

Get Started with Intel® Integrated Performance Primitives Cryptography

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Chapter 1: Get Started with Intel® Integrated Performance Primitives Cryptography for Intel® oneAPI Base Toolkit

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Intel® Integrated Performance Primitives (Intel® IPP) Cryptography is a software library that provides a broad range of secure and efficient cryptographic algorithm implementations.

The library is delivered as a part of [Intel® oneAPI Base Toolkit](#). You may install [specific library version](#) as well. This get started guide assumes you have installed Intel IPP Cryptography library as a part of the toolkit.

Prerequisites (Windows* OS)

Set Environment Variables

After installing Intel IPP Cryptography, set the *PATH*, *LIB*, and *INCLUDE* environment variables by running the script appropriate to your target platform architecture. The scripts are available in *<install_dir>\ippcp\bin*.

By default, the *<install_dir>* is *C:\Program files (x86)\Intel\oneapi*. See [Intel IPP high-level directories structure](#).

Configure Your IDE Environment to Link with Intel IPP Cryptography

To configure your Microsoft* Visual Studio* development system for linking with the Intel IPP Cryptography library, follow the steps below. Though some versions of the Visual Studio* IDE may vary slightly in the menu items mentioned below, the fundamental configuring steps are applicable to all these versions.

1. In Solution Explorer, right-click your project and click **Properties**.
2. Select **Configuration Properties** > **VC++ Directories** and set the following from the **Select directories for** drop down menu:
 - **Include Files** menu item, and then type in the directory for the Intel IPP Cryptography include files (default is *<install_dir>\ippcp\include*)
 - **Library Files** menu item, and then type in the directory for the Intel IPP Cryptography library files (default is *<install_dir>\ippcp\lib\<arch>*)
 - **Executable Files** menu item, and then type in the directory for the Intel IPP Cryptography executable files (default is *<install_dir>\redist\<arch>\ippcp*)

Build and Run Your First Intel® IPP Cryptography Application (Windows* OS)

The code example below represents a short application to help you get started with Intel IPP Cryptography:

```
#include "ippcp.h"
#include <stdio.h>

#define ippCPUID_MMX      0x00000001  /* Intel® Architecture MMX™
technology                */
#define ippCPUID_SSE      0x00000002  /* Intel® Streaming SIMD
Extensions                */
#define ippCPUID_SSE2     0x00000004  /* Intel® Streaming SIMD Extensions
2                          */
#define ippCPUID_SSE3     0x00000008  /* Intel® Streaming SIMD Extensions
3                          */
```

```

#define ippCPUID_SSSE3      0x00000010 /* Supplemental Streaming SIMD Extensions
3                               */
#define ippCPUID_MOVBE     0x00000020 /* The processor supports the MOVBE
instruction                     */
#define ippCPUID_SSE41     0x00000040 /* Intel® Streaming SIMD Extensions
4.1                             */
#define ippCPUID_SSE42     0x00000080 /* Intel® Streaming SIMD Extensions
4.2                             */
#define ippCPUID_AVX       0x00000100 /* Intel® Advanced Vector Extensions (Intel®
AVX)                             */
#define ippAVX_ENABLEDBYOS 0x00000200 /* The operating system supports Intel
AVX                             */
#define ippCPUID_AES       0x00000400 /* Intel® AES New Instructions (Intel® AES-
NI)                             */
#define ippCPUID_CLMUL     0x00000800 /* PCLMULQDQ
instruction                       */
#define ippCPUID_ABR       0x00001000 /*
Reserved                           */
#define ippCPUID_RDRAND    0x00002000 /* Read Random Number
instructions                       */
#define ippCPUID_F16C     0x00004000 /* Float16
instructions                       */
#define ippCPUID_AVX2     0x00008000 /* Intel® Advanced Vector Extensions
2                               */
#define ippCPUID_ADCOX     0x00010000 /* ADCX and ADOX
instructions                       */
#define ippCPUID_RDSEED    0x00020000 /* The RDSEED
instruction                       */
#define ippCPUID_PREFETCHW 0x00040000 /* The PREFETCHW
instruction                       */
#define ippCPUID_SHA       0x00080000 /* Intel® SHA
Extensions                       */
#define ippCPUID_AVX512F   0x00100000 /* Intel® Advanced Vector Extensions 512 (Intel®
AVX-512) Foundation instructions */
#define ippCPUID_AVX512CD  0x00200000 /* Intel AVX-512 Conflict Detection
instructions                       */
#define ippCPUID_AVX512ER  0x00400000 /* Intel AVX-512 Exponential & Reciprocal
instructions                       */
#define ippCPUID_AVX512PF  0x00800000 /* Intel AVX-512 Prefetch
instructions                       */
#define ippCPUID_AVX512BW  0x01000000 /* Intel AVX-512 Byte & Word
instructions                       */
#define ippCPUID_AVX512DQ  0x02000000 /* Intel AVX-512 DWord & QWord
instructions                       */
#define ippCPUID_AVX512VL  0x04000000 /* Intel AVX-512 Vector Length
extensions                       */
#define ippCPUID_AVX512VBMI 0x08000000 /* Intel AVX-512 Vector Bit Manipulation
instructions                       */
#define ippCPUID_MPX       0x10000000 /* Intel® Memory Protection
Extensions                       */
#define ippCPUID_AVX512_4FMADDPS 0x20000000 /* Intel AVX-512 DL floating-point single
precision                       */
#define ippCPUID_AVX512_4VNNIW 0x40000000 /* Intel AVX-512 DL enhanced word variable
precision                       */
#define ippCPUID_KNC       0x80000000 /* Intel® Xeon Phi™
Coprocessor                       */

int main(int argc, char* argv[])

