**C/C++ tip: How to detect the processor type using compiler predefined macros**

February 9, 2012

Topics: [C/C++](http://nadeausoftware.com/articles/c_c)

Processor macros are predefined by all C/C++ compilers to enable **#if/#endif** sets to wrap processor-specific code, such as in-line assembly for SSE instructions on x86 processors. But there are no standards for processor macros. The same compiler may have different macros on different operating systems, and different compilers for the same processor may have different macros. **This article surveys common compilers and shows how to use predefined macros to detect common desktop and server processors at compile time.**

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**How to list predefined macros**

See [How to list compiler predefined macros](http://nadeausoftware.com/articles/2011/12/c_c_tip_how_list_compiler_predefined_macros) for instructions on getting a list of macros for the compilers referenced here.

**How to detect the processor type**

Throughout the following sections note:

* Red text indicates deprecated macros that don't start with an underscore. C++ compilers, and C compilers in standards compliance mode, do not define them.
* **Green text** indicates recommended macros that are well-supported and useful for detecting a specific OS.

**Itanium**

|  |  |
| --- | --- |
| **A.K.A.:** | IA64 |
| **Developer:** | Intel |
| **Processors:** | Itanium, Itanium 2, Itanium 2 9000/9100/9300, etc. |

#if defined(\_\_ia64) || defined(\_\_itanium\_\_) || defined(\_M\_IA64)

/\* Itanium -------------------------------------------------- \*/

#endif

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***Itanium*** | | | | | |
| **Macro** | [**GNU GCC/G++**](http://gcc.gnu.org/) | | [**HP C/aC++**](http://h21007.www2.hp.com/portal/site/dspp/menuitem.863c3e4cbcdc3f3515b49c108973a801/?ciid=6b080f1bace021100f1bace02110275d6e10RCRD) | [**Intel ICC/ICPC**](http://software.intel.com/en-us/articles/intel-compilers/) | [**Microsoft  Visual Studio**](http://www.microsoft.com/visualstudio/en-us) |
| ***BSD, Linux*** | ***HP-UX*** | ***HP-UX*** | ***Linux*** | ***Windows*** |
| **ia64** |  |  |  | yes |  |
| **\_\_ia64** | yes | yes | yes | yes |  |
| **\_\_ia64\_\_** | yes | yes |  | yes |  |
| **\_\_IA64\_\_** |  | yes |  |  |  |
| **\_\_itanium\_\_** | yes | yes |  | yes |  |
| **\_M\_IA64** |  |  |  |  | yes |

Notes:

* "IA64" is the old name for the processor architecture. Intel now prefers "Itanium".
* There is no single Itanium processor macro defined by all compilers on all OSes. An **#if/#endif** that checks multiple macros is required.
* Microsoft's support for Itanium ended after Visual Studio 2010 and Windows Server 2008.
* Clang/LLVM currently does not support Itanium processors.

**POWER**

|  |  |
| --- | --- |
| **A.K.A.:** | PowerPC |
| **Developer:** | IBM, Freescale |
| **Processors:** | PowerPC, POWER 1/2/3/4/5/6/7, G1, G2, G3, G4, G5, etc. |

#if defined(\_\_powerpc\_\_) || defined(\_\_ppc\_\_) || defined(\_\_PPC\_\_)

/\* POWER ---------------------------------------------------- \*/

#if defined(\_\_powerpc64\_\_) || defined(\_\_ppc64\_\_) || defined(\_\_PPC64\_\_) || \

defined(\_\_64BIT\_\_) || defined(\_LP64) || defined(\_\_LP64\_\_)

