SOCL

OpenCL Frontend for StarPU

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StarPU

How to use the StarPU runtime system:

1. Low-level API

```
starpu_data_handle_t vector_handle;

starpu_vector_data_register(&vector_handle, 0, (uintptr_t)vector, NX,
    sizeof(vector[0]));

struct starpu_task *task = starpu_task_create();
task->synchronous = 1;
task->cl = &cl;
task->handles[0] = vector_handle;
task->cl_arg = &factor;
task->cl_arg_size = sizeof(factor);

starpu_task_submit(task);

starpu_data_unregister(vector_handle);
```

StarPU

How to use the StarPU runtime system:

1. Low-level API
2. Insert Task

```
starpu_insert_task(&mandelbrot_cl,
      STARPU_VALUE, &iby, sizeof(iby),
      STARPU_VALUE, &block_size, sizeof(block_size),
      STARPU_VALUE, &stepX, sizeof(stepX),
      STARPU_VALUE, &stepY, sizeof(stepY),
      STARPU_W, block_handles[iby],
      STARPU_VALUE, &pcnt, sizeof(int *),
      0);
```

StarPU

How to use the StarPU runtime system:

1. Low-level API
2. Insert Task
3. GCC Plugin

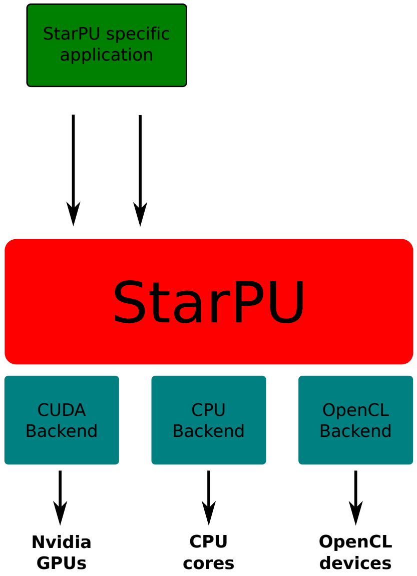
```
static void matmul (const float *A, const float *B, float *C, size_t nx, size_t
      ny, size_t nz)
  __attribute__ ((task));

static void matmul_cpu (const float *A, const float *B, float *C, size_t nx,
      size_t ny, size_t nz)
  __attribute__ ((task_implementation ("cpu", matmul)));

#pragma starpu register &A[i*zdim*bydim + j*bzdim*bydim] (bzdim * bydim)
#pragma starpu register &B[i*xdim*bzdim + j*bxdim*bzdim] (bxdim * bzdim)
#pragma starpu register &C[i*xdim*bydim + j*bxdim*bydim] (bxdim * bydim)

matmul (&A[i * zdim * bydim + k * bzdim * bydim],
      &B[k * xdim * bzdim + j * bxdim * bzdim],
      &C[i * xdim * bydim + j * bxdim * bydim], bxdim,
      bydim, bzdim);

#pragma starpu wait
```

StarPU

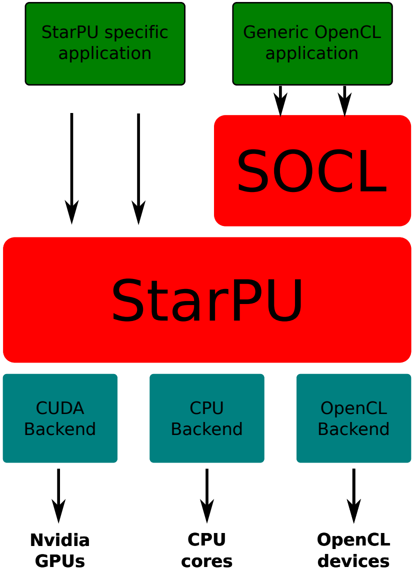
How to use the StarPU runtime system:

1. Low-level API
2. Insert Task
3. GCC Plugin
4. **OpenCL API**

Layers


StarPU specific application
StarPU
CUDA Backend
CPU Backend
OpenCL Backend
Nvidia GPUs
CPU cores
OpenCL devices

Layers


StarPU specific application
Generic OpenCL application
SOCL
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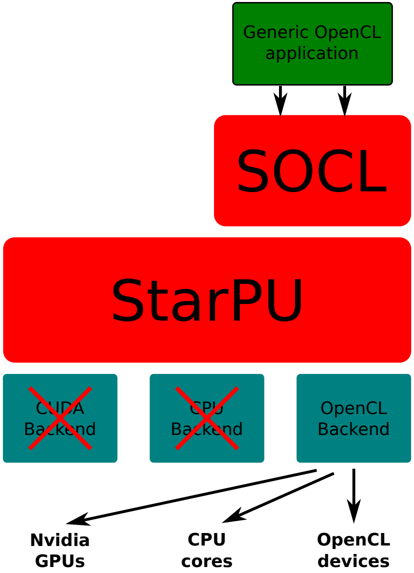
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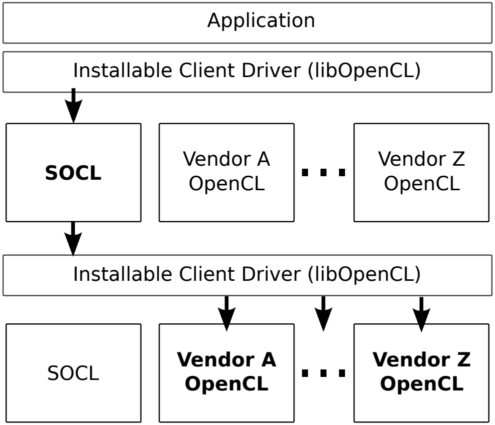
Installable Client Driver



