

# High-Speed Network Communication with **NETIO**

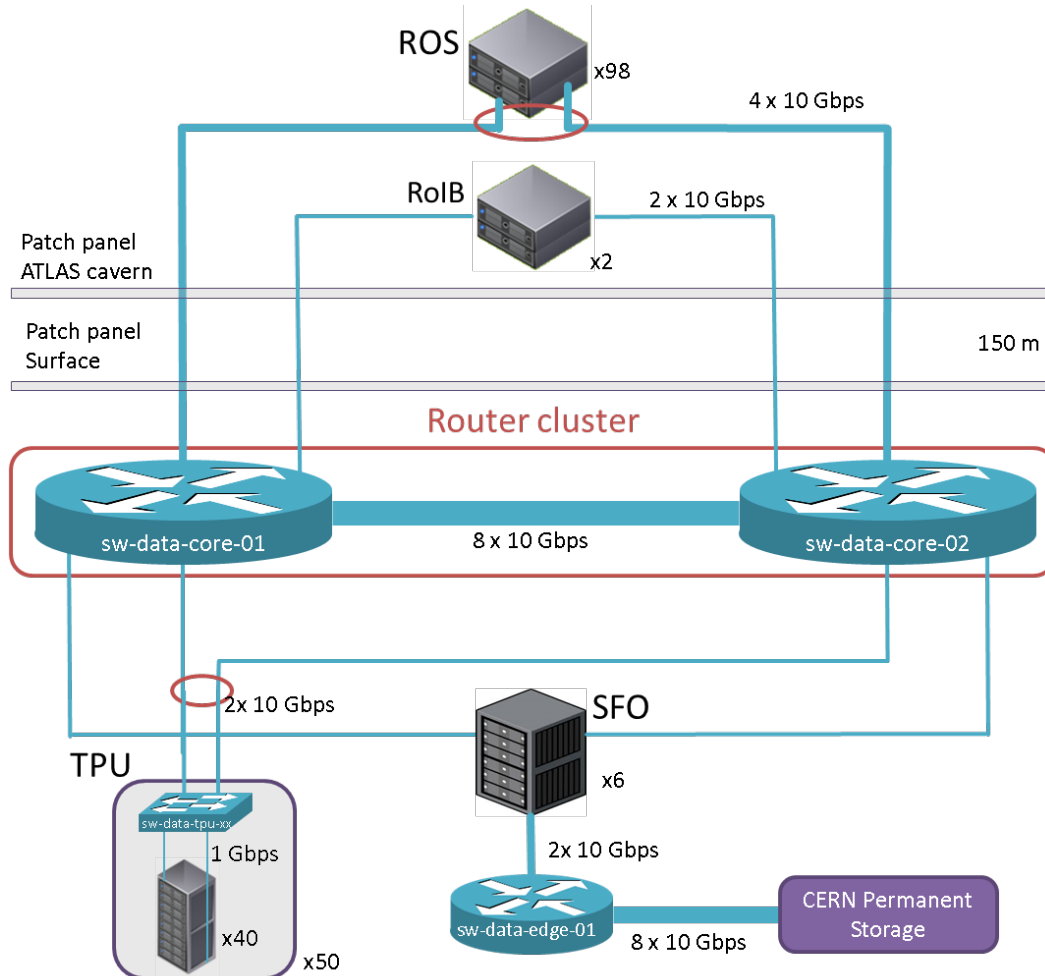
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# DAQ Networks in High-Energy Physics

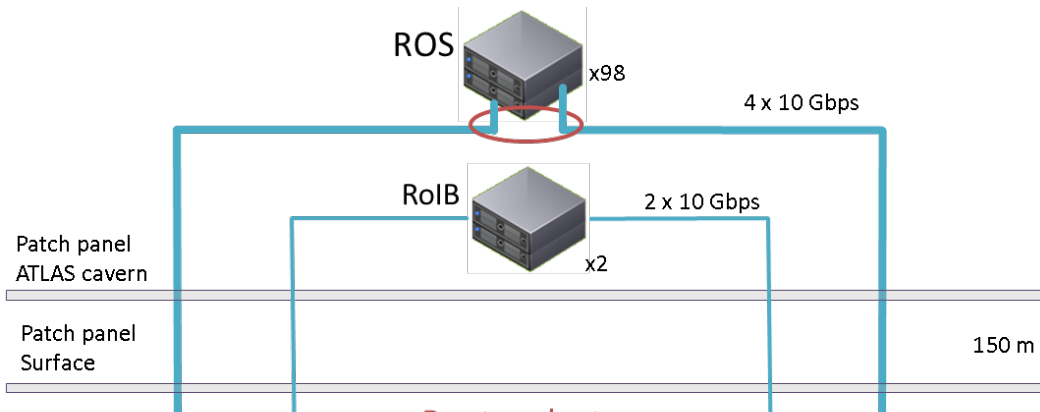


## **ATLAS Data Acquisition:**

- *60 TB* of raw data produced every second
- *1000s* of PCs with more than *40'000* cores
- *10000s* of applications sending and receiving messages
- Core network: 25 GB/s switched in core routers

**Today's DAQ systems rely heavily on high-speed network technology**

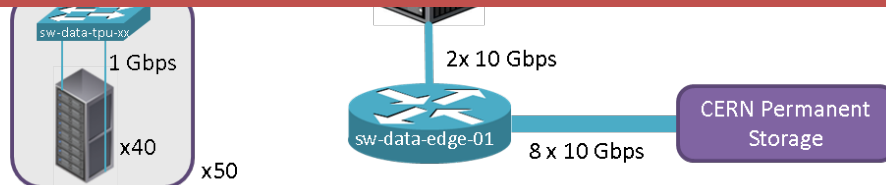
# DAQ Networks in High-Energy Physics



## ***ATLAS Data Acquisition:***

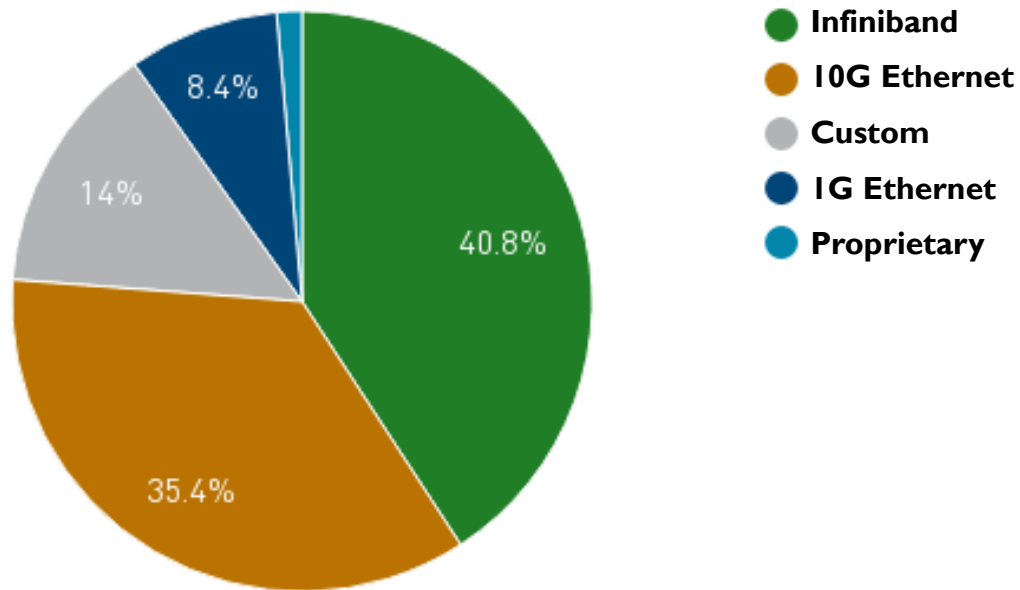
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- 1000s of PCs with more than 40'000 cores
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- Core network: 25 GB/s switched in core

