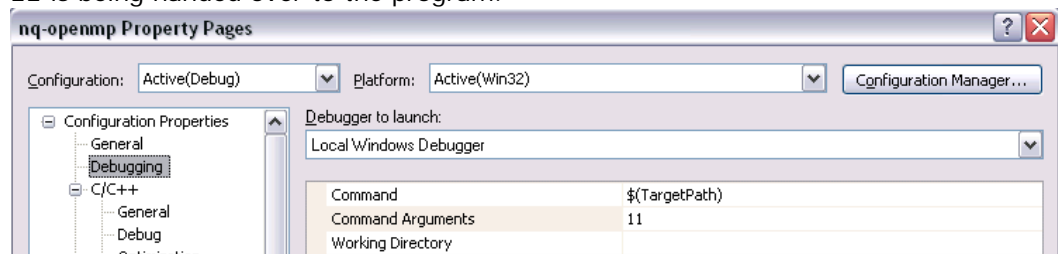
1. Unzip `<solution name>.zip` to a directory of your choice.
2. Locate and double-click the `.sln` file or open the solution file from the Microsoft Visual Studio* development environment.

Discussion in the steps below uses the **NQueens.zip** samples provided.

NOTE: If, during product installation, you accepted the default installation location, `<install-dir>` is `C:\Program Files\Intel\Compiler\11.1\<build_number>`.

Prepare Example Code for Debugging

1. Unzip the `NQueens.zip` to a directory of your choice.
2. Open sample projects in Microsoft Visual Studio* by double-clicking the `NQueens.sln`.
3. In `nq-openmp-intel` project, double-click `nq-openmp.cpp`.
4. Comment out the line `#pragma omp atomic` to create a data sharing violation.
5. Ensure that the `nq-openmp` project properties show that the command argument `11` is being handed over to the program.



6. Ensure that the compiler command line options `/ZI`, `/debug:parallel`, and `/Qopenmp` are set on the **Property Pages** of the project:

Configuration Properties > C/C++ > General > Debug Information

Format; Configuration Properties > C/C++ > Debug > Enable Parallel






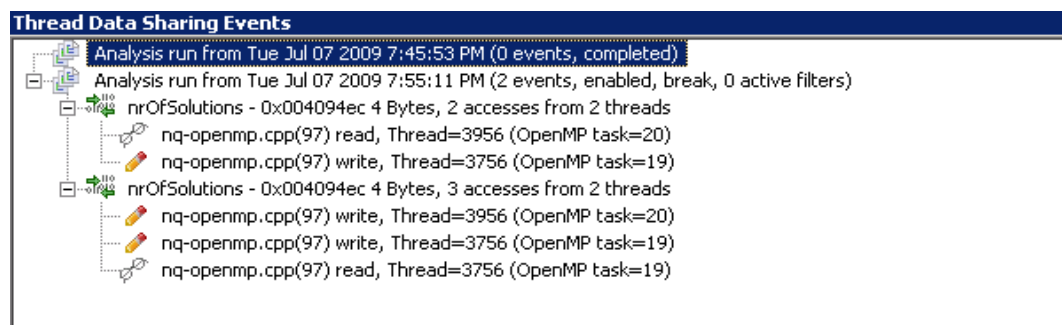
Debug Checks; and **Configuration Properties > C/C++ > Language > General > OpenMP Support** respectively.

7. Confirm that the linker command line option `/DEBUG` is set:
Configuration Properties > Linker > Debugging > Generate Debug Info.
8. Rebuild the project.

Identify Parallel Coding Issues

To identify **Thread Data Sharing Events** that might trigger runtime data sharing violations, do the following:



1. Select **Enable Detection** from **Debug > Intel Parallel Debugger Extension > Thread Data Sharing Detection** menu (or click ).
2. Start the debug session by selecting the **Start Debugging** from the **Debug** menu (or click ). The program execution will be halted as soon as a thread data sharing event is detected.
3. Click the **Thread Data Sharing Events** button  to see a log of events that caused the execution to be halted.




Result:

You can see from the **Thread Data Sharing Events** log that two different OpenMP* threads have been trying to access the **nrOfSolutions** variable: thread 3956 read the value and thread 3756 incremented the value. Since there are two different threads modifying and relying on a single variable this is a potentially serious problem that causes the N-Queens algorithm to produce incorrect results. Use the **#pragma omp atomic** to make the **nrOfSolutions++** increment thread safe.

