

GCC BPF status and discussion

Jose E. Marchesi

Toolchains MC / LPC 2025

Follow-up on GNU Tools Cauldron 2025

New goal: become the primary BPF compiler

- BPF declaration and type tags in GCC
 - By David Faust.
 - Support is now upstream.
- Verifiable code testsuite in GCC
 - By Piyush Raj, GSOC 2025
 - Still to be installed.
 - Will be in GCC 16.
- `-fverifiable`
- `smtgcc` ported to BPF, <https://github.com/kristerw/smtgcc>
 - It found several bugs in the GCC BPF backend.
- Improve the CO-RE built-ins
 - Suggestions by Andrew Pinski
- Generalized CO-RE

What are we up to

Assembler

[PR 32176] support `may_goto`

Compiler

[PR bpf/121419] GCC emits libcalls to `__clzdi2` in `udev-hid-bpf`
[PR bpf/113453] `line_info` is missing in `.BTF.ext`
[PR bpf/116717] fix built-in functions for memory model aware atomic operations
[PR bpf/116718] support `bpf_fastcall` attribute
[PR bpf/117068] add support for `preserve_static_offset` attribute
[PR bpf/120241] `preserve_access_index` in "nested" struct types

Verification issues

[PR bpf/114523] GCC optimization `ssa-phiopt` generates unverifiable code

Kernel selftests

[PR bpf/123021] GCC emits `set-but-unused` warning building `progs/free_timer.c`
[PR bpf/xxxxxx] invalid labels generated for `iters_looping.bpf.c`
[PR bpf/xxxxxx] again problems with overflown immediates in `pyperf` tests
[PR bpf/xxxxxx] `verifier_gotxx: .size` expression does not evaluate to a constant
[PR bpf/xxxxxx] ELF `relo #0` in section #2 points to missing symbol #4

Elfutils

[PR 30628] update BPF relocations in `elfutils`
[PR 30629] update BPF disassembler in `elfutils`

Support and usage

Distros

- Oracle Linux
- Gentoo and derivatives
- Debian/Ubuntu
- Fedora, RHEL and derivatives

Programs

- udev-hid-bpf
- bpftune
- systemd
- dtrace

A few challenges

- Staffing, attention span
- Engagement with the BPF community. Getting better.
- glibc headers still included in BPF selftests, fixed case by case
- Getting rid of clang-specific stuff, like push/pop attributes
- libcalls, internal and external linking
- ABI
- Compiling Rust to BPF, gccrs
- BPF variants want attention, like sBPF (Solana, blockchain)

Any other point to discuss?