We need fast network technologies to build DAQ systems



# HPC Network Market in 2016

Interconnect Families in Top500 List in July 2016

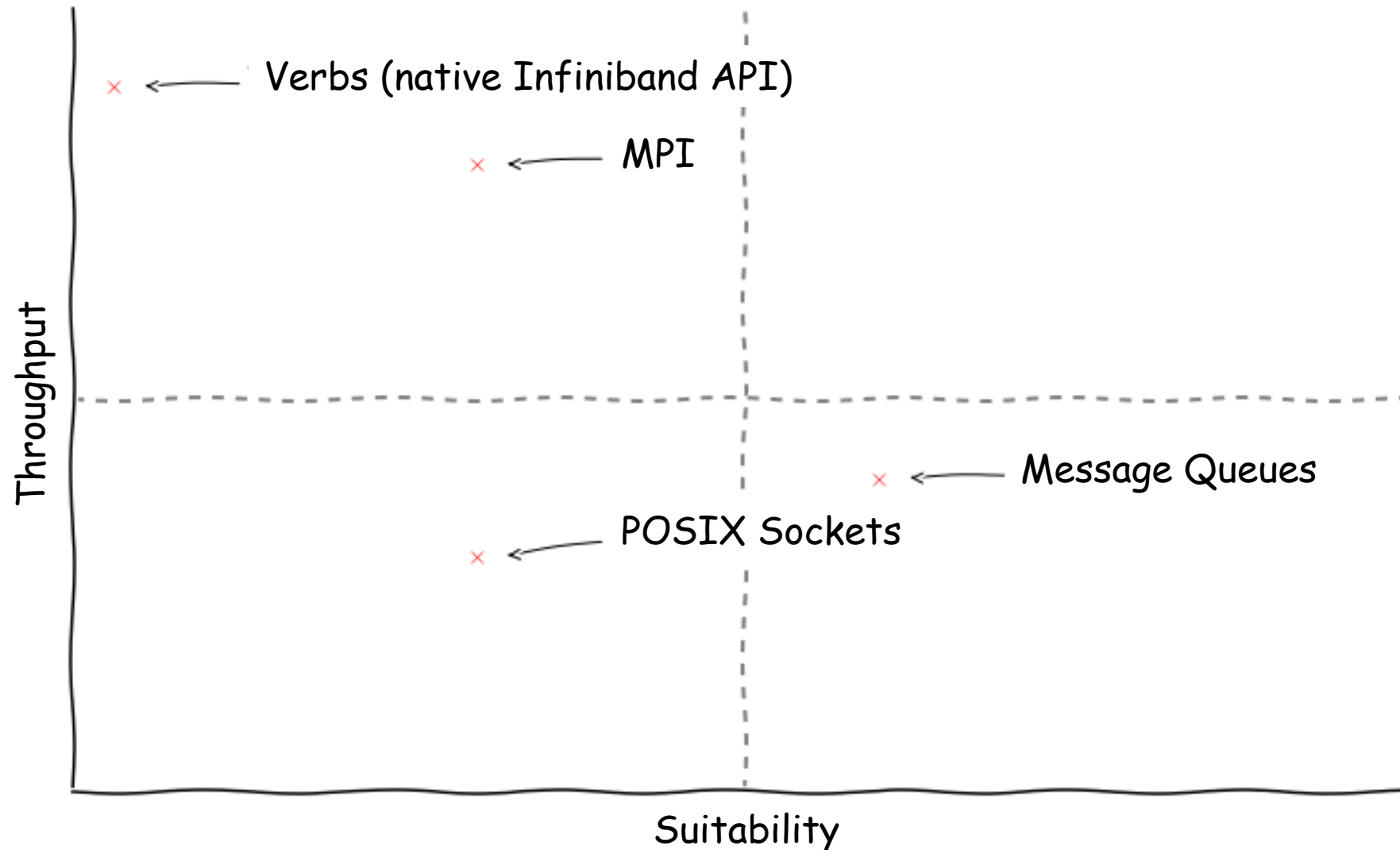


Source: top500.org

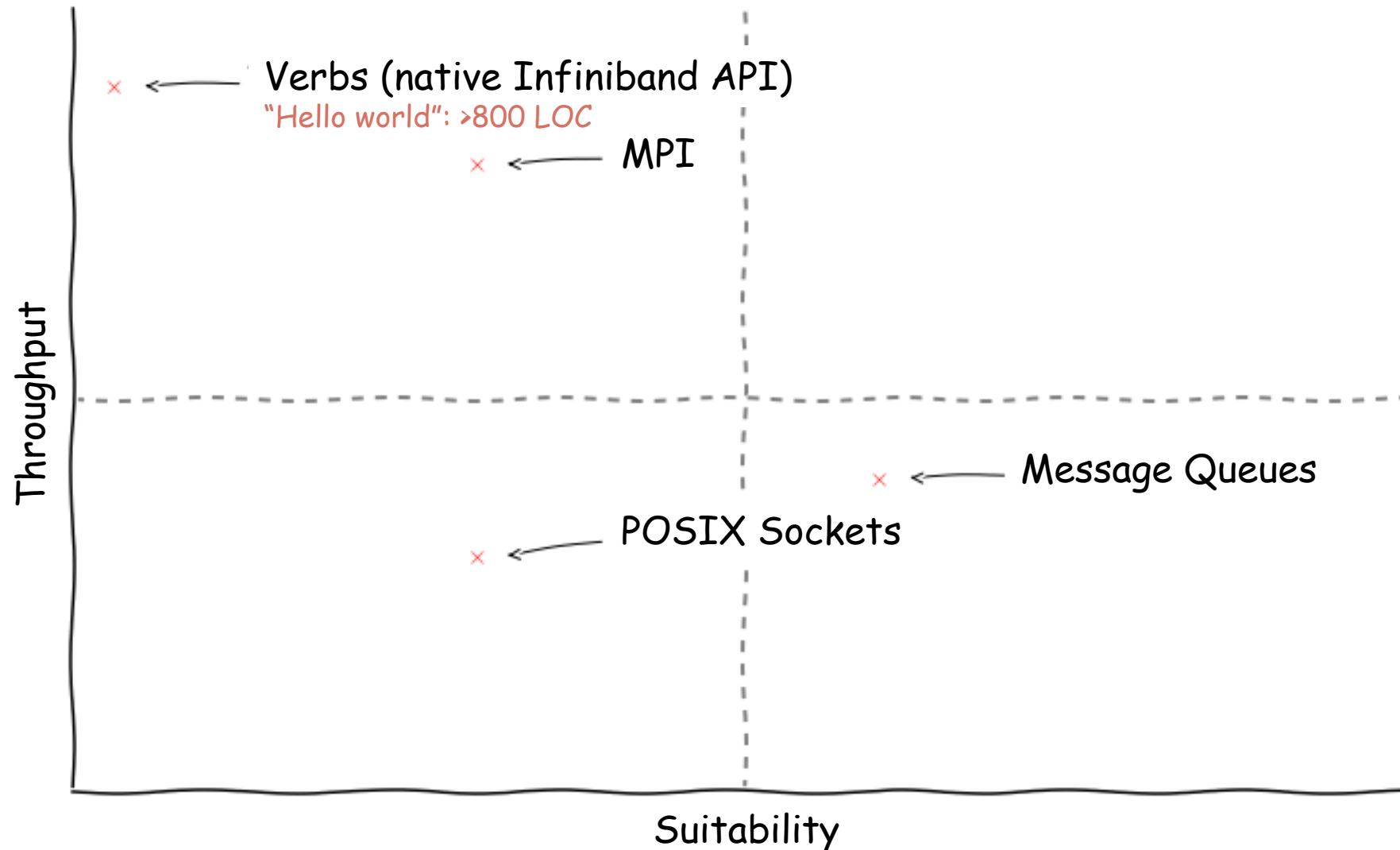
