

High-Speed Network

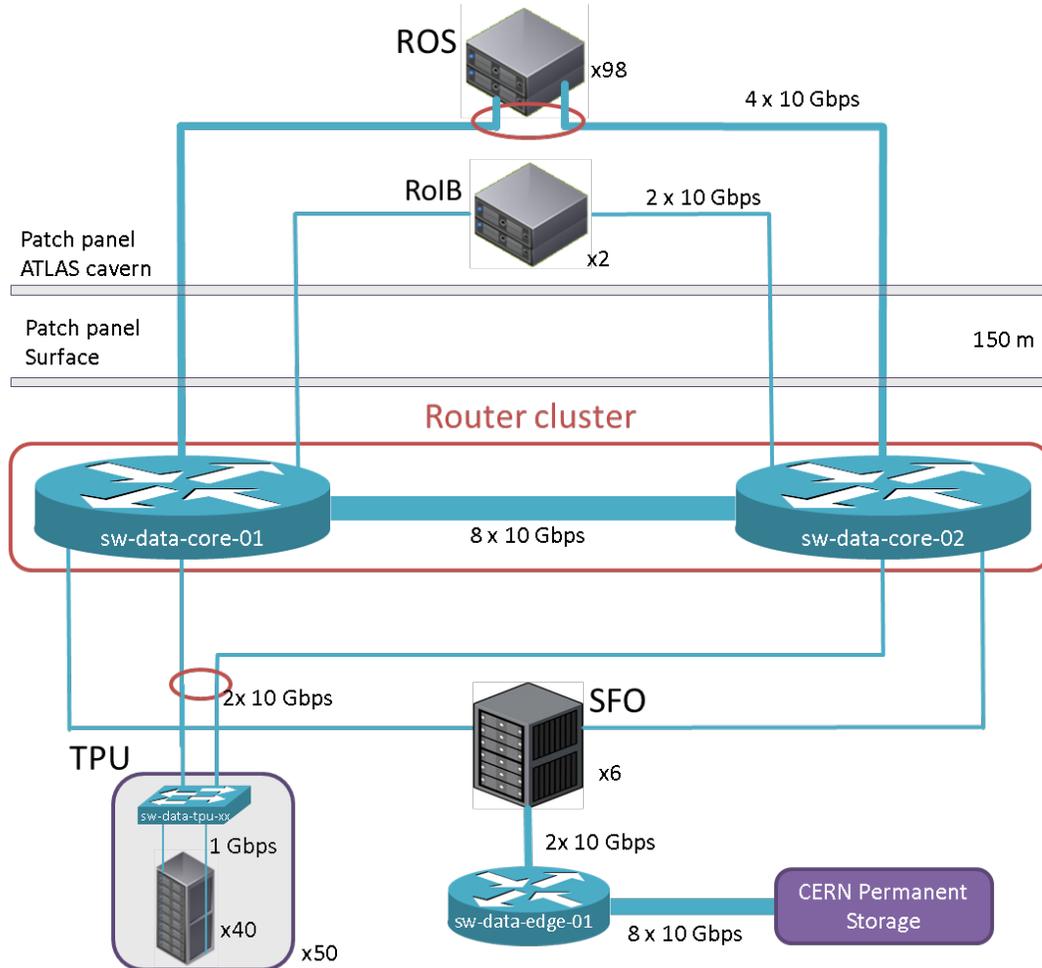
Communication with **NETIO**

Jörn Schumacher
CERN and Paderborn University
jorn.schumacher@cern.ch



UNIVERSITÄT PADERBORN
Die Universität der Informationsgesellschaft

DAQ Networks in High-Energy Physics

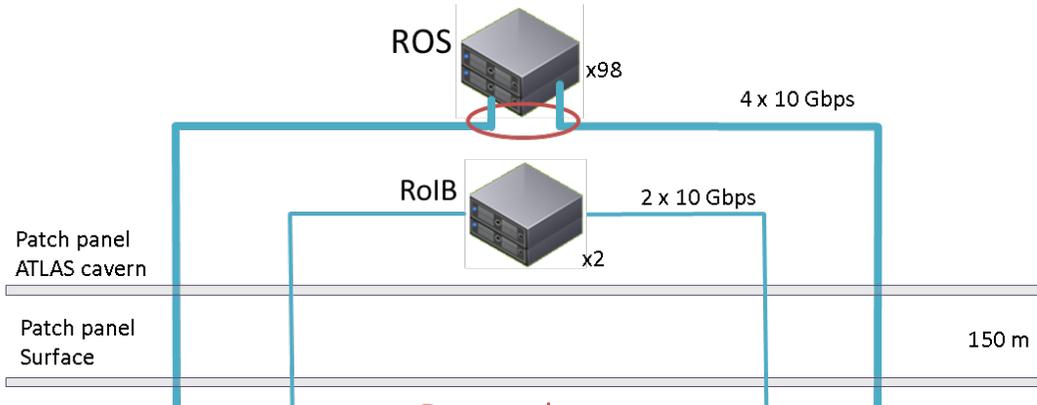


ATLAS Data Acquisition:

- 60 TB of raw data produced every second
- 1000s of PCs with more than 40'000 cores
