vms Software

When 3 Memory Models Aren’t Enough

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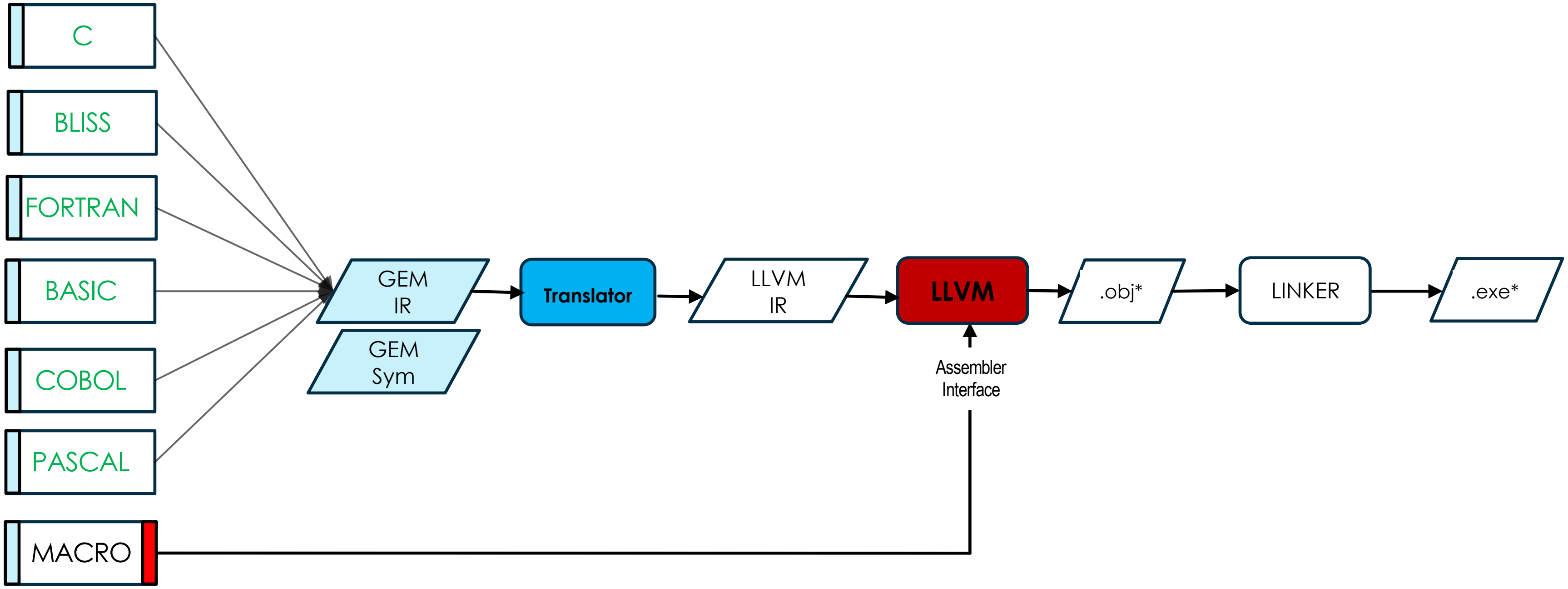
Porting VMS to x86 using LLVM

- Began two years ago
- Host LLVM on OpenVMS Itanium
- Using older 3.4.2 due to Itanium C++
- Convert our backend's IR to LLVM IR
- Reuse existing frontends with almost no change
- Currently booting on VirtualBox & KVM

OpenVMS Cross-compilers



- Continue with current GEM-based frontends
- Use open source LLVM for backend code generation
- *Create internal representation (IR) translator*

Calling Standard & Memory Model

- Based on the AMD ABI
- Add OpenVMS changes
  - Arg count on every routine
    - Added new intrinsic and function attribute
    - Passed via AH
  - Exception handling / unwind information
    - Asynch unwind directives for prologue/epilogue
    - Others are doing current work and we'll piggyback
  - ELF section vendor-specific flags
  - OpenVMS memory model

OpenVMS Memory Model

- Lots of legacy 32-bit VAX interfaces in OS
- Two sizes of pointers (32 & 64)
- Stack resides in 32-bit address space
- Static data resides in 32-bit address space
- Heap either in 32 or 64 bit address space
- Code in 64-bit address space by default
- But “routine addresses” must be 32-bit

OpenVMS Memory Model

- PIC only
- Since code may be very far from any static data, all data lots must be through the GOT. No PC-relative offsets allowed including literal pool.
- Since routines in other sections may be very far way, all routine calls must be through the GOT
- To achieve 32-bit routine values, the linker creates trampoline routines in 32-bit space

Current status

- Most GEM IR maps easily to LLVM
- G2L 26,000 lines of C++
- Static variable initialization is very different
- Aliasing variables for BLISS is a challenge
- DWARF is partially done, waiting for update to native LLVM
- Continue to use GEM's util routines for command line, listing files, etc
- All LLVM changes total about 500 lines
- No optimizers for cross-compilers
- Work underway to native bootstrap to current LLVM by cross-compiling on Linux and cross-linking on OpenVMS Itanium for eventual execution on OpenVMS x86
- Followed by a VMS-ification of clang to use as our C++ compiler

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