/\* POWER 64-bit --------------------------------------------- \*/

#else

/\* POWER 32-bit --------------------------------------------- \*/

#endif

#endif

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***POWER 32-bit*** | | | | | | | | | |
| **Macro** | [**Clang/LLVM**](http://llvm.org/) | [**GNU GCC/G++**](http://gcc.gnu.org/) | | | | | | [**IBM XL C/C++**](http://www-01.ibm.com/software/awdtools/xlcpp/) | |
| ***BSD, Linux, OSX*** | ***AIX*** | ***FreeBSD*** | ***Linux*** | ***NetBSD*** | ***OpenBSD*** | ***OSX*** | ***AIX*** | ***Linux*** |
| **\_ARCH\_PPC** | yes |  |  |  |  |  |  |  |  |
| **\_POWER** |  | yes |  |  |  |  |  |  |  |
| **powerpc** |  |  | yes | yes |  |  |  |  |  |
| **\_\_powerpc** |  |  | yes | yes |  |  |  | yes | yes |
| **\_\_powerpc\_\_** | yes | yes | yes | yes | yes |  |  | yes | yes |
| **\_\_PowerPC\_\_** |  |  | yes |  |  |  |  |  |  |
| **\_\_POWERPC\_\_** | yes |  |  |  |  |  | yes |  |  |
| **PPC** |  |  | yes | yes |  | yes |  |  |  |
| **\_\_ppc\_\_** | yes |  | yes |  |  |  | yes |  |  |
| **\_\_PPC** |  |  | yes | yes |  | yes |  | yes | yes |
| **\_\_PPC\_\_** |  | yes | yes | yes |  | yes |  | yes | yes |

|  |  |  |  |  |  |  |  |  |  |
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| ***POWER 64-bit*** | | | | | | | | | |
| **Macro** | [**Clang/LLVM**](http://llvm.org/) | [**GNU GCC/G++**](http://gcc.gnu.org/) | | | | | | [**IBM XL C/C++**](http://www-01.ibm.com/software/awdtools/xlcpp/) | |
| ***BSD, Linux, OSX*** | ***AIX*** | ***FreeBSD*** | ***Linux*** | ***NetBSD*** | ***OpenBSD*** | ***OSX*** | ***AIX*** | ***Linux*** |
| **\_ARCH\_PPC** | yes |  |  |  |  |  |  |  |  |
| **\_ARCH\_PPC64** | yes |  |  |  |  |  |  |  |  |
| **\_POWER** |  | yes |  |  |  |  |  |  |  |
| **\_\_powerpc** |  |  |  | yes |  |  |  | yes | yes |
| **\_\_powerpc\_\_** | yes | yes | yes | yes | yes |  |  | yes | yes |
| **\_\_powerpc64\_\_** | yes |  | yes | yes |  |  |  | yes | yes |
| **\_\_PowerPC\_\_** |  |  | yes |  |  |  |  |  |  |
| **\_\_POWERPC\_\_** | yes |  |  |  |  |  | yes |  |  |
| **\_\_ppc\_\_** | yes |  | yes |  |  |  |  |  |  |
| **\_\_ppc64** |  |  |  |  |  |  |  | yes |  |
| **\_\_ppc64\_\_** | yes |  |  |  |  |  | yes |  |  |
| **\_\_PPC** |  |  |  | yes |  | yes |  | yes | yes |
| **\_\_PPC\_\_** |  | yes | yes | yes |  | yes |  | yes | yes |
| **\_\_PPC64\_\_** |  |  | yes | yes |  |  |  | yes | yes |

Notes:

* There is no single POWER processor macro defined by all compilers on all OSes. An **#if/#endif** that checks multiple macros is required.
* GCC for AIX, NetBSD, and OpenBSD defines the same macros for 32-bit and 64-bit POWER processors. For AIX, **\_\_64BIT\_\_** is defined for 64-bit POWER. For OpenBSD, **\_LP64** and **\_\_LP64\_\_** are defined for 64-bit POWER. For NetBSD, GCC doesn't provide a macro to check for 64-bit use.
* Apple's OSX support for POWER processors ended after OSX 10.5 Leopard in 2007. The open source [Darwin](http://darwinsource.sourceforge.net/) distribution, on which OSX is based, is still available for POWER processors.