- 1000s 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

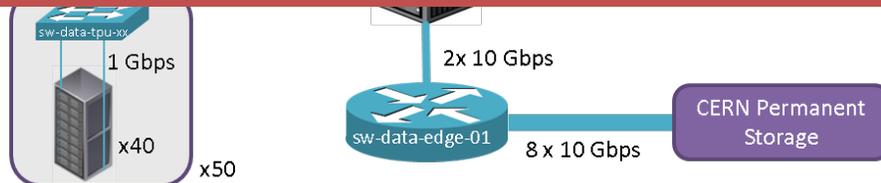
DAQ Networks in High-Energy Physics



ATLAS Data Acquisition:

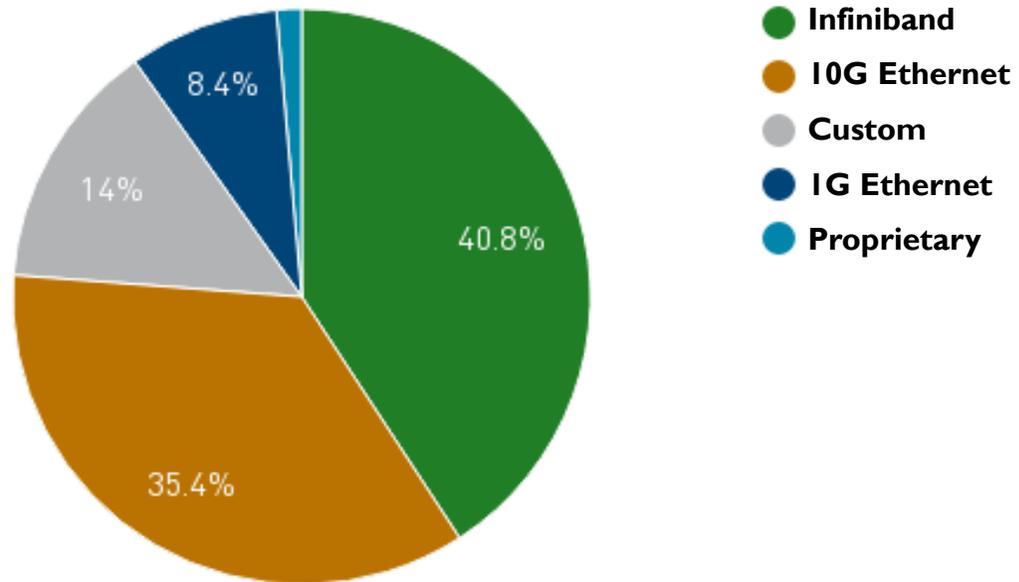
- 60 TB of raw data produced every second
- 1000s of PCs with more than 40'000 cores
- 10000s of applications sending and receiving messages
- Core network: 25 GB/s switched in core

