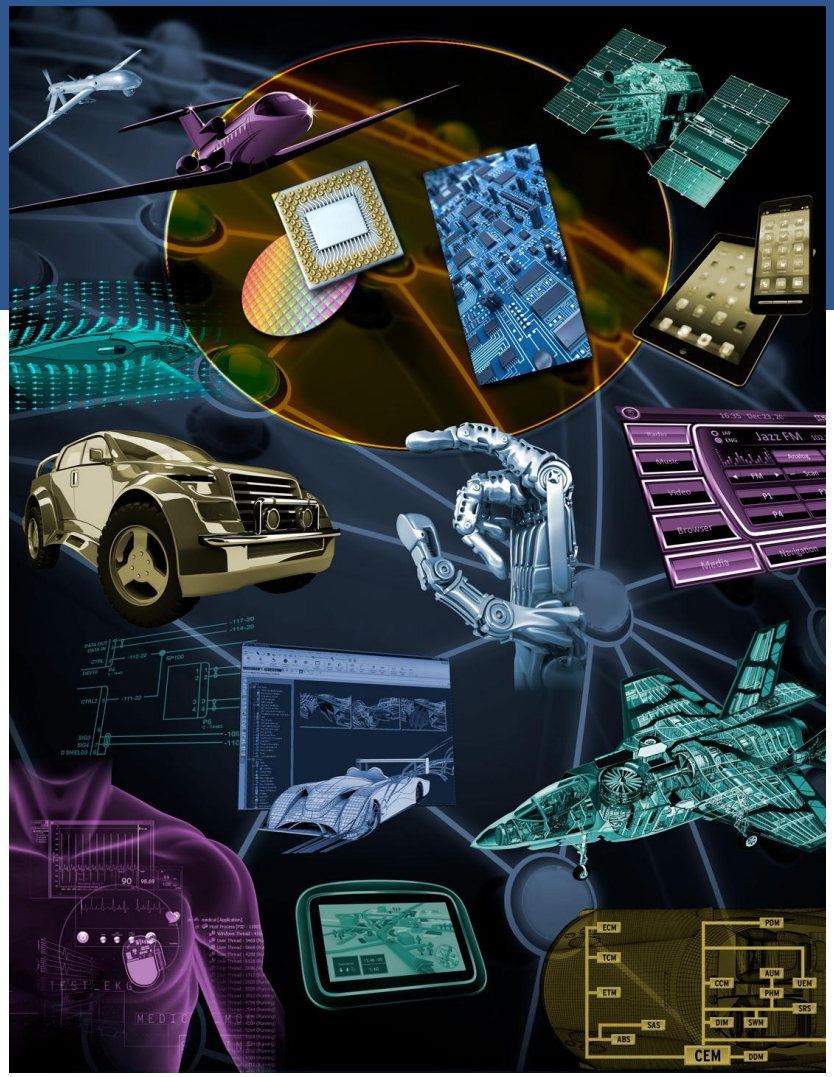

AMD GCN Update

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Mentor®
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What is AMD GCN?

- "Graphics Core Next" GPU architecture
- Used by all recent AMD Radeon GPUs
- Planned for use in ORNL's "Frontier" exascale supercomputer

- 64 (or 60) hardware compute units
  - Each with
    - 3200x 32-bit scalar registers
    - 1024x 2048-bit 64-lane vector registers (i.e. 32-bits per lane)
    - 64 kB low-latency RAM
    - Up to 40 threads (2560 vector "work items")
      - more threads means fewer registers per thread.

Project Status

- GCC 9: Basic ISA support
  - C/Fortran
  - Single-threaded
- GCC 10: Offloading
  - C/C++/Fortran
  - OpenMP & OpenACC offload
  - 3 GCN devices
    - gfx803 Fiji (GCN3)
    - gfx900 Vega 10 (GCN5)
    - gfx906 Vega 20 (GCN5)

Image Source: https://www.amd.com/en/graphics/workstations-radeon-pro-vega-frontier-edition

Project Status

- GCC 10:
  - GCN fully supports all GCC's OpenMP features
  - GCN mostly supports GCC's OpenACC features
    - Limited to 1 worker per gang, 2 gangs per CU
- Development branch: devel/omp/gcc-10 ("OG10")
  - Up to 16 workers per gang
  - Up to 40 gangs per CU
    - (not exceeding hardware limit of 40 workers total)
  - OpenACC improvements
    - Bug fixes, non-contiguous array.
    - Performance, profiling, etc.
- GCC 11:
  - Incremental merge from the development branch in progress
    - Limited by patch review bandwidth

Current Development: Debug

- AMD Radeon Open Compute (ROC) GDB project in progress
  - Primarily developed for the use of the AMD HIP compiler (LLVM)
  - Heterogenous GDB support implemented
    - Context aware architecture settings
      - Disassembler, register display, target control adjusted automatically
    - GPU threads presented via “info threads”
  - ROC GDB 3.5 supports basic debug info
    - Future releases will support CFI
  - New DWARF extensions have been proposed
  - Not upstream yet
- Mentor working on GCC debug info support
  - Initial support already upstream (Git master & OG10)
  - CFI support almost ready

Try It Yourself

- Prerequisites:
  - x86_64 system with a supported GPU
  - Ubuntu/SLES/CentOS/RHEL
- Install ROCm drivers, tools and libraries
  - https://rocmdocs.amd.com
- Download the binary toolchain from Mentor
  - https://go.mentor.com/cblite
  - Current release (May 2020) is GCC 9, plus all the development patches
  - Next release (November 2020) will be GCC 10, plus development patches
- Or, build it yourself
  - https://gcc.gnu.org/wiki/Offloading

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