OpenMP 5.1: The Interop Construct

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Prepared by LLNL under Contract DE-AC52-07NA27344
OpenMP 5.1: Interoperability and a new construct

- OpenMP 5.1 introduces the `interop` construct

- The `interop` construct provides:
  - A mechanism to request low-level foreign runtime information from OpenMP runtimes
  - The ability to write portable fully async code that uses both OpenMP and native functionality together
  - A long-term extensible place to add interoperability features to OpenMP

- Concrete uses *in 5.1*
  - `targetsync`: Access a synchronization object from the foreign runtime, connect the OpenMP task graph and the foreign runtime task graph
  - `target`: Get native foreign runtime handles to resources associated with a device (context, platform, device information)
async_openmp_work(arr);

omp_interop_t o = 0; intptr_t type;

#pragma omp interop init(targetsync: o) depend(inout: arr)

auto type = omp_get_interop_property_int(o, omp_ipr_fr_id);

if (type == omp_ifr_cuda) {
    cudaStream_t s = omp_get_interop_property_ptr(o, omp_ipr_targetsync);
    cublasSetStream(s);
    call_cublas_async_stuff(arr);
} else {
    // handle other cases
}

#pragma omp interop destroy(o) depend(inout: arr)
### Available properties

<table>
<thead>
<tr>
<th>Available in interop-type</th>
<th>property</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreign runtime id</td>
<td>all</td>
</tr>
<tr>
<td>Foreign runtime name</td>
<td>all</td>
</tr>
<tr>
<td>Vendor id</td>
<td>all</td>
</tr>
<tr>
<td>Vendor name</td>
<td>all</td>
</tr>
<tr>
<td>Device number</td>
<td>all</td>
</tr>
<tr>
<td>Platform</td>
<td>target</td>
</tr>
<tr>
<td>Device</td>
<td>target</td>
</tr>
<tr>
<td>Device context</td>
<td>target</td>
</tr>
<tr>
<td>Targetsync object</td>
<td>targetsync</td>
</tr>
</tbody>
</table>
void foo(double *a) {
    #pragma omp target teams distribute parallel for nowait depend(inout:a[0])
    process_a_1();
    omp_interop_t o = 0;
    #pragma omp interop init(targetsync: o) depend(inout: arr) nowait

    process_a_with_sycl_without_blocking(a, my_get_queue(o));

    #pragma omp interop destroy(o) depend(inout: arr) nowait

    #pragma omp target teams distribute parallel for nowait depend(inout:a[0])
    process_a_3();
}

Fully asynchronous dependencies
Interop going forward

- Additional interop types in consideration:
  - Thread: access the underlying thread information, say a posix_thread_t or std::thread
  - Lock: directly access underlying lock implementations

- Other possible properties
  - Memory handle types for systems that don’t directly use pointers
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