To identify **Function Re-Entrancy** events, do the following:

1. Disable the data sharing event detection by clicking on the **Enable Detection** button  so it changes to a disabled state .



2. Select **Debug > Intel Parallel Debugger Extension > Break on Re-Entrant Call** from the menu (or click ).
3. In the pop-up window that is being displayed enter **{,,nq-openmp.exe)setQueen**. Simply entering **setQueen** would also suffice.
4. Select **Continue Debug**.
5. Upon detecting function re-entrancy, the **Re-entrant Call Detected** window opens with information about the thread IDs of the threads involved.
6. Select **OK**.

Result:

The debugger instruction pointer sits at the function entry point of the function where re-entrance was detected.

```
void setQueen(int queens[], int row, int col, int id) {  
    for(int i=0; i<row; i++) {  
        // vertical attacks  
        if (queens[i]==col) {  
            return;  
        }  
    }  
}
```

OpenMP task 20 and OpenMP task 19 both entered the function `setQueen()`. Both tasks are modifying values and using data inside this function. You need to ensure that they do not overwrite each other's data. If you observed a runtime problem in the function `setQueen()`, this could be an important pointer telling you that `setQueen()` needs to be implemented in a thread-safe manner if it is not already thread-safe.

Other Debugging Considerations

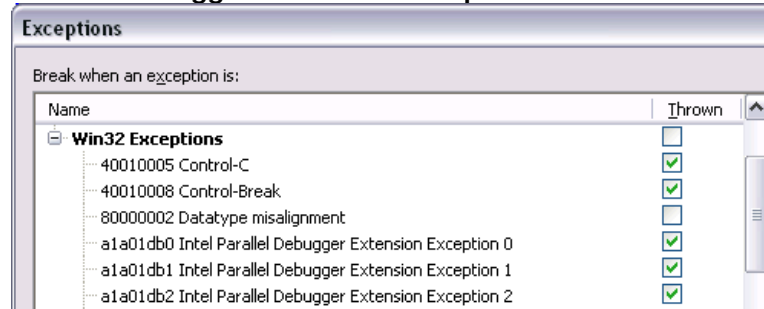
If you are using Microsoft Visual Studio* 2005 you might first need to verify that the Intel® Parallel Debugger Exceptions are enabled in the Microsoft Visual Studio* Debugger.

Verify the exceptions are enabled by doing the following:

1. From the **Debug** pull-down menu select **Exceptions**.




2. Ensure that in the **Win32 Exceptions** tree-view list the boxes for **Intel Parallel Debugger Extension Exception** are enabled.



3. Go to the **File** pull-down menu, and select **Save all**.

5 User and Reference Documentation

This guide focuses on basic Intel® C++ Compiler Professional features. To explore more features, check the following resources.

Resources	Notes
<i>Intel® C++ Compiler Professional Edition Documentation</i>	<p>Use this HTML page to locate additional Intel® C++ Compiler Professional Edition 11.1 documentation for the following:</p> <ul style="list-style-type: none"> • Intel® C++ Compiler. • Intel® Threading Building Blocks. • Intel® Math Kernel Library. • Intel® Integrated Performance Primitives. • Intel® Parallel Debugger Extension. <p>To open this HTML page, from the Windows* Start menu, choose Intel® Software Development Tools > Intel® C++ Compiler Professional 11.1.xxx > Documentation.</p>
Sample code	<p>Use sample code in a zip file provided at <install_dir>\Samples\<locale>\C++\ to learn how to use various threading techniques. <code>samples.htm</code> provides an overview of the C++ samples.</p>
Integrated User and Reference Help	<p>Open the <i>Integrated User and Reference Help</i> from Microsoft Visual Studio* Help menu. Select Help > Intel C++ Compiler Pro > Intel C++ Compiler Help.</p> <p>To enable Intel C++ quick start help topic, click  on the toolbar.</p> <p>Filter the contents and index information: select Intel from the Filtered by drop-down list to view only the Intel® C++ Compiler Pro documentation.</p>
Product Information and Technical Support	<p>For general product information or information on support for Intel software products, visit the Intel web site: http://www.intel.com/software/products/. At this site, you will find comprehensive product information, including:</p> <ul style="list-style-type: none"> • Links to each product, where you will find technical information such as white papers and articles.



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