GCC Update

OpenACC Summit 2021
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OpenACC Summit 2021

Pre-recorded, because… any day now…
GCC/OpenACC

GCC Branches

- GCC 11: current stable release series
  - OpenACC 2.6 support
  - Code offloading to AMD (GCN) and Nvidia (nvptx) GPUs
- og11 development branch (public)
  - GCC 11 release branch plus new features:
    - Backlog inherited from og10 branch
    - Ongoing development
  - Provides early access to GCC 12+ features
- GCC 12: next major release due spring 2022
  - Ongoing development
GCC/OpenACC
Last Year: Development Focus

- OpenACC 'kernels' work
- Compiler "magic":
  - Array access delinearization
  - Scalar data privatization
  - Analyze 'loop' constructs with 'auto' clause, decide 'seq' vs. 'independent'
- See talk at LPC¹, GNU Tools Track: OpenACC "kernels" improvements
  - <https://linuxplumbersconf.org/event/11/contributions/998/> (Frederik Harwath)
- Work done on separate development branch; currently integrating into og11 branch
- Upstreaming (and revision) of existing og10 development branch work into GCC mainline

¹ Linux Plumbers Conference 2021, <https://linuxplumbersconf.org/>, virtual, week of 2021-09-20
GCC/OpenACC
Last Year: Upstreaming

Integrated into GCC mainline (for GCC 12):

- Decompose OpenACC 'kernels' constructs into parts, a sequence of compute constructs
- OpenACC worker parallelism for AMD GPUs
  - Execution state changes (neutering/broadcasting) as a GCC middle end transformation
  - Different approach from nvptx where it all happens in the back end
- Interactive debugging (GDB; ROCGDB) for GCN offloading
  - See demo at LPC¹, GNU Tools Track: Debugging offloaded kernels on AMD GPUs
    - <https://linuxplumbersconf.org/event/11/contributions/997/> (Andrew Stubbs)
  - See also at LPC¹, GNU Tools Track: DWARF extensions for optimized SIMT/SIMD (GPU) debugging
    - <https://linuxplumbersconf.org/event/11/contributions/1012/> (AMD: Tony Tye, Zoran Zaric)
GCC/OpenACC
Last Year: Upstreaming, continued

Integrated into GCC mainline (for GCC 12), continued:

- Bug fixing (such as OpenACC specification adherence), for example:
  - Data privatization/sharing at the gang level: use GCN LDS, nvptx '.shared' memory
  - OpenACC/Fortran: strided array sections and components of derived-type arrays
  - OpenACC ‘async’ correctness
  - Keep up with breaking changes of LLVM/HSA (GCN), PTX/CUDA (nvptx)
  - The usual miscellanea
- Optimizations: middle end as well as GCN, nvptx back ends
- Diagnostics: '-Wopenacc-parallelism' to diagnose potentially suboptimal choices of OpenACC parallelism
GCC/OpenACC

Next Steps

- Further revision of existing og11 branch changes for integration into GCC mainline
  - Still for GCC 12 until cut-off date (winter)
- Same for current OpenACC 'kernels' work
- OpenACC 2.7 features (not yet scheduled)
- Other items as prioritized by customers
- … and: continue working with OpenACC Technical Committee

Thanks!

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