

AMD GCN GPU Port Update

Thomas Schwinge
(standing in for Andrew Stubbs)
CodeSourcery

Friday 13th September, 2019

AMD GCN Overview

- GPU comprises ~60 Compute Units (CUs)
 - Each runs up to 40 “wavefronts” (hardware-managed threads)
 - Each wavefront has the same entry point, but may diverge arbitrarily
 - Maximum number of wavefronts limited by the resources used
 - ❑ 40 wavefronts with 64 scalar registers, and 24 vector registers, each
 - ❑ or, 32 wavefronts with 84 scalars, and 32 vectors
 - ❑ or, 20 wavefronts with 102 scalars, and 48 vectors
 - ❑ or, 16 wavefronts with 102 scalars, and 64 vectors (*current implementation*)
 - ❑ or, 4 wavefronts with 102 scalars, and 256 vectors
- SIMD vectors have 2048 bits divided into 64 32-bit lanes
 - Fixed lane-count (fully maskable)
 - Two registers can be combined to make a 4096-bit, 64-lane, 64-bit vector
 - 8/16-bit vectors not well supported

GCC Port Status

- The GCN *backend* is present in GCC 9 (& mainline)
 - Committed January 2019
 - Support for single thread only
 - Enough to run the testsuite
 - Supports GFX803 “Fiji” and GFX900 “Vega 10”
 - Mainline also supports GFX903 “Vega 20” devices.
- OpenMP and OpenACC support on “openacc-gcc-9-branch” (OG9)
 - Branch already in use for NVidia development
 - Offload toolchain development is now unified!
 - GCN patches committed August 2019
 - Support for 16 wavefronts per CU
 - OpenMP 4.5
 - OpenACC 2.6 (many upgrades over base GCC 9)

Next Steps

- Performance improvements
 - Enable up to 40 wavefronts per CU (requires ABI and NUMA changes)
 - Review OpenMP library overheads

- Bug fixes

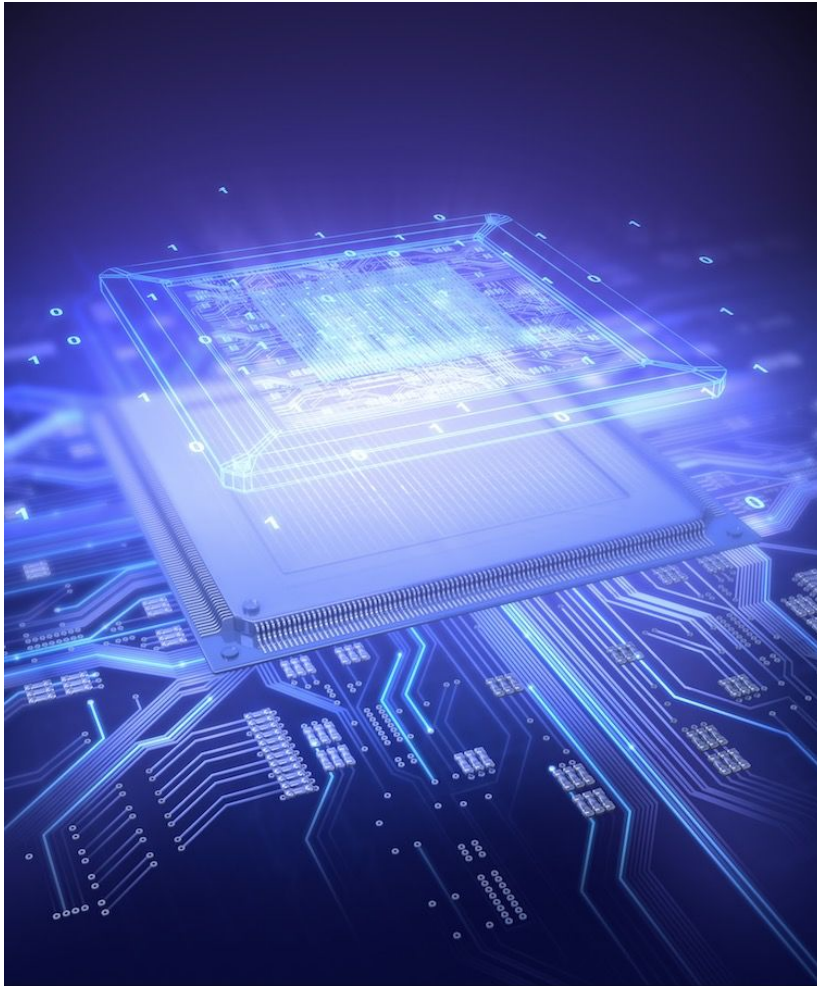
- Sourcery CodeBench 2019.11
 - Binary release, available for free download in November
 - <https://go.mentor.com/cblite>

Upstreaming

- Not too soon ...
 - GCN team concentrating on the public release, right now
 - Return to upstreaming in November/December
 - The GCN OpenACC patches have many dependencies on OG9 patches
 - NVidia team merging OG9, slowly
 - OpenMP has fewer dependencies, so may land sooner

- Forecast: maybe GCC 10, probably GCC 11

Summary



- **GCC 9: Basic support**
- **OG9: Full offload support**
- **GCC 10/11: Official support**

- **Binary CodeBench releases:**
 - <https://go.mentor.com/cblite>

Mentor[®]
A Siemens Business

www.mentor.com