**Ethernet** and **Infiniband** are the two dominating technologies in the HPC market

ATLAS, ALICE, CMS and LHCb all use Ethernet and/or Infiniband in their DAQ systems

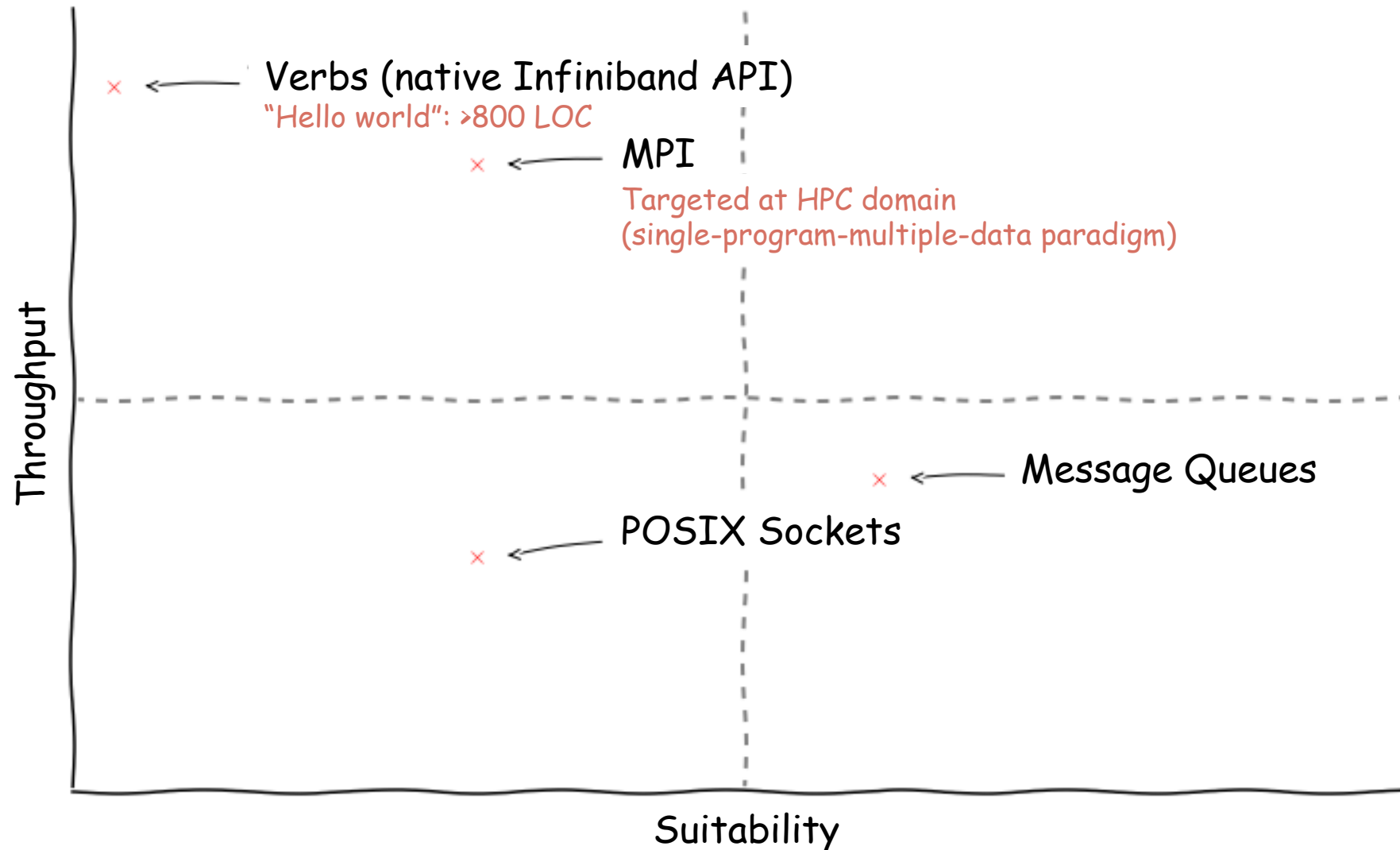
# Programming Models (subjective)



