**Introduction**

- Open-source rendering solutions that are capable of utilizing a large number of computational resources are rare.
- Usually made for render farms but not directly for High Performance Computing (HPC) clusters.
- One of such solutions is Flamenco [1] that is a render manager based on Blender 3D creation suite [2]. It supports offline rendering only.
- We are currently developing a rendering-as-a-service platform that efficiently utilizes HPC resources in the supercomputing centres.
- HPC cluster can be equipped with classical CPU nodes or accelerated nodes or their combination.
- We decided to build our solution on Blender since it gathers on popularity and offers realistic renderers and variety of extension possibilities in terms of plug-ins.

**Our approach**

- Our platform is based on Blender renderers and upgrades them with HPC technologies such as:
  - MPI for distributed rendering.
  - OpenMP for parallelization for multi-core CPUs.
  - Support for modern architectures such as Intel Xeon Phi in form of accelerator or stand-alone processor which include extended support for wide SIMD units (up to 512 bits).
  - Integration of EMBREE library [3] into Blender Cycles, the physically based production renderer.
  - Integration of OpenSWR library into Blender Eevee, the physically based rendering engine for real-time visualization.
- In this way we can offer not only standard offline but also interactive rendering mode which relies on fast HPC interconnecting networks.

**Offline & Interactive Rendering Scalability**

- Scalability performance in offline rendering mode using Cycles renderer [4]:
  - Scene duplicated on all nodes.
  - Support for load balancing.
  - OMP24 stands for 2 x Haswell and Symmetric for 2 x Haswell + 2 x KNC.

**Architecture performance**

- Performance evaluation in terms of rendering time in Cycles renderer offline mode for different processor architectures.
- General Blender Cycles benchmark scenes have been used.
- Evaluated architectures:
  - NVIDIA GeForce GTX TITAN X.
  - Intel Xeon Phi 7120P (KNC).
  - Intel Xeon E5-2680v3 (Haswell).
  - Intel Xeon Phi 7250 (KNL).
  - Intel Xeon 8160 (SKL).
- The results show promising performance on:
  - new Intel Xeon Phi 7250 (68 CPU cores) with 512 bit wide SIMD units.
  - Intel Xeon 8160 (24 CPU cores) architectures with 512 bit wide SIMD units.
- Parallel efficiency in our implementation has been reached.

**Rendering examples**

- (a) Medical imaging
- (b) Engineering
- (c) Animation (Agent327 by Blender Institute)

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**References**