intel Software

oneAPI

Single Programming Model to Deliver Cross-Architecture Performance

Industry initiative, Intel® oneAPI Beta Products

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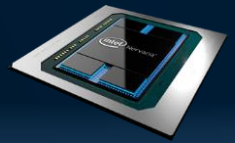
All information provided in this deck is subject to change without notice.
Contact your Intel representative to obtain the latest Intel product specifications and roadmaps.

INTEL DATA-CENTRIC HARDWARE: HIGH PERFORMANCE, FLEXIBLE OPTIONS

General Purpose CPU	Programmable Data Parallel Accelerator GPU	FPGA	Domain Optimized Accelerator NNP
			
SCALAR	VECTOR	SPATIAL	MATRIX

GENERAL PURPOSE HARDWARE WORKLOAD OPTIMIZED

Provide optimal performance over the widest variety of workloads

Deliver highest performance per $/Watt/U/Rack for critical applications

Growth in specialized workloads
Diverse set of data-centric hardware required

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PROGRAMMING CHALLENGES FOR MULTIPLE ARCHITECTURES

Today, each kind of data-centric HW:

No common programming language or APIs

Inconsistent tool support across platforms (ie. profiling, debugging)

Each platform requires unique software investment (time and $)

No reuse to target a different architecture

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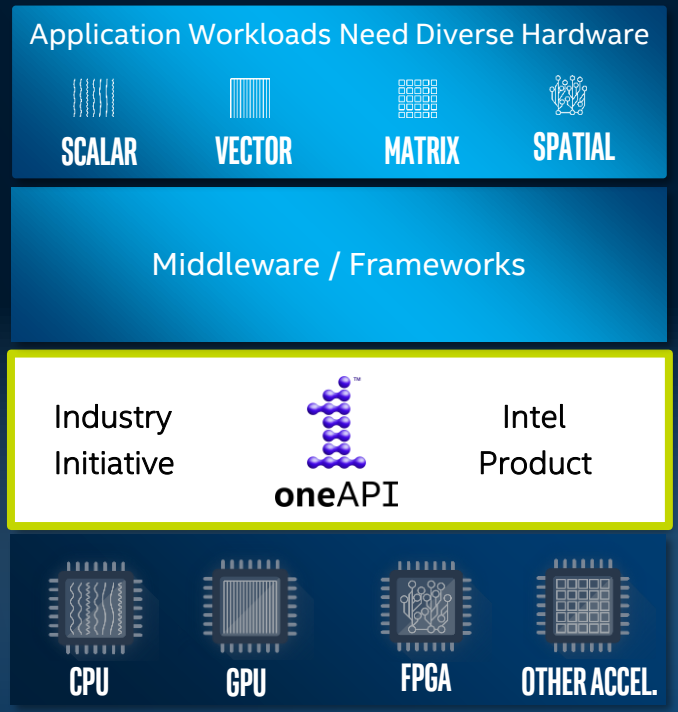
INTRODUCING ONEAPI

A project to deliver a unified software development environment across CPU and accelerator architectures.

Unified and simplified language and libraries for expressing parallelism

Delivering native high-level language performance

Based on industry standards and open specifications



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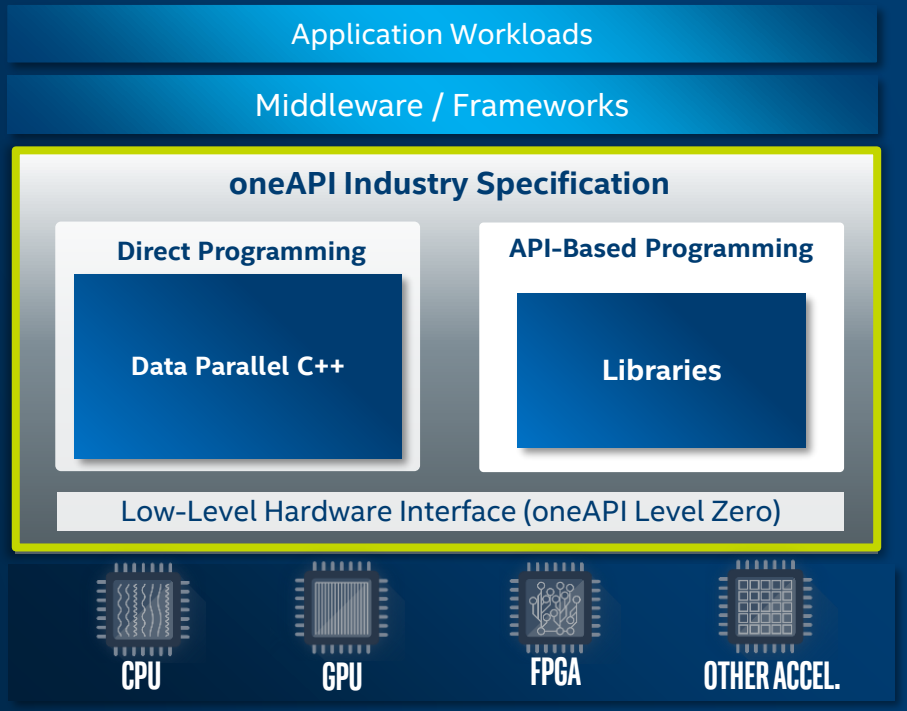
oneAPI INDUSTRY INITIATIVE
ALTERNATIVE TO SINGLE-VENDOR SOLUTION