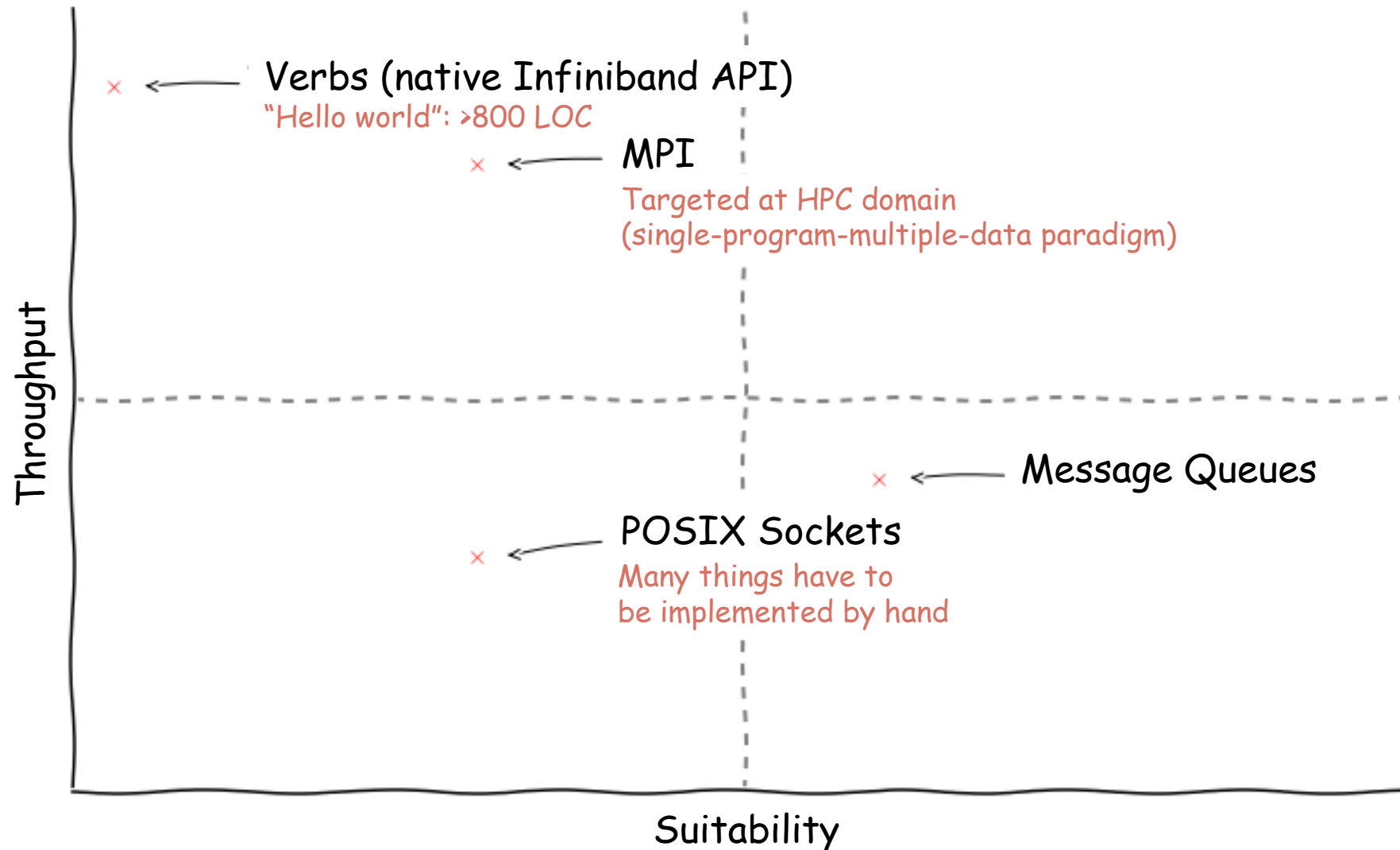
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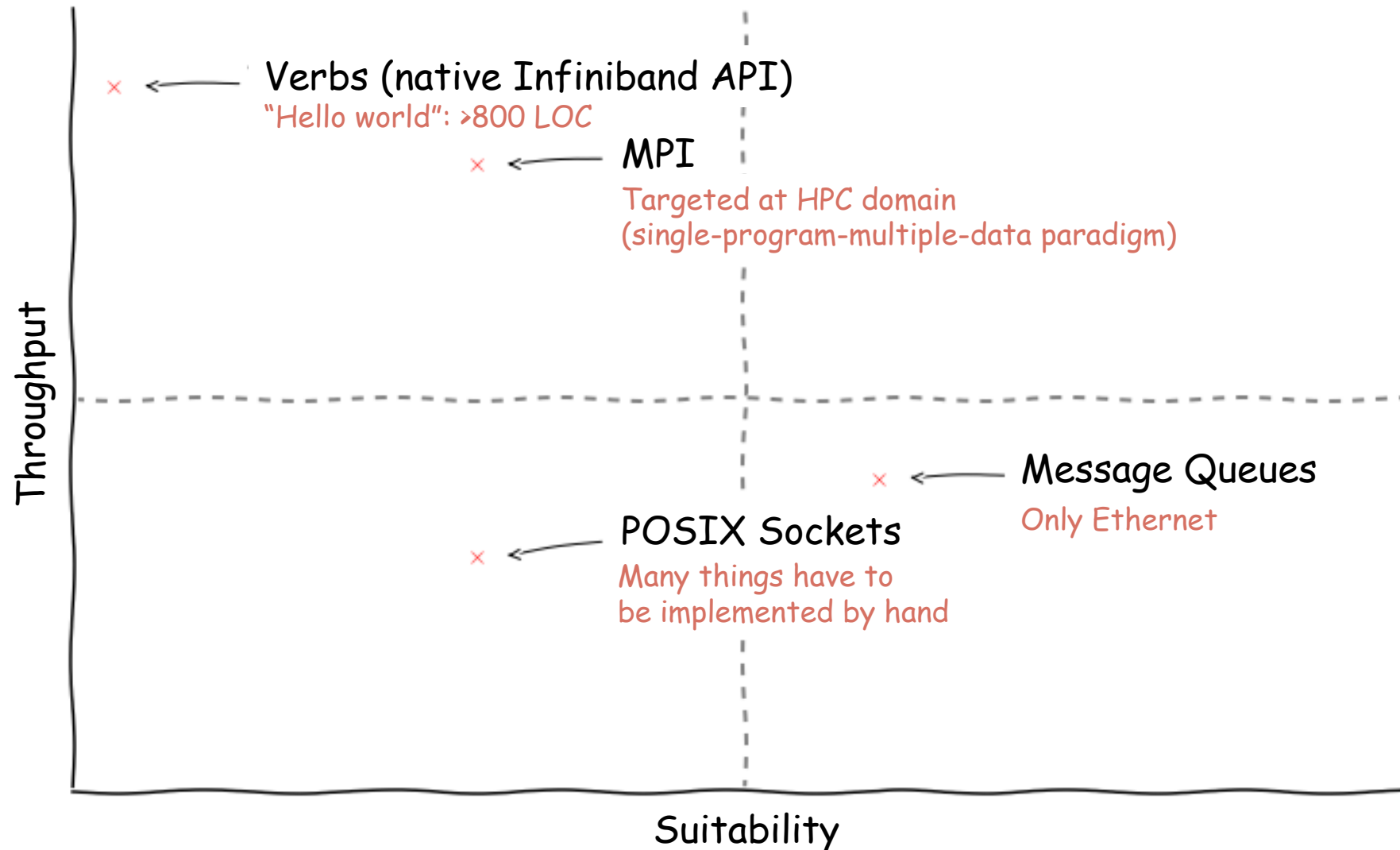


