



# Intel<sup>®</sup> High Level Synthesis Compiler

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## Version 19.1 Release Notes

Updated for Intel<sup>®</sup> Quartus<sup>®</sup> Prime Design Suite: **19.1**



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# 1. Intel® High Level Synthesis Compiler Version 19.1 Release Notes

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The *Intel® High Level Synthesis Compiler Release Notes* provide late-breaking information about the Intel High Level Synthesis Compiler Version 19.1.

## 1.1. New Features and Enhancements

The Intel High Level Synthesis Compiler Version 19.1 includes the following new features:

- **PRO** The Intel HLS Compiler is now available as separately installable component.  
You can add the standalone Intel HLS Compiler Version 19.1 component to an existing Intel Quartus® Prime Pro Edition V19.1, V18.1.1, V18.0.1, or V17.1.1 installation.
- **PRO** Added system of tasks to allow expression of thread-level parallelism within your HLS components.
- **PRO** Added System Viewer report to show overview of your full HLS system, including components and associated tasks.
- **PRO** Added a new memory attribute so that you can specify whether a memory system should be implemented in M20Ks or MLABs. By default, the compiler now implements memory systems as AUTO.
- **PRO** Expanded support for memory attributes:
  - Memory attributes can now be applied to constant memories (memories with loads only). This enables the creation of multi-ported ROMs, and forcing ROMs into LUTs.
  - Memory attributes can now be applied to a member of a `struct`.
  - Memory attributes can now be applied to HLS slave memories.
- **PRO** Improved control of array private copies.  
Use the `hls_max_concurrency` attribute to request fewer private copies than the loop concurrency.
- **PRO** Added new component attributes to set component target clock rate and component initialization interval (II).
- **PRO** Added ability to disable Hyper-Optimized Handshaking for Intel Stratix® 10 designs.



- **PRO** Added ability to control the number of speculated loop iterations launched.
- **PRO** Enhanced High Level Design Reports with new reports:
  - The Block Viewer shows clusters created by the compiler along with the logic that surrounds each cluster.
  - The Cluster Viewer shows the details of a cluster including instructions and instruction dependencies.
  - The Fmax/II Report lists key performance metrics or indicators for all basic blocks in your component, including scheduled  $f_{MAX}$ , sustainable II, block latency, and maximum interleaving iterations.
  - The Function Memory Viewer enhances and replaces the Component Memory Viewer with expanded reporting for arrays and improved logical and physical views of your memories in your component.
- **PRO** Improved automatic compiler behavior:
  - Stall-free port sharing of on-chip memory ports.
  - Duplication of arrays for loop unrolling or function inlining.
  - Dot-product size optimization by FPGA family architecture.
  - Disabled automatic loop unrolling.
- **PRO** Added support for `ac_complex` datatypes
- **PRO** Added support for the creation of HLS libraries from RTL source files. HLS components can use functions defined in these libraries without needing to know the underlying RTL code.
- **STD** Intel HLS Compiler Standard Edition Version 19.1 is not available.

## 1.2. Intel High Level Synthesis Compiler Prerequisites

The Intel HLS Compiler is part of the Intel Quartus Prime Design Suite. You can install it as part of your Intel Quartus Prime software installation or install it a separate installer. It requires Intel Quartus Prime and additional software to use.

For detailed instructions about installing Intel Quartus Prime software, including system requirements, prerequisites, and licensing requirements, see [Intel FPGA Software Installation and Licensing](#).

The Intel HLS Compiler requires the following software in addition to Intel Quartus Prime:

### C++ Compiler

For Linux, install one of the following versions of the GCC compiler and C++ libraries, depending on your edition of Intel Quartus Prime software:



- **PRO** GCC compiler and C++ Libraries version 5.4.0  
You must install these libraries manually. See [Installing the Intel HLS Compiler on Linux Systems](#) for instructions.
- **STD** GCC compiler and C++ Libraries version 4.4.7  
These libraries are included in the version of Linux supported by the Intel HLS Compiler.

**Important:** The Intel HLS Compiler software does not support versions of the GCC compiler other than those specified for the edition of the software.