Open standard specification to promote community and industry vendors support and includes:

Direct programing flow with an open, unified language: DPC++ based on C++ with SYCL extensions

API-based programming flow with a set of powerful libraries designed for each hardware to accelerate key domain-specific functions, most of them open sourced

Specification of Low-level interface to provide a hardware abstraction layer to vendors



Together, these components allow Intel and other companies to build their own implementations of oneAPI

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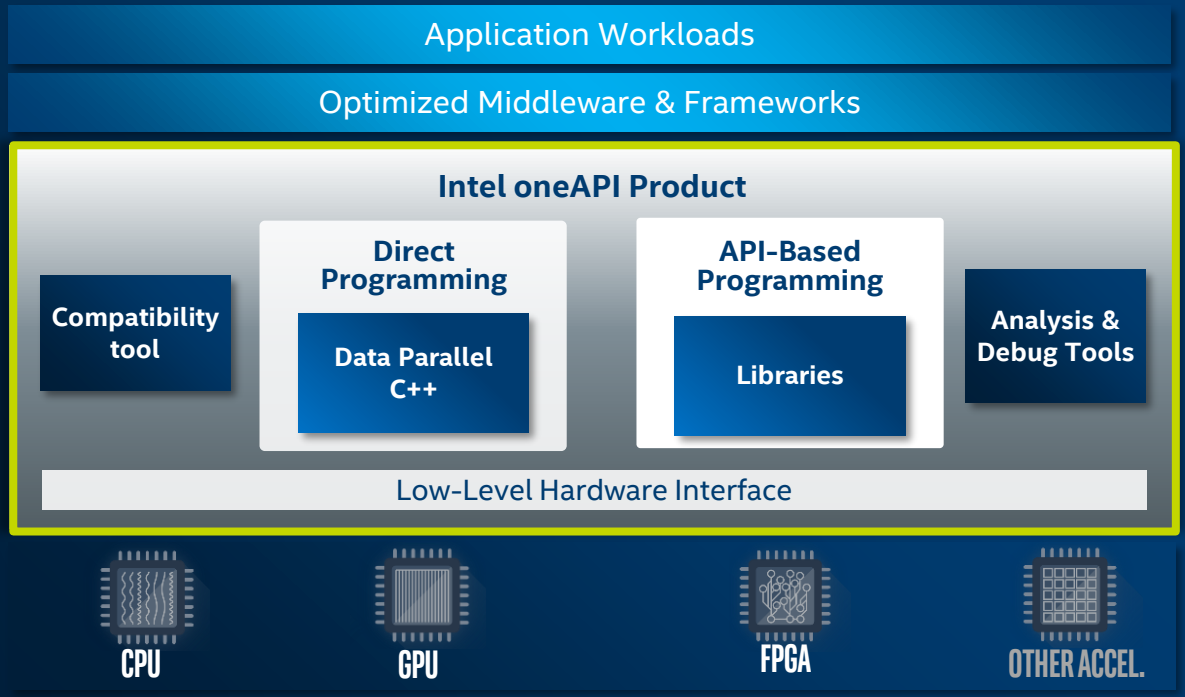
INTEL® ONEAPI PRODUCTS (BETA)

Intel's reference implementation of oneAPI

Distributed through a core toolkit and a complementary set of add-on domain-specific toolkits

Includes DPC++ compatibility tool for code migration along with advanced performance analysis and debug tools



Visit software.intel.com/oneapi for more details

Some capabilities may differ per architecture and custom-tuning will still be required. Other accelerators to be supported in the future.

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INTEL® ONEAPI TOOLKITS (BETA)

TOOLKITS TAILORED TO YOUR NEEDS

Domain-specific sets of tools to get your job done quickly.