We need fast network technologies to build DAQ systems



HPC Network Market in 2016

Interconnect Families in Top500 List in July 2016

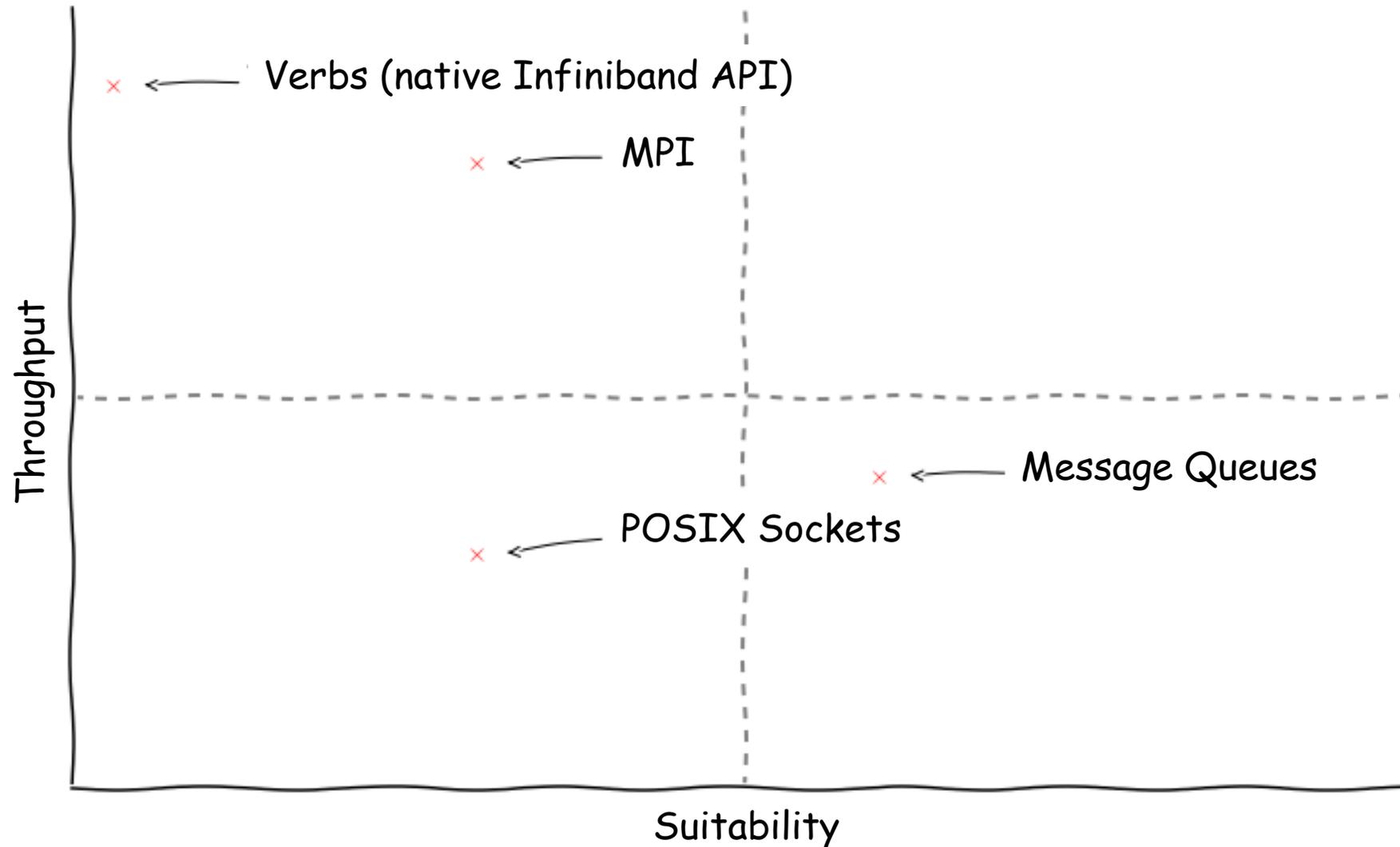