For Windows, install one of the following versions of the Microsoft Visual Studio Professional, depending on your edition of Intel Quartus Prime software:

- **PRO** Microsoft Visual Studio 2015 Professional
- **PRO** Microsoft Visual Studio 2015 Community
- **STD** Microsoft Visual Studio 2010 Professional

**Important:** The Intel HLS Compiler software does not support versions of Microsoft Visual Studio other than those specified for the edition of the software.

### Mentor Graphics\* ModelSim\* Software

You can install the ModelSim\* software from the Intel Quartus Prime software installer. The available options are:

- ModelSim - Intel FPGA Edition
- ModelSim - Intel FPGA Starter Edition

Alternatively, you can use your own licensed version of Mentor Graphics\* ModelSim software.

On Linux systems, ModelSim software requires the Red Hat development tools packages. Additionally, any 32-bit versions of ModelSim software (including those provided with Intel Quartus Prime) require additional 32-bit libraries. The commands to install these requirements are provided in [Installing the Intel HLS Compiler on Linux Systems](#).

For information about all the ModelSim software versions that the Intel software supports, refer to the *EDA Interface Information* section in the Software and Device Support Release Notes for your edition of Intel Quartus Prime

### Related Information

- [Intel High Level Synthesis Compiler Getting Started Guide](#)
- [Supported Operating Systems](#)
- [Software Requirements](#)  
in *Intel FPGA Software Installation and Licensing*
- [EDA Interface Information \(Intel Quartus Prime Standard Edition\)](#)
- [EDA Interface Information \(Intel Quartus Prime Pro Edition\)](#)
- [Mentor Graphics Website](#)



### 1.3. Known Issues and Workarounds

This section provides information about known issues that affect the Intel High Level Synthesis Compiler Version 19.1.

Description	Workaround
(Windows only) Compiling a design in a directory with a long path name can result in compile failures.	Compile the design in a directory with a short path name.
(Windows only) A long path for your Intel Quartus Prime installation directory can prevent you from successfully compiling and running the Intel HLS Compiler tutorials and example designs.	Move the tutorials and examples to a short path name before trying to run them.
When you use the <code>-c</code> command option to have separate compilation and linking stages in your workflow, and if you do not specify the <code>-march</code> option in the linking stage (or specify a different <code>-march</code> option value), your linking stage might fail with or without error messages.	Ensure that you use the same <code>-march</code> option value for both the compilation with the <code>-c</code> command option stage and the linking stage.
The <code>hls_memory_impl("MLAB")</code> and <code>hls_doublepump</code> memory attributes cannot be simultaneously applied to the same memory.	If you want double pumped memory in your design, use M20K memory blocks. This workaround does not reflect a restriction of the underlying hardware.
Applying the <code>hls_merge</code> memory attribute to an array declared within an unrolled or partially unrolled loop creates an unexpectedly wide memory.	Avoid using the <code>hls_merge</code> memory attribute in unrolled loops. If you need to merge memories in an unrolled loop, explicitly declare an array of struct type.

### 1.4. Software Issues Resolved

The following issues were corrected or otherwise resolved in the Intel HLS Compiler Pro Edition Version 19.1.

**Table 1. Issues Resolved in the Intel HLS Compiler Version**

Customer Service Request Numbers						
00402868	00412640	00415384	11345379	11406453	11364116	11364838
11410991	11411334					

### 1.5. Intel High Level Synthesis Compiler Release Notes Archives

Intel HLS Compiler Version	User Guide
18.1	<a href="#">Intel High Level Synthesis Compiler Version 18.1 Release Notes</a>
18.0	<a href="#">Intel High Level Synthesis Compiler Version 18.0 Release Notes</a>
17.1	<a href="#">Intel High Level Synthesis Compiler Version 17.1 Release Notes</a>



## 1.6. Document Revision History for Intel HLS Compiler Version 19.1 Release Notes

Document Version	Intel Quartus Prime Version	Changes
2010.04.01	19.1	<ul style="list-style-type: none"><li>Initial release.</li></ul>