Intel® oneAPI Base Toolkit

A core set of high-performance tools for building Data Parallel C++ applications and oneAPI library based applications

Learn More

Intel® oneAPI HPC Toolkit

Everything HPC developers need to deliver fast C++, Fortran, & OpenMP* applications that scale

Learn More

Intel® oneAPI IoT Toolkit

Tools for building high-performing, efficient, reliable solutions that run at the network's edge

Learn More

Intel® oneAPI DL Framework Developer Toolkit

Tools for developers & researchers who build deep learning frameworks or customize existing ones so applications run faster

Learn More

Intel® oneAPI Rendering Toolkit

Powerful rendering libraries to create high-performance, high-fidelity visualization applications

Learn More

Toolkits Powered by oneAPI

Intel® System Bring-Up Toolkit

Tools to debug & tune power & performance in pre- & post-silicon development

Learn More

Intel® Distribution of OpenVINO™ Toolkit

Tools to build high performance deep learning inference & computer vision applications (production-level tool)

Learn More

Intel® AI Analytics Toolkit

Tools to build applications that leverage machine learning & deep learning models

Learn More

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DETAILS ABOUT INTEL® ONEAPI TOOLKITS (BETA)

INTEL® ONEAPI BASE TOOLKIT

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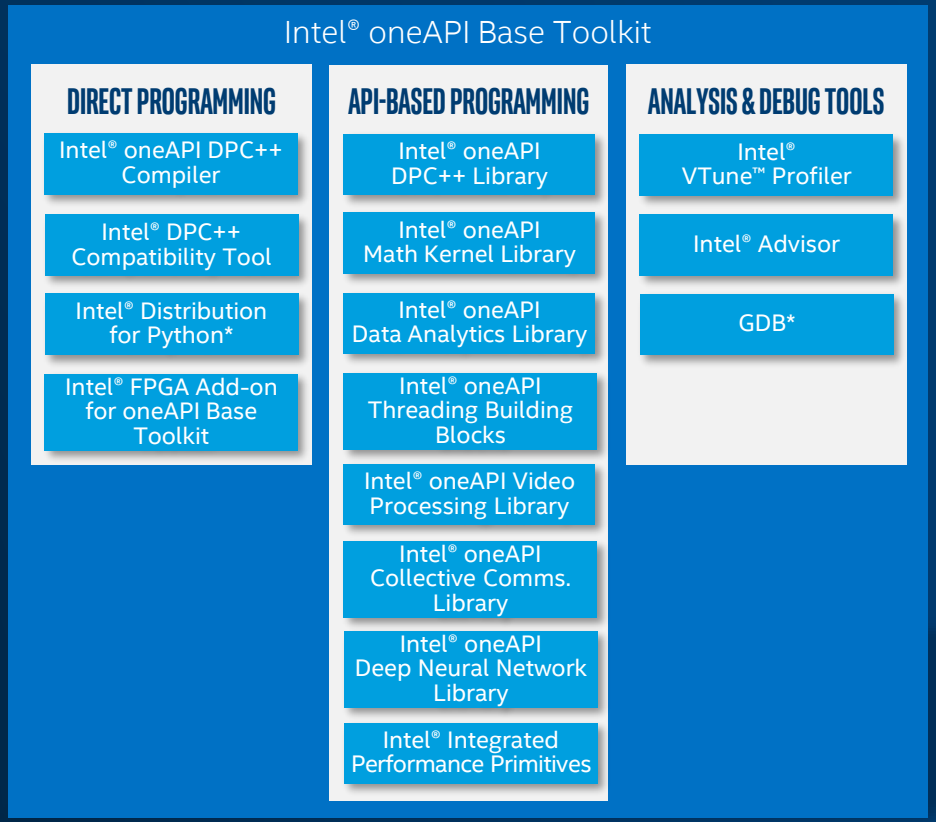
INTEL® ONEAPI BASE TOOLKIT (BETA)

Core set of frequently used tools and libraries for developing high-performance applications across diverse architectures—CPU, GPU, FPGA.