```

```

{
    const IppLibraryVersion *lib;
    IppStatus status;
    Ipp64u mask, emask;

    /* Get Intel IPP Cryptography library version info */
    lib = ippcpGetLibVersion();
    printf("%s %s\n", lib->Name, lib->Version);

    /* Get CPU features and features enabled with selected library level */
    status = ippcpGetCpuFeatures( &mask );
    if( ippStsNoErr == status ) {
        emask = ippcpGetEnabledCpuFeatures();
        printf("Features supported by CPU\tbody Intel® Integrated Performance Primitives Cryptography\n");

        printf("-----\n");
        printf(" ippCPUID_MMX      = ");
        printf("%c\t%c\t", ( mask & ippCPUID_MMX ) ? 'Y':'N', ( emask & ippCPUID_MMX ) ? 'Y':'N');
        printf("Intel® Architecture MMX technology supported\n");
        printf(" ippCPUID_SSE      = ");
        printf("%c\t%c\t", ( mask & ippCPUID_SSE ) ? 'Y':'N', ( emask & ippCPUID_SSE ) ? 'Y':'N');
        printf("Intel® Streaming SIMD Extensions\n");
        printf(" ippCPUID_SSE2     = ");
        printf("%c\t%c\t", ( mask & ippCPUID_SSE2 ) ? 'Y':'N', ( emask & ippCPUID_SSE2 ) ? 'Y':'N');
        printf("Intel® Streaming SIMD Extensions 2\n");
        printf(" ippCPUID_SSE3     = ");
        printf("%c\t%c\t", ( mask & ippCPUID_SSE3 ) ? 'Y':'N', ( emask & ippCPUID_SSE3 ) ? 'Y':'N');
        printf("Intel® Streaming SIMD Extensions 3\n");
        printf(" ippCPUID_SSSE3    = ");
        printf("%c\t%c\t", ( mask & ippCPUID_SSSE3 ) ? 'Y':'N', ( emask & ippCPUID_SSSE3 ) ?
'Y':'N');
        printf("Supplemental Streaming SIMD Extensions 3\n");
        printf(" ippCPUID_MOVBE    = ");
        printf("%c\t%c\t", ( mask & ippCPUID_MOVBE ) ? 'Y':'N', ( emask & ippCPUID_MOVBE ) ?
'Y':'N');
        printf("The processor supports MOVBE instruction\n");
        printf(" ippCPUID_SSE41    = ");
        printf("%c\t%c\t", ( mask & ippCPUID_SSE41 ) ? 'Y':'N', ( emask & ippCPUID_SSE41 ) ?
'Y':'N');
        printf("Intel® Streaming SIMD Extensions 4.1\n");
        printf(" ippCPUID_SSE42    = ");
        printf("%c\t%c\t", ( mask & ippCPUID_SSE42 ) ? 'Y':'N', ( emask & ippCPUID_SSE42 ) ?
'Y':'N');
        printf("Intel® Streaming SIMD Extensions 4.2\n");
        printf(" ippCPUID_AVX      = ");
        printf("%c\t%c\t", ( mask & ippCPUID_AVX ) ? 'Y':'N', ( emask & ippCPUID_AVX ) ? 'Y':'N');
        printf("Intel® Advanced Vector Extensions (Intel® AVX) instruction set\n");
        printf(" ippAVX_ENABLEDBYOS = ");
        printf("%c\t%c\t", ( mask & ippAVX_ENABLEDBYOS ) ? 'Y':'N', ( emask & ippAVX_ENABLEDBYOS ) ?
'Y':'N');
        printf("The operating system supports Intel® AVX\n");
        printf(" ippCPUID_AES      = ");
        printf("%c\t%c\t", ( mask & ippCPUID_AES ) ? 'Y':'N', ( emask & ippCPUID_AES ) ? 'Y':'N');
        printf("Intel® AES instruction\n");
        printf(" ippCPUID_SHA      = ");
        printf("%c\t%c\t", ( mask & ippCPUID_SHA ) ? 'Y':'N', ( emask & ippCPUID_SHA ) ? 'Y':'N');
        printf("Intel® SHA new instructions\n");
        printf(" ippCPUID_CLMUL    = ");
    }
}

