Intel oneAPI Rendering Toolkit

OSPRay Library

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Agenda

- Introduction
- ospExample application demo
- Building OSPRay
- ospTutorial code walkthrough
- ospExample code walkthrough
- Distributed rendering with MPI
- Where to learn more?
- Q&A

Introduction

- Intel OSPRay is an open source, scalable, and portable ray tracing engine for high-performance, high-fidelity visualization on Intel Architecture CPUs.
- It is part of the Intel oneAPI Rendering Toolkit
- Currently supports Linux, macOS, and Windows
- Internally builds on top of Intel Embree and Open VKL
- Uses code vectorization with Intel ISPC (Implicit SPMD Program Compiler), supports Intel SSE4, AVX, AVX2, and AVX-512
- Released under the permissive Apache 2.0 license

ospExample application demo

Building OSPRay

- Building is not always necessary, Linux, macOS and Windows binaries are available at the OSPRay webpage
- Source code is placed and maintained at GitHub:
  https://github.com/ospray/ospray

```
git clone https://github.com/ospray/ospray.git
```

- Tools:
  - CMake
  - C++11 compiler (GCC, Clang, MSVC, ICC)
  - ISPC compiler
- Dependencies:
  - Intel Threading Building Blocks (TBB)
  - Intel oneAPI RenderKit common library (rkcommon)
  - Intel oneAPI RenderKit Embree library
  - Intel oneAPI RenderKit Open VKL library
  - Intel oneAPI RenderKit Open Image Denoise (optional)

Building OSPRay, cont.

- There are two build options:
  - Manually download and install all dependencies

```
mkdir ospray/build
cd ospray/build
ccmake ..
make -j
```

  - Use superbuild:

```
mkdir build
cd build
cmake [<OSPRAY_SOURCE_LOC>/scripts/superbuild]
cmake --build .
```

ospTutorial code walkthrough

ospExample code walkthrough

Distributed rendering with MPI

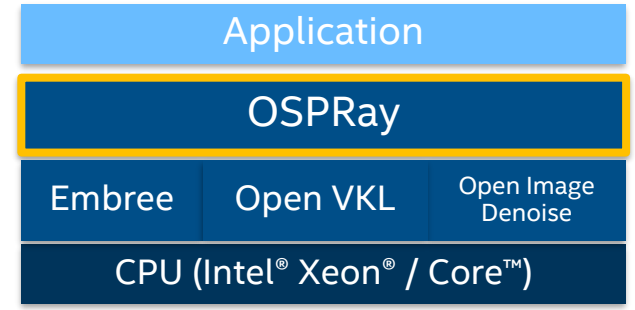
- MPI Offload Rendering
  - Image parallel rendering only
  - Modifications to the application not required

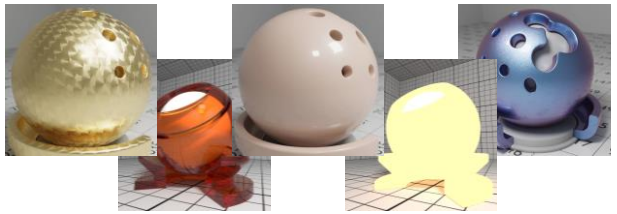
```
mpirun -n <N> ./ospExamples --osp:load-modules=mpi --osp:device=mpiOffload
```

- MPI Distributed Rendering
  - Image parallel or data parallel rendering
  - Application must load MPI module and create *mpiDistributed* device
  - Special *mpiRaycast* renderer must be used
  - Separate world for each node

OSPRay features summary

Combined geometry and volume rendering

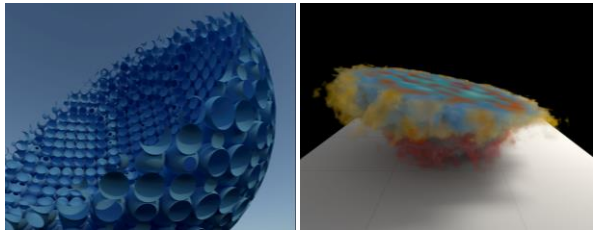




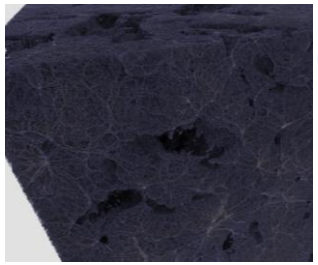
Advanced materials

SciVis renderer and path tracer

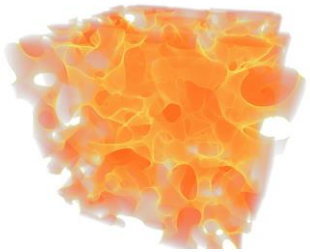
Runs at all scales



Clipping Geometries

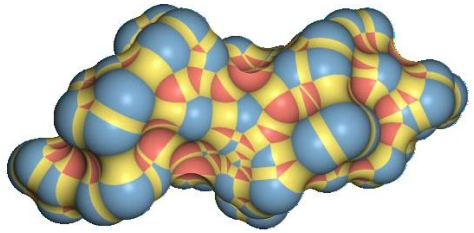


12 billion particles



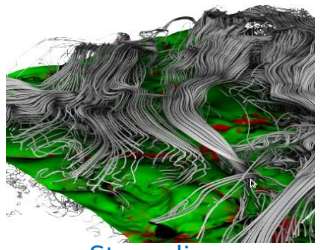
10TB

Huge datasets



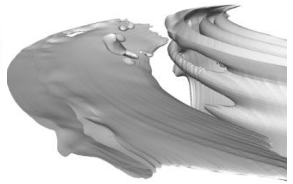
Extensible

e.g. SES Geometry, UStuttgart



Streamlines

Particles / spheres



Implicit isosurfaces

Non-polygonal Geometry

Where to learn more?

- Intel oneAPI Rendering Toolkit:
  https://software.intel.com/content/www/us/en/develop/tools/oneapi/rendering-toolkit.html
- Intel OSPRay website:
  https://www.ospray.org
- Intel OSPRay source code:
  https://github.com/ospray/ospray

Q&A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