Libfabric OPX Provider

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Introduction

• Who is Cornelis Networks?
  • Omni-Path Architecture (OPA)
  • Third year of talks in this workshop
  • Spun out of Intel

• What is OPX?
  • Labfabric provider for Cornelis and Omni-Path fabrics
  • User-space part of hfi1 device driver/hardware interfaces
  • Started as a clone of the BGQ provider
  • Supports 100Gbps and 400Gbps (upcoming) fabrics

• Who am I?
  • User-space Senior Software Engineer Cornelis Networks
Past Year’s Progress

- Bulk Transfer Tx (offloads Tx PIO interface)
- Additional feature: Auto progress
- Additional feature: AV_TABLE
- Enhanced feature: Tag matching at scale
- DAOS progress (coming in version 2.4)
- Reliability enhancements for HPC apps at scale
- One-sided MPI and OpenSHMEM support
- Observability
- Performance has increased for vast majority of workloads and message sizes
2022 Performance improvement
In Progress

- RDMA - Expected Receive
  - Eliminates Rx bounce buffers and offloads Rx Eager Ring
  - Requires hardware mapping/pinning of HPC application memory pages
  - Extra overhead makes this non-performant for ‘small’ messages
  - Buffer fragmentation adds to headaches
  - HPC app behavior affects performance (re-map buffers vs re-use)

- DAOS support
  - Internode and Intranode durable connection resume support
  - Eventually will need Scalable Endpoints
  - Alternative to IB_verbs for HPC storage

- GPU support
  - GPUs have their own non-standard APIs, need to use these for best performance
  - Testing base support for CUDA, intranode and internode traffic
  - Avoiding vendor lock-in creates more testing and more design requirements

- CN5000 - 400 Gbps adapters, more fabric features for scalability
- Programmer creature comforts: Observability and Debuggability
Message length thresholds

- RZV/SDMA/RDMA
- PIO
- Single packet eager
- Multipacket eager

Message Size

- 0B, 2B, 8B, 32B, 128B, 512B, 2KB, 8KB, 32KB, 128KB, 512KB, 2MB
Upstream First

- Similar points Dennis mentioned for the hfi1 device driver
- User space HPC community easier to work with than Linux Kernel
- Testing before upstream, SO MANY VARIATIONS, CI not 100% coverage
- There’s also test case and debug code that is #ifdef out
- Plan Cornelis software releases around upstream project releases whenever possible
- Official support is still Cornelis Networks software releases of ‘OPXS’ (used to be called IFS)
- Libfabric CI on upstream PRs
Extended testing

- How does a developer know if their changes affected performance?
  - Microbenchmarks don’t tell the whole story
  - Testing at scale, what is ‘big’ in HPC?
- Developers need tooling, emulators, and hardware
  - Hardware counters, processor, PCIe, and hfi1 driver
  - Tools like Intel SDE and vTune
  - Instrumented testing with asserts, debug-builds, and testing code
  - Hard to automate this type of testing
- Amount of extended testing is limited by Developer’s time
**Observability**

- Means that anyone (a dev or a user) can see granular details about how the hardware under their job is configured
- With HPC performance constraints, a re-compile of Libfabric/Opx may be needed for extra logs and counters. Debug builds are prohibitively verbose currently.
- User can enable/configure more logging with #define and re-compile...
- Set ENV FI_LOG_LEVEL=info with any build of Libfabric to see SOME things, especially useful on HPC job startup.
Deboggability

• OPX observability and debug logs COULD sometimes help users debug their own code...but probably not much help

• Users need help/hints about their own bugs like hangs and performance issues

• OPX can provide counters and ‘current status’, like how many unmatched messages are sitting in the match queues

• What information from the provider/fabric do users want to help their own debug?
Thank You

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