**SPARC**

|  |  |
| --- | --- |
| **Developer:** | Oracle, Fujitsu, Sun |
| **Processors:** | UltraSPARC I/II/III/IV/T1/T2, SPARC T3/T4, etc. |

#if defined(\_\_sparc)

/\* SPARC ---------------------------------------------------- \*/

#endif

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***SPARC*** | | | | |
| **Macro** | [**Clang/LLVM**](http://llvm.org/) | [**GNU GCC/G++**](http://gcc.gnu.org/) | | [**Oracle  Solaris Studio**](http://www.oracle.com/technetwork/server-storage/solarisstudio/overview/index.html) |
| ***BSD, Linux, Solaris*** | ***BSD*** | ***Linux, Solaris*** | ***Solaris*** |
| **sparc** | yes | yes | yes | yes |
| **\_\_sparc** | yes | yes | yes | yes |
| **\_\_sparc\_\_** | yes | yes | yes |  |
| **\_\_sparc64\_\_** |  | yes |  |  |

Notes:

* GCC defines processor name macros depending upon the value of the **-march** command-line option. These include**\_\_sparclite\_\_, \_\_sparclet\_\_, \_\_sparc\_v8\_\_, \_\_sparc\_v9\_\_, \_\_supersparc\_\_, \_\_hypersparc\_\_**, and so forth. However, other compilers don't provide this level of detail and writing code that depends upon these macros is probably a bad idea.

**x86 and x86-64**

|  |  |
| --- | --- |
| **A.K.A. (32-bit):** | IA-32, i386, x86, x86-32 |
| **A.K.A. (64-bit):** | AMD64, EM64T, IA-32e, Intel64, x64, x86-64 |
| **Developers:** | AMD, Intel |
| **Processors:** | Athlon, Atom, Core, Core 2, Core i3/i5/i7, Opteron, Pentium, Phenom, Sempron, Turion, etc. |

#if defined(\_\_x86\_64\_\_) || defined(\_M\_X64)

/\* x86 64-bit ----------------------------------------------- \*/

#elif defined(\_\_i386) || defined(\_M\_IX86)

/\* x86 32-bit ----------------------------------------------- \*/

#endif

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***x86 32-bit*** | | | | | | | | | | |
| **Macro** | [**Clang/LLVM**](http://llvm.org/) | | | [**GNU GCC/G++**](http://gcc.gnu.org/) | | [**Intel ICC/ICPC**](http://software.intel.com/en-us/articles/intel-compilers/) | | [**Portland  PGCC/PGCPP**](http://www.pgroup.com/products/pgiworkstation.htm) | [**Oracle  Solaris  Studio**](http://www.oracle.com/technetwork/server-storage/solarisstudio/overview/index.html) | [**Microsoft  Visual  Studio**](http://www.microsoft.com/visualstudio/en-us) |
| ***BSD, Cygwin, Linux, OSX, Solaris*** | ***MinGW*** | ***Windows*** | ***BSD,  Linux, OSX, Solaris*** | ***Cygwin, MinGW, Windows*** | ***Linux, OSX*** | ***Windows*** | ***Linux, OSX, Windows*** | ***Linux, Solaris*** | ***Windows*** |
| **i386** | yes | yes | yes | yes | yes | yes |  | yes | yes |  |
| **\_\_i386** | yes | yes | yes | yes | yes | yes |  | yes | yes |  |
| **\_\_i386\_\_** | yes | yes | yes | yes | yes | yes |  | yes |  |  |
| **\_M\_IX86** |  |  | yes |  |  |  | yes |  |  | yes |
| **\_X86\_** |  | yes |  |  | yes |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***x86 64-bit*** | | | | | | | | |
| **Macro** | [**Clang/LLVM**](http://llvm.org/) | | [**GNU GCC/G++**](http://gcc.gnu.org/) | [**Intel ICC/ICPC**](http://software.intel.com/en-us/articles/intel-compilers/) | | [**Portland  PGCC/PGCPP**](http://www.pgroup.com/products/pgiworkstation.htm) | [**Oracle  Solaris  Studio**](http://www.oracle.com/technetwork/server-storage/solarisstudio/overview/index.html) | [**Microsoft  Visual  Studio**](http://www.microsoft.com/visualstudio/en-us) |
| ***BSD, Linux, MinGW,  OSX, Solaris*** | ***Windows*** | ***BSD, Linux, MinGW,  OSX, Solaris, Windows*** | ***Linux, OSX*** | ***Windows*** | ***Linux, OSX , Windows*** | ***Linux, Solaris*** | ***Windows*** |
| **\_\_x86\_64** | yes | yes | yes | yes |  |  | yes |  |
| **\_\_x86\_64\_\_** | yes | yes | yes | yes |  | yes | yes |  |
| **\_\_amd64** | yes | yes | yes |  |  |  | yes |  |
| **\_\_amd64\_\_** | yes | yes | yes |  |  | yes | yes |  |
| **\_M\_AMD64** |  | yes |  |  | yes |  |  | yes |
| **\_M\_X64** |  | yes |  |  | yes |  |  | yes |