Top Features/Benefits

- Data Parallel C++ compiler, library, and analysis tools
- DPC++ Compatibility tool helps migrate existing code written in CUDA*
- Python distribution includes accelerated scikit-learn, NumPy, SciPy libraries
- Optimized performance libraries for threading, math, data analytics, deep learning, and video/image/signal processing



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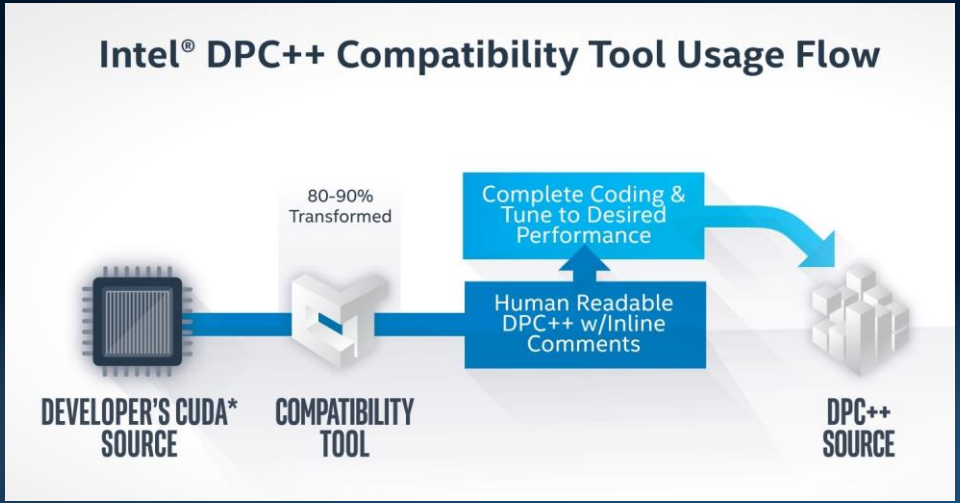
INTEL® DPC++ COMPATIBILITY TOOL (BETA)
MINIMIZES CODE MIGRATION TIME

Assists developers migrating code written in CUDA* to DPC++ **bridging the gap between the languages**

Migrated result includes:

- DPC++ code and inline comments
- Unchanged CUDA code and hints to assist developers complete the rest manually



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INTEL® VTUNE™ PROFILER (BETA)

DPC++ PROFILING – TUNE FOR CPU, GPU & FPGA

Analyze Data Parallel C++ (DPC++)

See the lines of DPC++ that consume the most time

Tune for CPU, GPU & FPGA

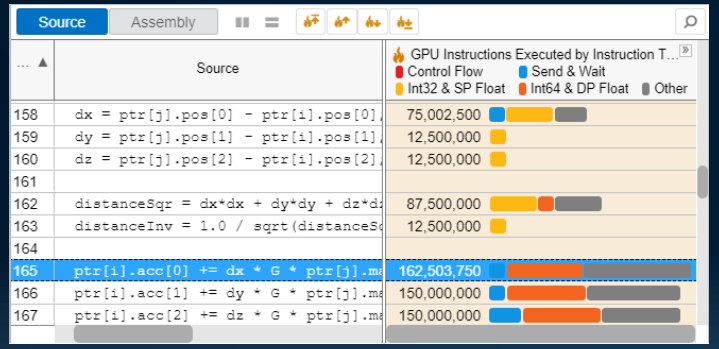
Optimize for any supported hardware accelerator

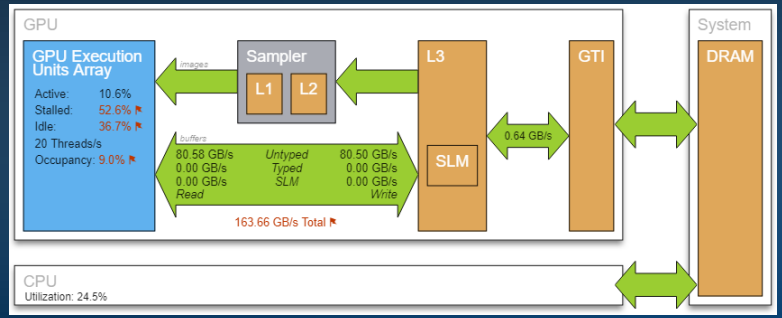
Optimize Offload

Tune OpenMP* offload performance

Supports Popular Languages

DPC++, C, C++, Fortran, Python*, Go*, Java*, or a mix





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INTEL® ADVISOR (BETA)

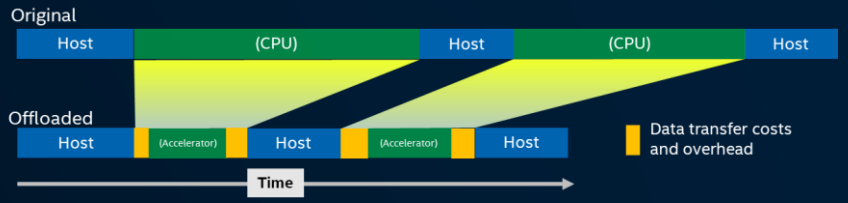
DESIGN ASSISTANT — DESIGN FOR MODERN HARDWARE