# Programming Models (subjective)





# Programming Models (subjective)



# Wishlist for a Software Network Library

Support different network technologies  
(Ethernet, Infiniband and more) seamlessly

→ Adjust to future technology developments

High performance  
(high throughput, low latency)

→ Tailored for our applications (performance)

Message-based, high-level user interface with  
use-cases for typical DAQ applications

→ Tailored for our applications (programming interface)

# NETIO

**FELIX**

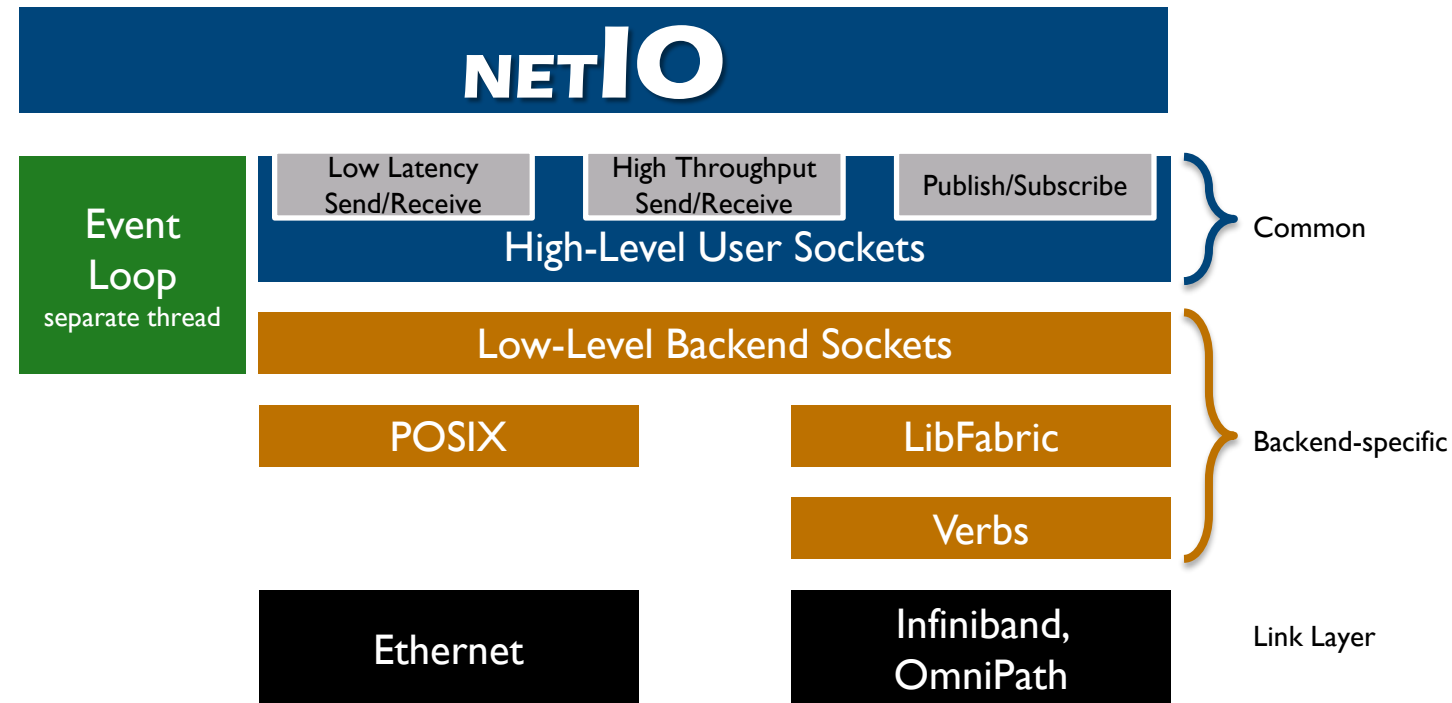


See talk by Soo Ryu on FELIX

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# NetIO: Libfabric Backend

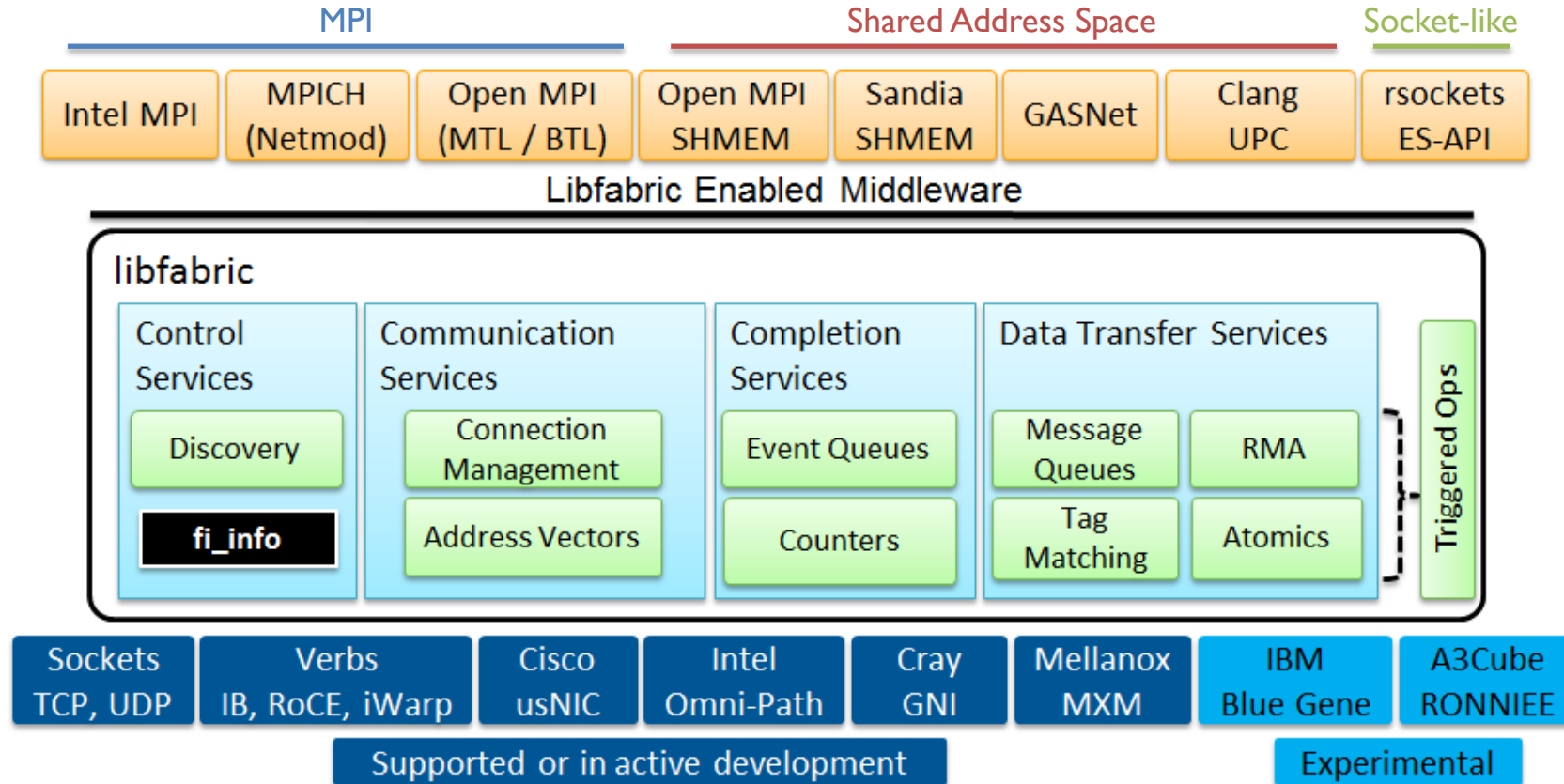


Image source: OFI Working Group



# NetIO: Libfabric Backend

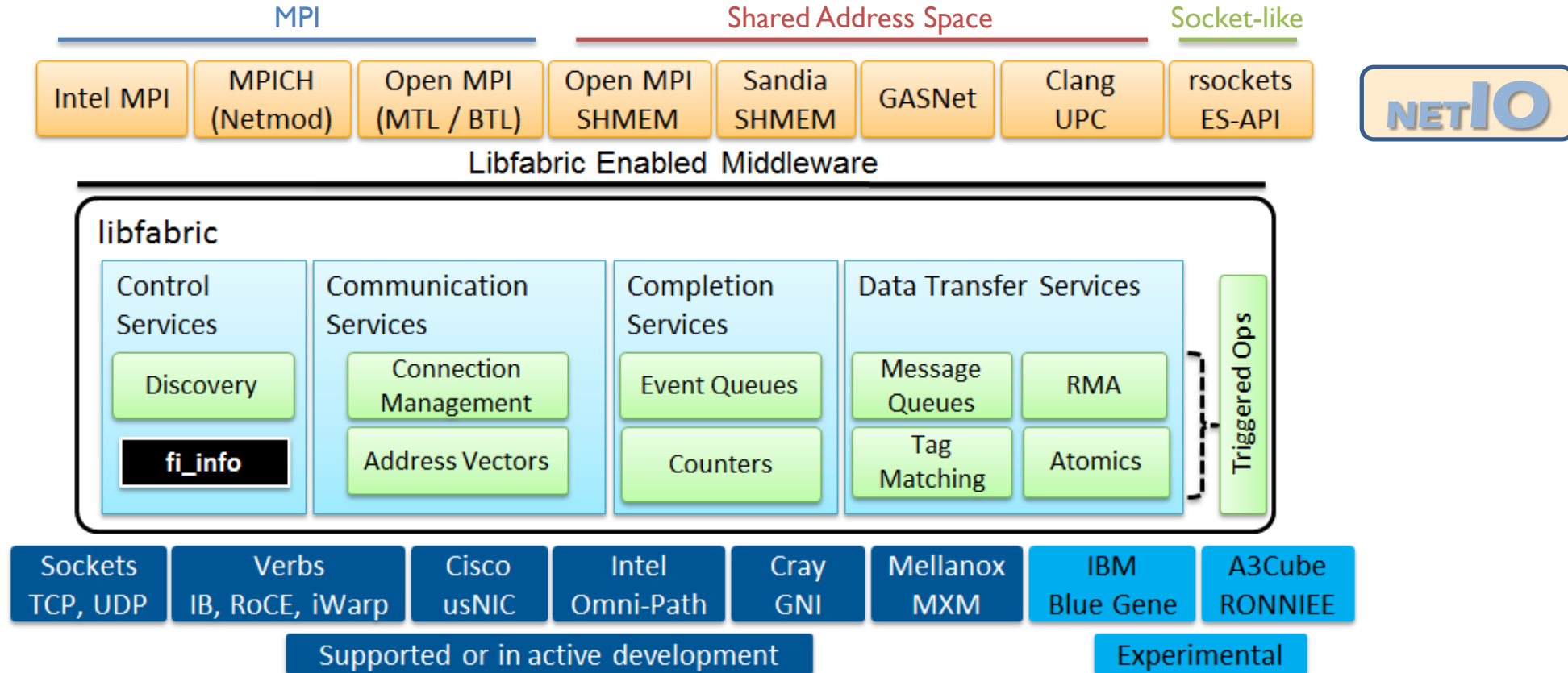
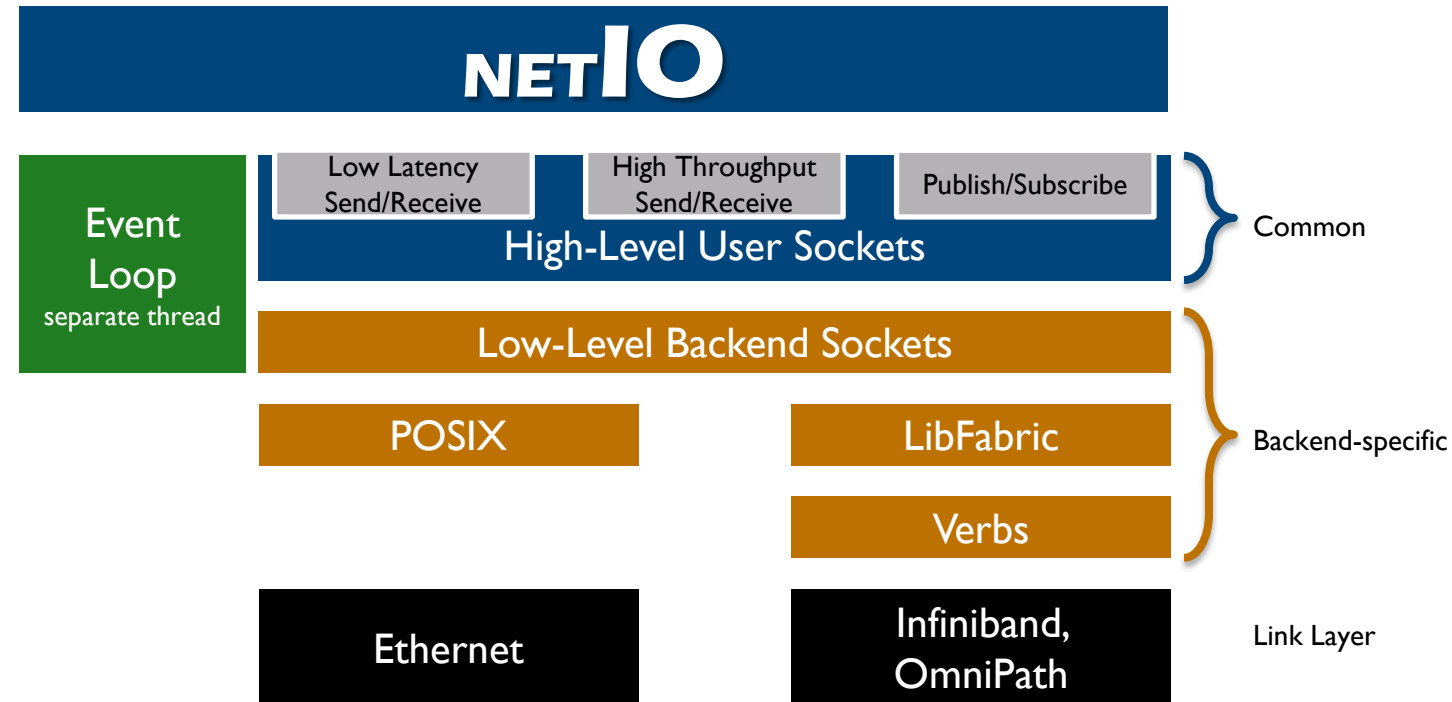