Source: top500.org

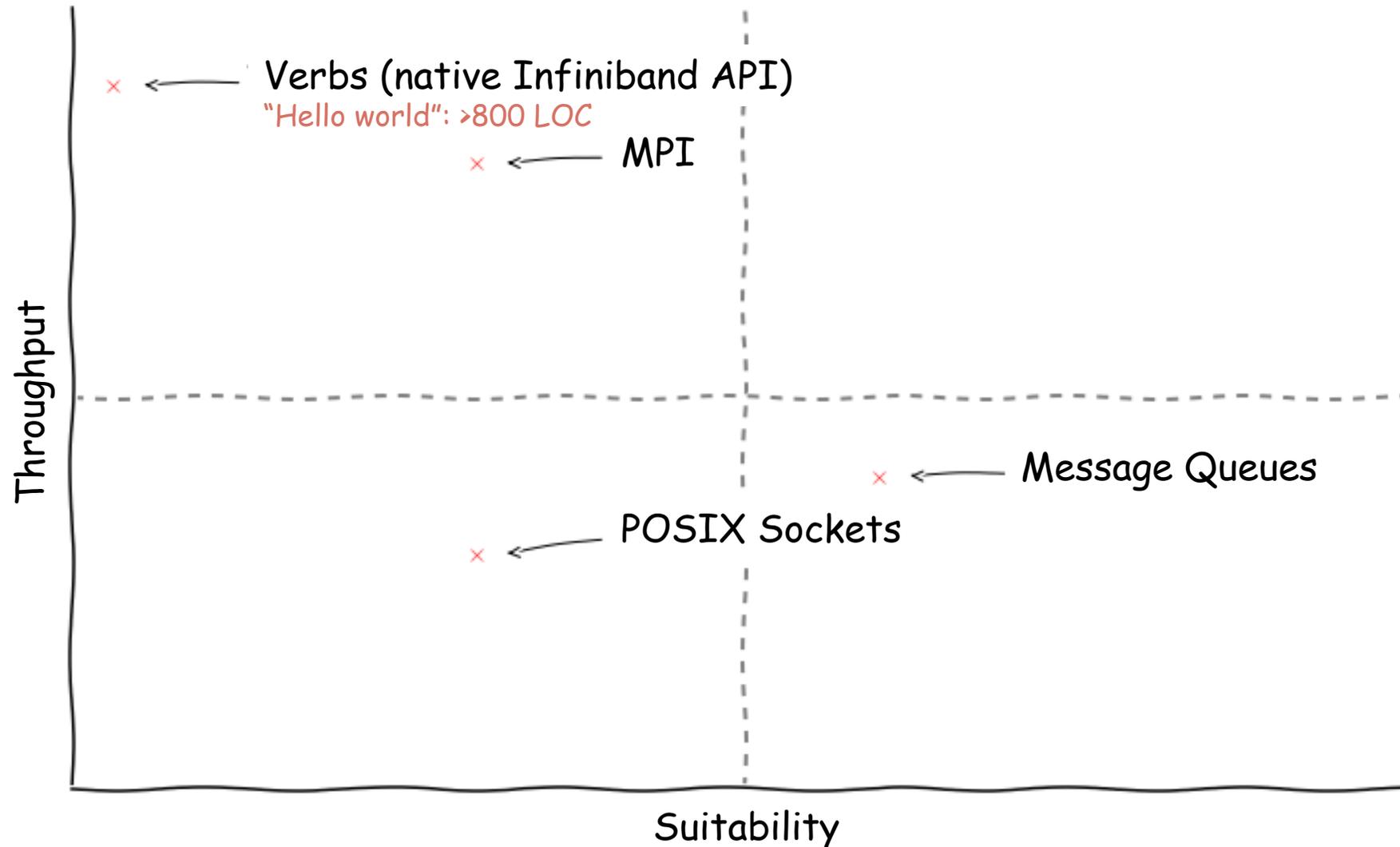
Ethernet and **Infiniband** are the two dominating technologies in the HPC market