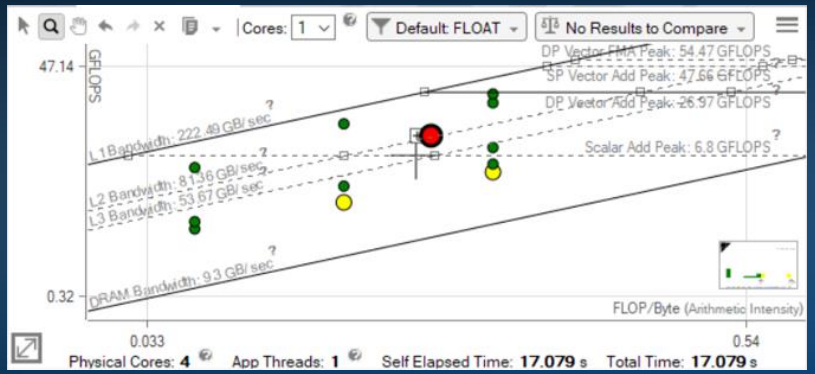
Determine if your code would benefit from offloading to an accelerator – even before you have the hardware

Projects performance on accelerators

Estimates overhead from data transfers and kernel launch costs

Pinpoint accelerator performance bottlenecks (memory, cache, compute and data transfer)





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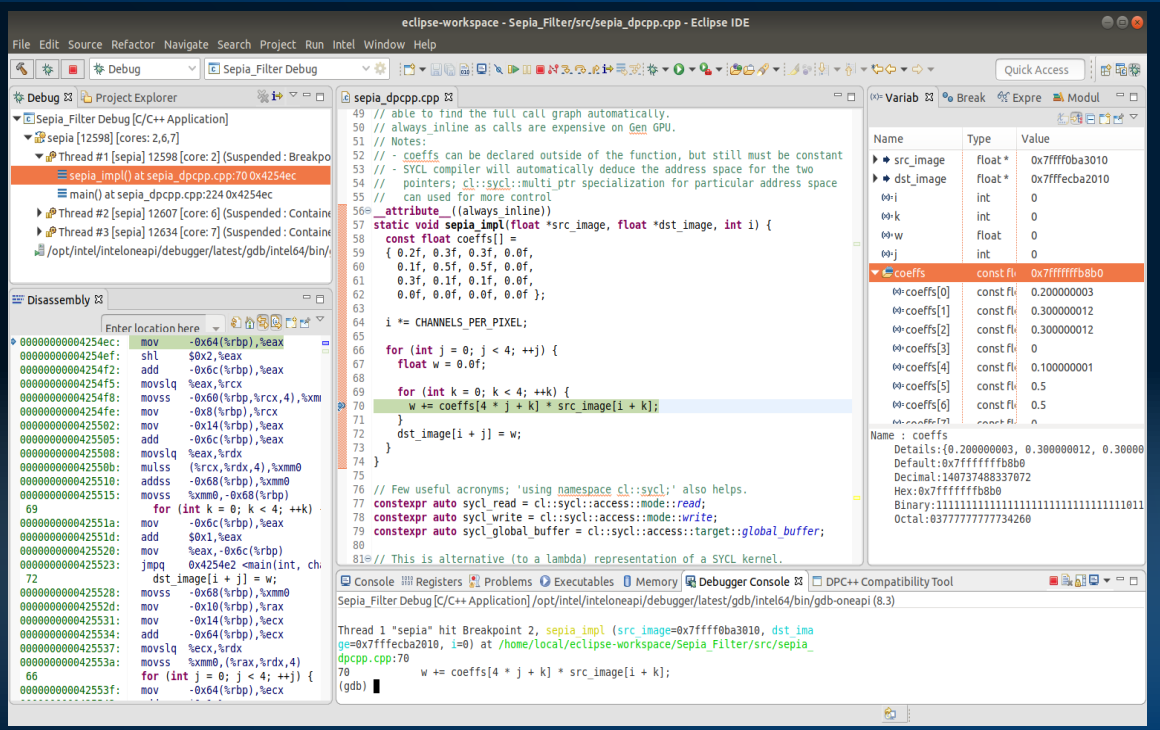
GDB* (BETA)
DPC++ DEBUG — HETEROGENEOUS APPLICATION DEBUG

High-level language debug support

Multiple accelerator support: CPU, GPU and FPGA in emulation

Auto-detect accelerator architecture during application runtime

Non-proprietary open-source solution based on GDB*



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ONEAPI FOR FPGA

DPC++ CODING FOR SPATIAL ARCHITECTURE

For Experienced FPGA Developers

Ease of Use

Experienced FPGA users can take advantage of a streamlined programming model using DPC++