SOCL Platform

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  - Automatic transfers between devices handled by StarPU

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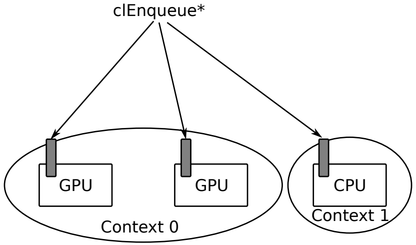
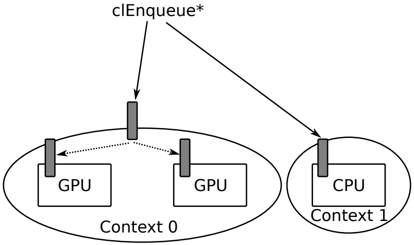
- SOCL Platform exposes devices of every other platforms
  - GPUs, CPUs, accelerators...
- Synchronizations (events...) can be used between all devices
- Buffers can be shared by all devices
  - Automatic transfers between devices handled by StarPU
- Static scheduling (à-la OpenCL) can be used as described in the specification
  - One command queue per device

Scheduling Contexts



Scheduling Contexts



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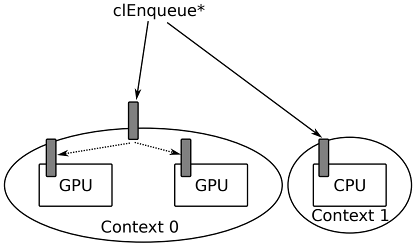
Scheduling Contexts



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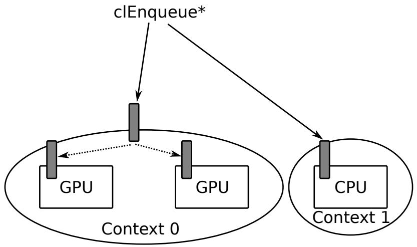
Scheduling Contexts

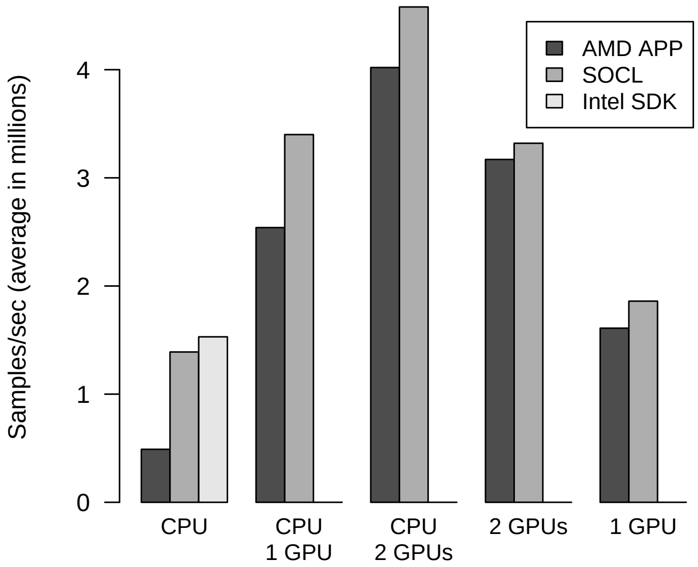


- Command queues can now be associated to contexts
- Automatic scheduling for commands submitted in these queues!
- Scheduler can be chosen for each context

Scheduling Contexts

```
cl_context_properties gpu_properties[] = {
   CL_CONTEXT_PLATFORM, (cl_context_properties)platforms[platform_idx],
   CL_CONTEXT_SCHEDULER_SOCL, "heft",
   CL_CONTEXT_NAME_SOCL, "GPUs",
   0
};
gpu_context = clCreateContextFromType(gpu_properties, CL_DEVICE_TYPE_GPU, NULL,
     NULL, &err);
```

LuxRender



Intel Xeon E5-2650 2.00GHz with 32GB, 2 AMD Radeon HD 7900

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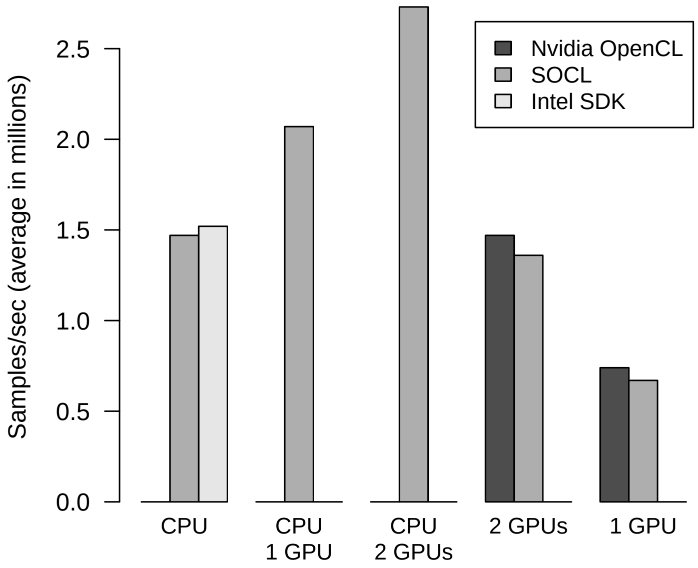

Intel Xeon E5-2650 2.00GHz with 64GB, 2 NVidia Tesla M2075

Thank you