OpenMP, OpenACC & Offloading BoF

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Topics

- **OpenMP**
  - OpenMP 4.5 (2015-11,368p); supported since GCC 6, Fortran only partially
  - OpenMP 5.0 (2018-11,666p); OpenMP 5.1 upcoming: TR8 (’19), TR9 (’20)
  - Partially supported since GCC 9

- **OpenACC**
  - OpenACC 2.6 (2017-11,129p), supported since GCC 10;
    OpenACC 2.7 (’18), 3.0 (’19), 3.1 (’20?)
Topics

- Offloading
  - NVPTX (since GCC 6), AMD GCN (since GCC 9/10)
  - Xeon Phi (since GCC 5), HSA/LL (GCC 6 to 10)
- Related Topics
  - Other offloading, other concurrency (C++’s, Fortran’s, Ada, ...)
OpenMP – Missing features

- Mapping changes (C++ this, Fortran allocatable components, array shaping), declare mapper
- Allocator clause/directive, unified shared address/memory
- Allocators high bandwidth memory support using memkind
- Ancestor modifier on device clause, reverse offloading
- Support for non-perfectly nested loops
- Metadirectives
- Declare variant (partially supported)
- OMPT + OMPD
OpenMP – Missing features

- Detach clause, omp_fulfill_event
- Lvalue expressions in map/to/from clauses
- The omp_get_device_num API
- OMP_TARGET_OFFLOAD env var
- Figure out NUMA topology and handle host teams accordingly
Offloading Performance

- OpenACC: “kernels”
  - Autoparallelization issues

- Optimizations:
  - Value propagation into offloading function
  - Avoid copying-out of values if not modified
  - Avoid copying-in if not changed
  - Early optimizations → avoid entries in offload table
    vs. late (IPA, LTO) → cannot modify offload table (not using, pass NULL?)
  - Alias analysis
Offloading Targets

- **General**
  - Support more than one ISA; esp. GCN has incompatible -march=
  - Other software distribution changes?

- **nvptx**
  - Currently only sm_30 + sm_35 (current: sm_80 of CUDA 11)

- **GCN**
  - Currently, fiji, gfx900, gfx906
  - Debugging support