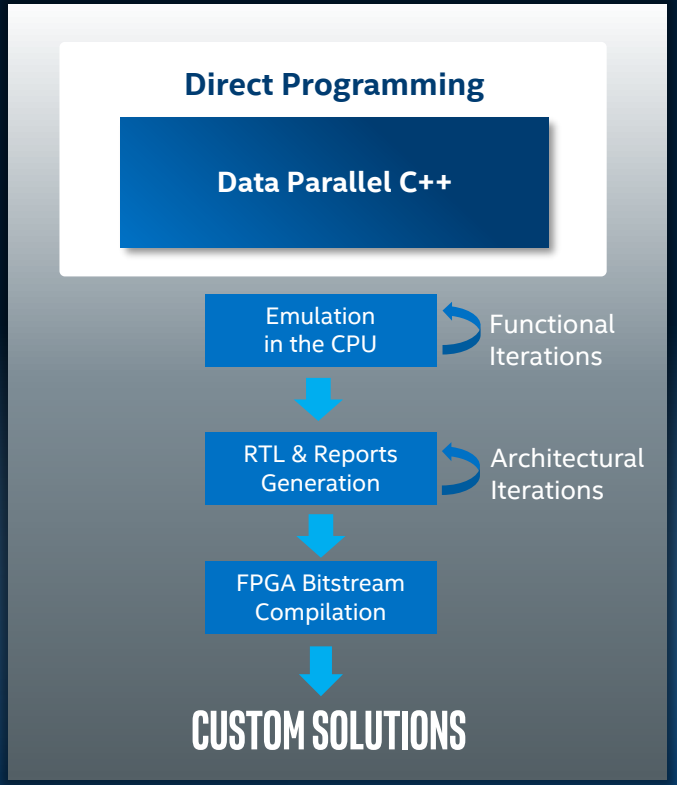
Runtime Analysis Support

Collect profiling data at runtime to analyze CPU & FPGA interaction with Intel® VTune™ Profiler

Device Specific Optimizations

Developers are expected to make use of FPGA specific pragmas & attributes to optimize their designs

Process data faster with deterministic low latency & high throughput in FPGAs



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DETAILS ABOUT INTEL® ONEAPI TOOLKITS(BETA)

DOMAIN-SPECIFIC TOOLKITS FOR SPECIALIZED WORKLOADS

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INTEL® ONEAPI HPC TOOLKIT (BETA)

A toolkit that makes easier to build, analyze, optimize & scale HPC applications for Intel® Xeon® Scalable, Intel® Core™ processors & Intel® Accelerators.

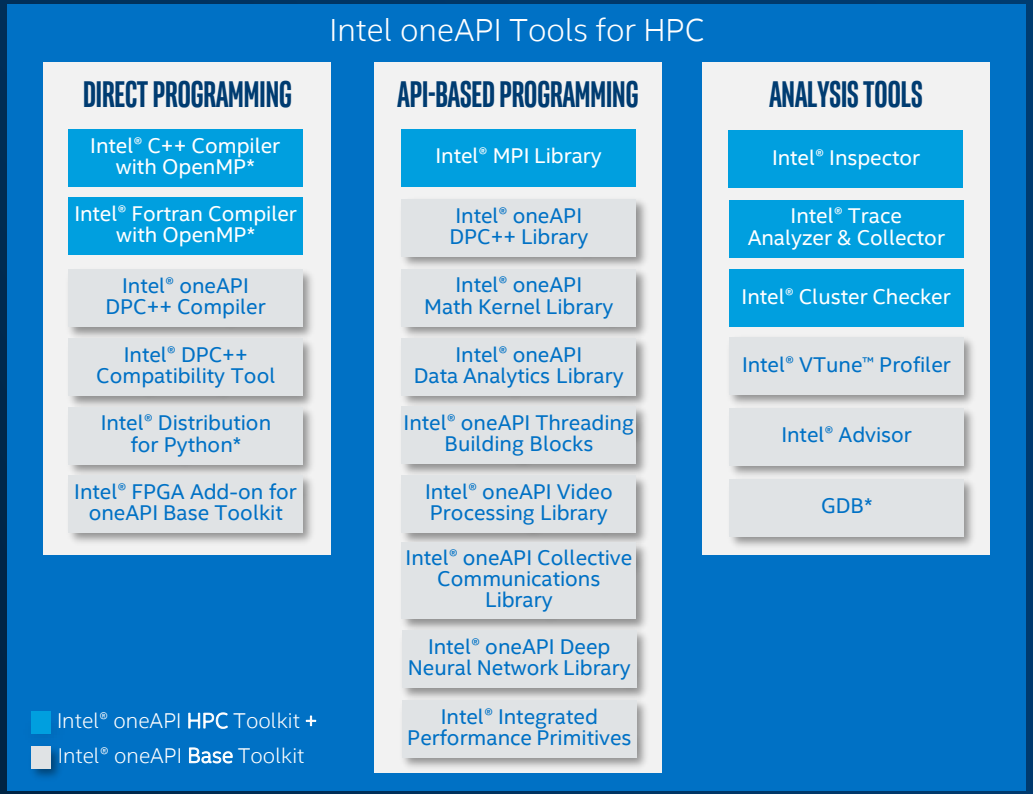
Who Uses It?