```

```

    printf("%c\t%c\t", ( mask & ippCPUID_CLMUL ) ? 'Y':'N', ( emask & ippCPUID_CLMUL ) ?
'Y':'N');
    printf("PCLMULQDQ instruction\n");
    printf(" ippCPUID_RDRAND      = ");
    printf("%c\t%c\t", ( mask & ippCPUID_RDRAND ) ? 'Y':'N', ( emask & ippCPUID_RDRAND ) ?
'Y':'N');
    printf("Read Random Number instructions\n");
    printf(" ippCPUID_F16C      = ");
    printf("%c\t%c\t", ( mask & ippCPUID_F16C ) ? 'Y':'N', ( emask & ippCPUID_F16C ) ? 'Y':'N');
    printf("Float16 instructions\n");
    printf(" ippCPUID_AVX2      = ");
    printf("%c\t%c\t", ( mask & ippCPUID_AVX2 ) ? 'Y':'N', ( emask & ippCPUID_AVX2 ) ? 'Y':'N');
    printf("Intel® Advanced Vector Extensions 2 instruction set\n");
    printf(" ippCPUID_AVX512F     = ");
    printf("%c\t%c\t", ( mask & ippCPUID_AVX512F ) ? 'Y':'N', ( emask & ippCPUID_AVX512F ) ?
'Y':'N');
    printf("Intel® Advanced Vector Extensions 512 Foundation instruction set\n");
    printf(" ippCPUID_AVX512CD    = ");
    printf("%c\t%c\t", ( mask & ippCPUID_AVX512CD ) ? 'Y':'N', ( emask & ippCPUID_AVX512CD ) ?
'Y':'N');
    printf("Intel® Advanced Vector Extensions 512 Conflict Detection instruction set\n");
    printf(" ippCPUID_AVX512ER    = ");
    printf("%c\t%c\t", ( mask & ippCPUID_AVX512ER ) ? 'Y':'N', ( emask & ippCPUID_AVX512ER ) ?
'Y':'N');
    printf("Intel® Advanced Vector Extensions 512 Exponential & Reciprocal instruction set\n");
    printf(" ippCPUID_ADCOX      = ");
    printf("%c\t%c\t", ( mask & ippCPUID_ADCOX ) ? 'Y':'N', ( emask & ippCPUID_ADCOX ) ?
'Y':'N');
    printf("ADCX and ADOX instructions\n");
    printf(" ippCPUID_RDSEED      = ");
    printf("%c\t%c\t", ( mask & ippCPUID_RDSEED ) ? 'Y':'N', ( emask & ippCPUID_RDSEED ) ?
'Y':'N');
    printf("The RDSEED instruction\n");
    printf(" ippCPUID_PREFETCHW    = ");
    printf("%c\t%c\t", ( mask & ippCPUID_PREFETCHW ) ? 'Y':'N', ( emask & ippCPUID_PREFETCHW ) ?
'Y':'N');
    printf("The PREFETCHW instruction\n");
    printf(" ippCPUID_KNC          = ");
    printf("%c\t%c\t", ( mask & ippCPUID_KNC ) ? 'Y':'N', ( emask & ippCPUID_KNC ) ? 'Y':'N');
    printf("Intel® Xeon Phi™ Coprocessor instruction set\n");
}
return 0;
}

```

This application consists of two sections:

1. Get the library layer name and version.
2. Show the hardware optimizations used by the selected library layer and supported by CPU.

On Windows* OS, Intel IPP Cryptography applications are significantly easier to build with Microsoft* Visual Studio*. To build the code example above, follow the steps:

1. Start Microsoft* Visual Studio* and create an empty C++ project.
2. Add a new c file and paste the code into it.
3. Set the include directories and the linking model.
4. Compile and run the application.

Training and Documentation

Document	Description
Intel® IPP Cryptography Developer Guide	Provides detailed guidance on Intel IPP Cryptography library configuration, development environment, and linkage modes.
Intel® IPP Cryptography Developer Reference	Contains detailed descriptions of the Intel IPP Cryptography functions.
Intel® Integrated Performance Primitives	Intel® IPP product page. See this page for support and online documentation.

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