Image source: OFI Working Group

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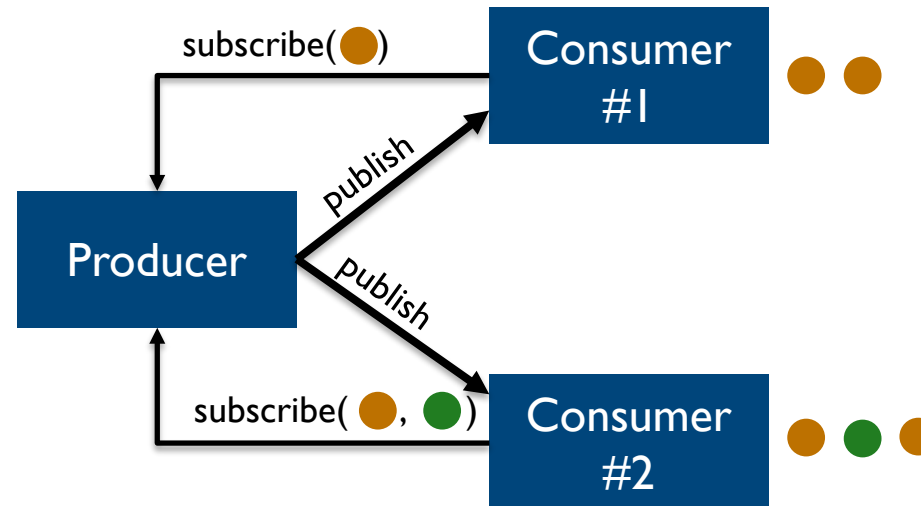
1) Low-Latency Send/Receive



2) High-Throughput Send/Receive



3) Publish/Subscribe



```
int main(int argc, char** argv) {
    netio::context ctx("posix");
    std::thread bg_thread([&ctx]() {
        ctx.event_loop()->run_forever();
    });

    netio::subscribe_socket socket(&ctx);
    socket.subscribe(SUBSCRIPTION_TAG, netio::endpoint("10.113.142.1", 1234));

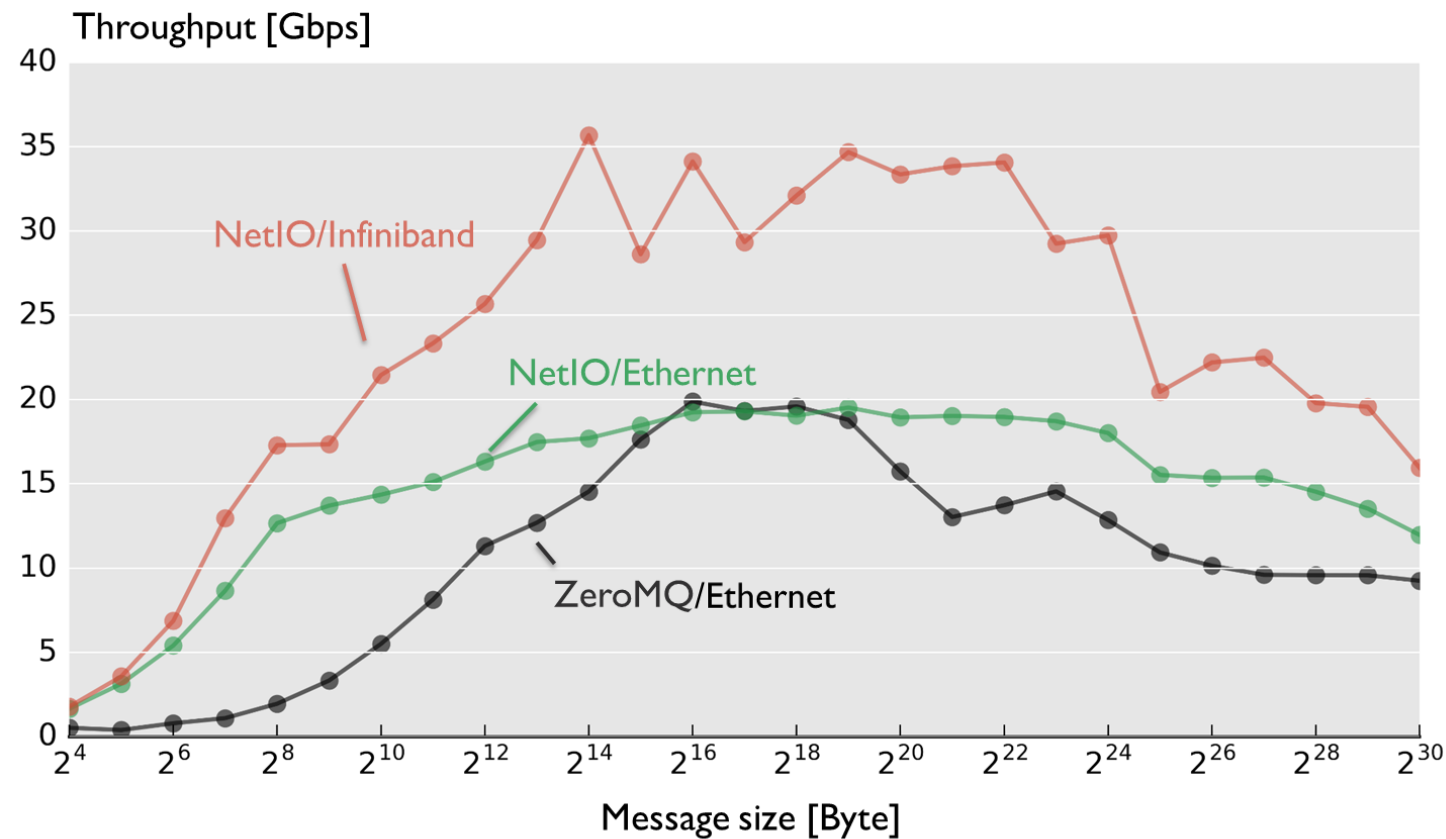
    while(1) {
        netio::message m;
        socket.recv(m);
        std::cout << m.data_copy().data() << std::endl;
    }
}
```