C/C++, Fortran, OpenMP & MPI application developers

Top Features/Benefits

Optimized compilers & performance libraries for Intel® architectures

Powerful analysis tools to identify optimization opportunities for threading, memory & offloading



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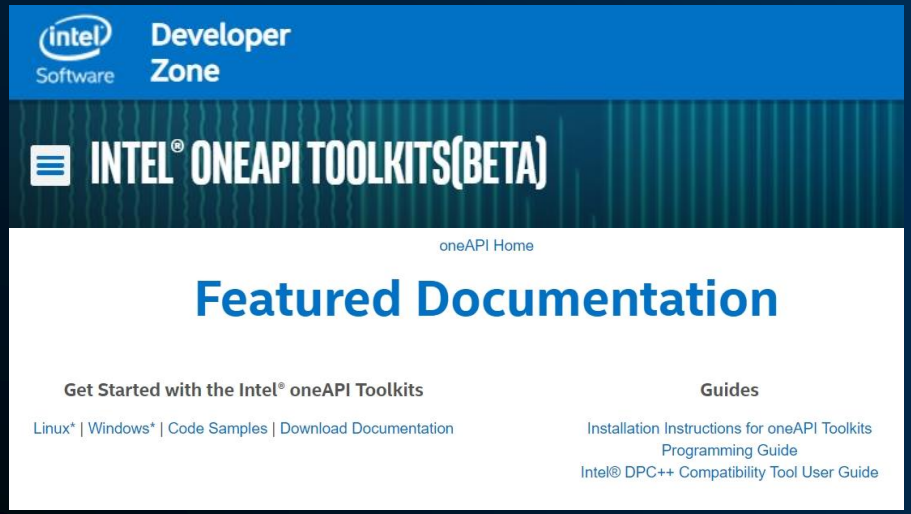
LEARN DPC++ AND ONEAPI

https://software.intel.com/en-us/oneapi/documentation



https://jamesreinders.com/dpcpp/

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ONEAPI AVAILABLE NOW ON INTEL® DEVCLOUD

A development sandbox to develop, test and run your workloads across a range of Intel CPUs, GPUs, and FPGAs using Intel's oneAPI beta software

software.intel.com/devcloud/oneapi

NO DOWNLOADS | NO HARDWARE ACQUISITION | NO INSTALLATION | NO SET-UP & CONFIGURATION

GET UP & RUNNING IN SECONDS!

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ONEAPI DEVCLOUD

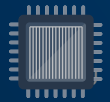
What you can do

- Learn DPC++
- Learn about Intel oneAPI toolkits
- Evaluate workloads
- Prototype your projects
- Build heterogeneous applications

Hardware

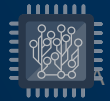
CPU:

Intel® Xeon® Scalable 6128 processors
Intel® Xeon® Scalable 8256 processors



GPU:

Intel® Xeon® E-2176 P630 processors
(with Intel® Processor Graphics Gen9)



FPGA:

Intel® Arria® 10 FPGAs

Included Toolkits

- Intel® oneAPI Base Toolkit
- Intel® oneAPI HPC Toolkit
- Intel® oneAPI Deep Learning Framework Developer Toolkit
- Intel® AI Analytics Toolkit
- Intel® Distribution of OpenVINO™ Toolkit
- + more