Notes:

* There is no single x86 processor macro defined by all compilers on all OSes. An **#if/#endif** that checks multiple macros is required.
* 64-bit instructions for the x86 architecture originated with AMD and were later adopted by Intel. The **\_amd64**, **\_amd64\_\_**, and **\_M\_AMD64** macros are for legacy support, while the newer **\_\_x86\_64**, **\_\_x86\_64\_\_**, and **\_M\_X64** are vendor-generic.
* With appropriate command-line options, Clang/LLVM and GCC can build 32-bit and 64-bit binaries for Windows instead of POSIX. The macros they define differ between POSIX and Windows.
* GCC and Clang/LLVM define a variety of processor name macros, depending upon the value of the **-march** command-line option. These include **\_\_i486\_\_**, **\_\_i586\_\_**, **\_\_pentium\_\_**, **\_\_pentiumpro\_\_**, **\_\_athlon\_\_**, **\_\_atom\_\_**, **\_\_core2\_\_**, **\_\_corei7\_\_**, **\_\_k8\_\_**, and so forth. However, other compilers do not provide this level of detail and writing code that depends upon these macros is probably a bad idea.

**Further reading**

**Related articles at NadeauSoftware.com**

[C/C++ tip: How to list compiler predefined macros](http://nadeausoftware.com/articles/2011/12/c_c_tip_how_list_compiler_predefined_macros) explains how to get a compiler's macros by using command-line options and other methods.

[C/C++ tip: How to detect the compiler name and version using compiler predefined macros](http://nadeausoftware.com/articles/2012/10/c_c_tip_how_detect_compiler_name_and_version_using_compiler_predefined_macros) provides **#if/#endif** sets for detecting common compilers.

[C/C++ tip: How to detect the operating system type using compiler predefined macros](http://nadeausoftware.com/articles/2012/01/c_c_tip_how_use_compiler_predefined_macros_detect_operating_system) provides **#if/#endif** sets for detecting desktop and server operating systems using compiler macros.

**Web articles**

[Architectures](http://sourceforge.net/apps/mediawiki/predef/index.php?title=Architectures) at Sourceforge.net provides a list of current and obsolete processors and some of the macros used to detect them. Unfortunately, the list is out of date, occassionally wrong, doesn't include several compilers, and doesn't show differences between compilers and OSes.

[List of CPU architectures](http://en.wikipedia.org/wiki/List_of_CPU_architectures) at Wikipedia.org provides categories of processor architectures and links to further information about each. No information is provided on predefined macros.

[Pre-defined C/C++ Compiler Macros](http://beefchunk.com/documentation/lang/c/pre-defined-c/prearch.html) at beefchunk.com has a brief list of processors and predefined macros. However, the list is incomplete and doesn't show differences among compilers and operating systems.