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## NetIO Performance on Infiniband and Ethernet





# NetIO Development Status

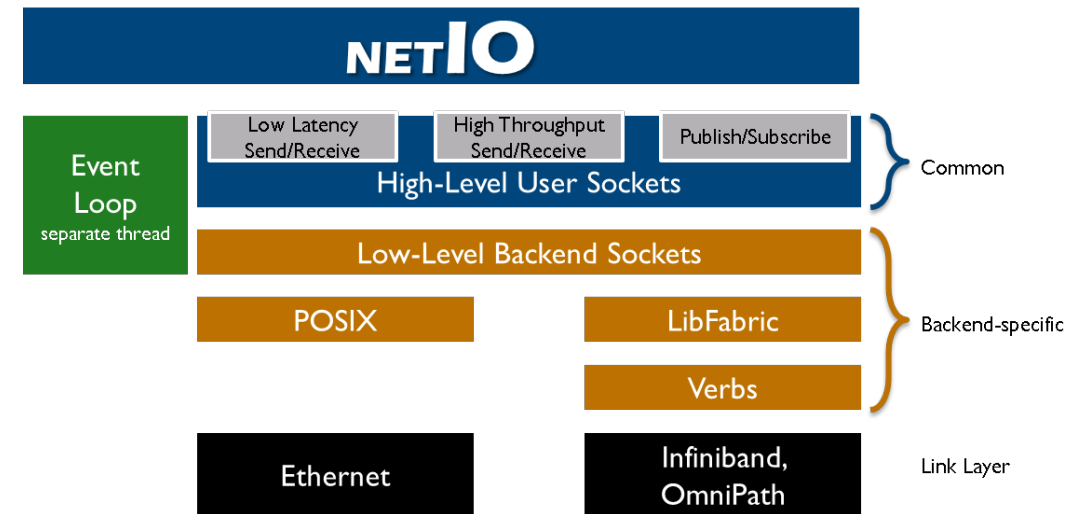
Actively in use in the ATLAS FELIX project



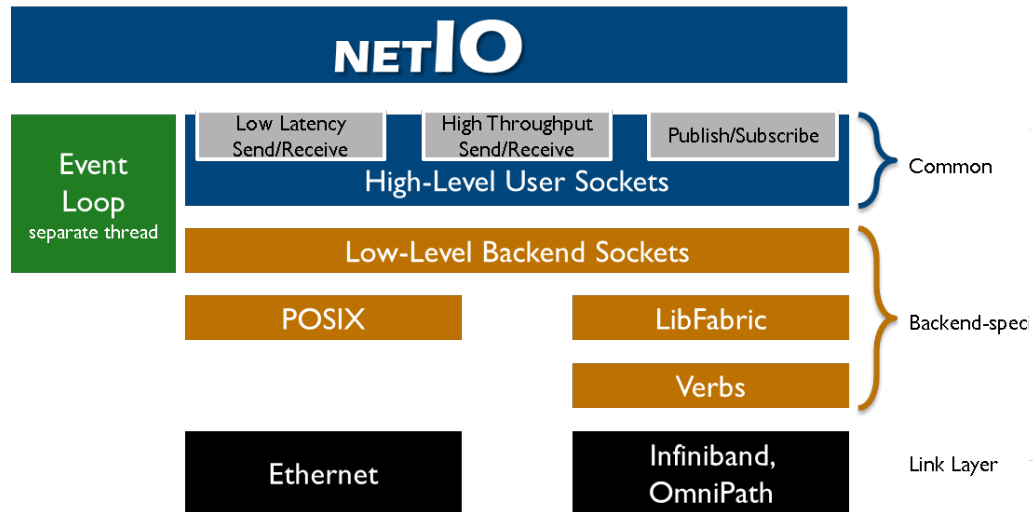
High-Throughput sockets (point-to-point and publish/subscribe) work reliably

Low-latency sockets need more tuning

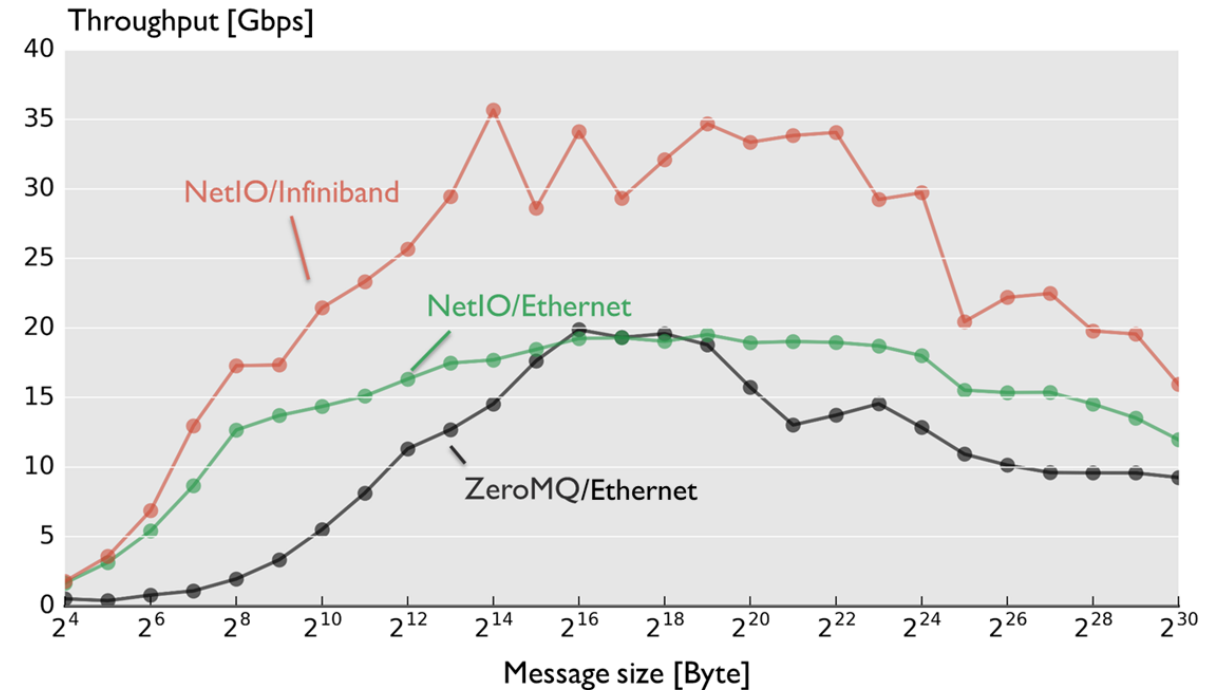
Add support for more backends (Intel OmniPath)



# NETIO



NetIO Performance on Infiniband and Ethernet



If you are interested in NetIO, please contact

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