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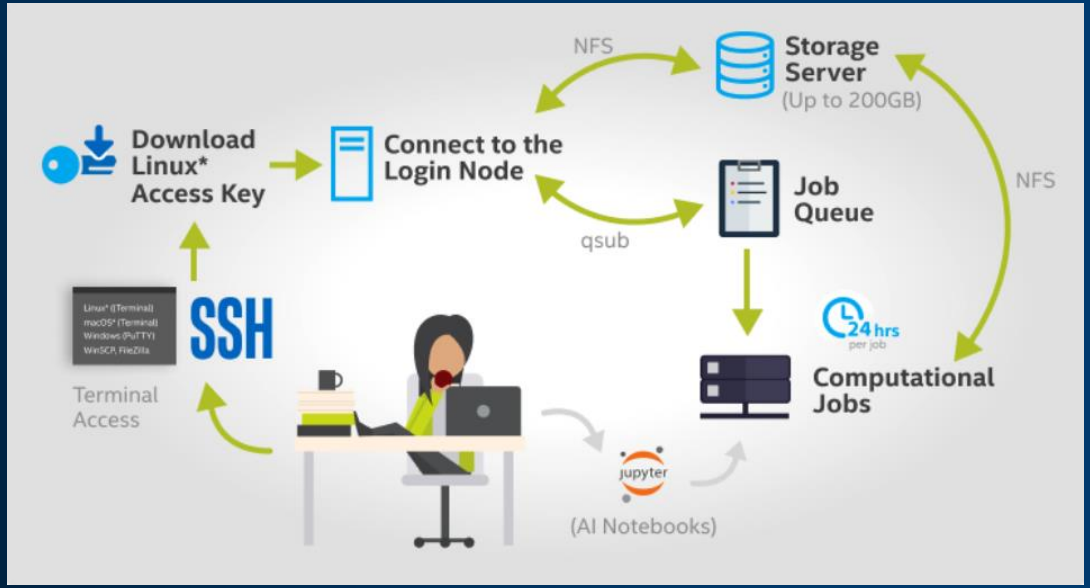
ONEAPI DEVCLOUD

What you get

- Access to Intel® oneAPI software and hardware
- 200 GB of file storage
- 192 GB RAM
- 120 days of access (extensions available)
- Terminal Interface (Linux*) and web (jupyter notebook)

How it works



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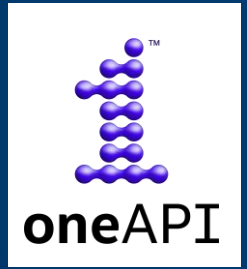
SUMMARY



Diverse workloads are driving the need for heterogeneous compute architectures

oneAPI is an open industry initiative & an Intel reference product

oneAPI unifies & simplifies programming of heterogeneous architectures delivering developer productivity & maximum performance for each hardware

Get Started – test code & workloads using the Intel® DevCloud

https://www.oneapi.com/

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ONEAPI INDUSTRY SPECIFICATION

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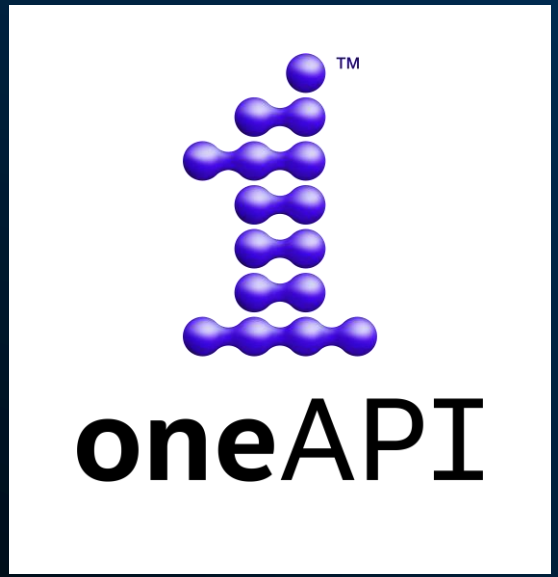

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Library Interoperability
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Data Parallel C++ (DPC++)
oneAPI Data Parallel C++ Library (oneDPL)
oneAPI Deep Neural Network Library (oneDNN)
oneAPI Collective Communications Library (oneCCL)
oneAPI Level Zero (Level Zero)
oneAPI Data Analytics Library (oneDAL)
oneAPI Threading Building Blocks (oneTBB)
oneAPI Video Processing Library (oneVPL)
oneAPI Math Kernel Library (oneMKL)
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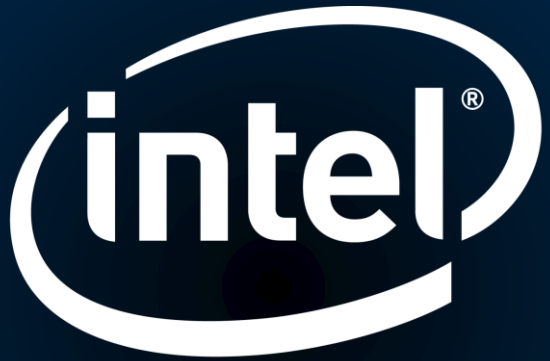

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