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

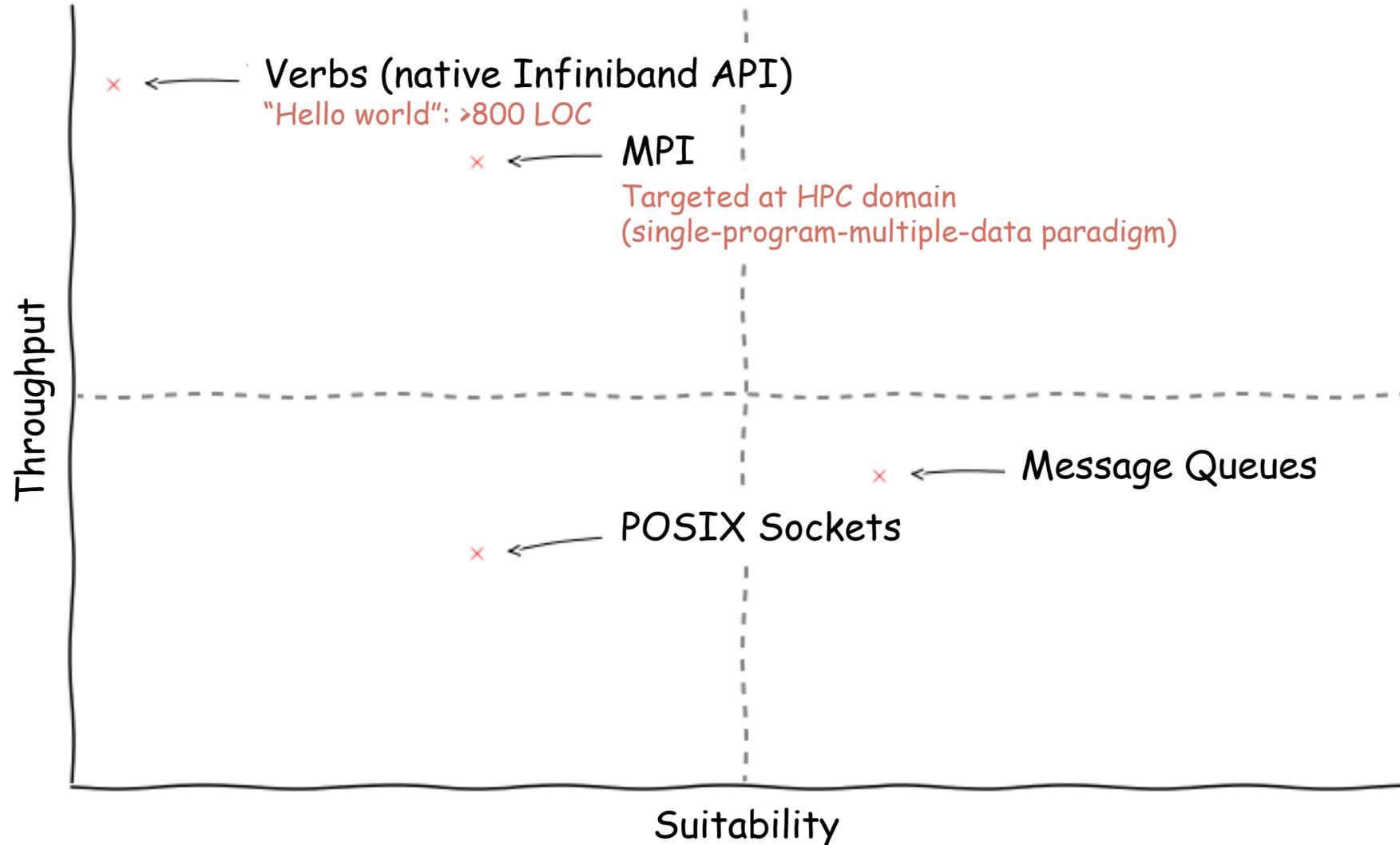
Programming Models (subjective)



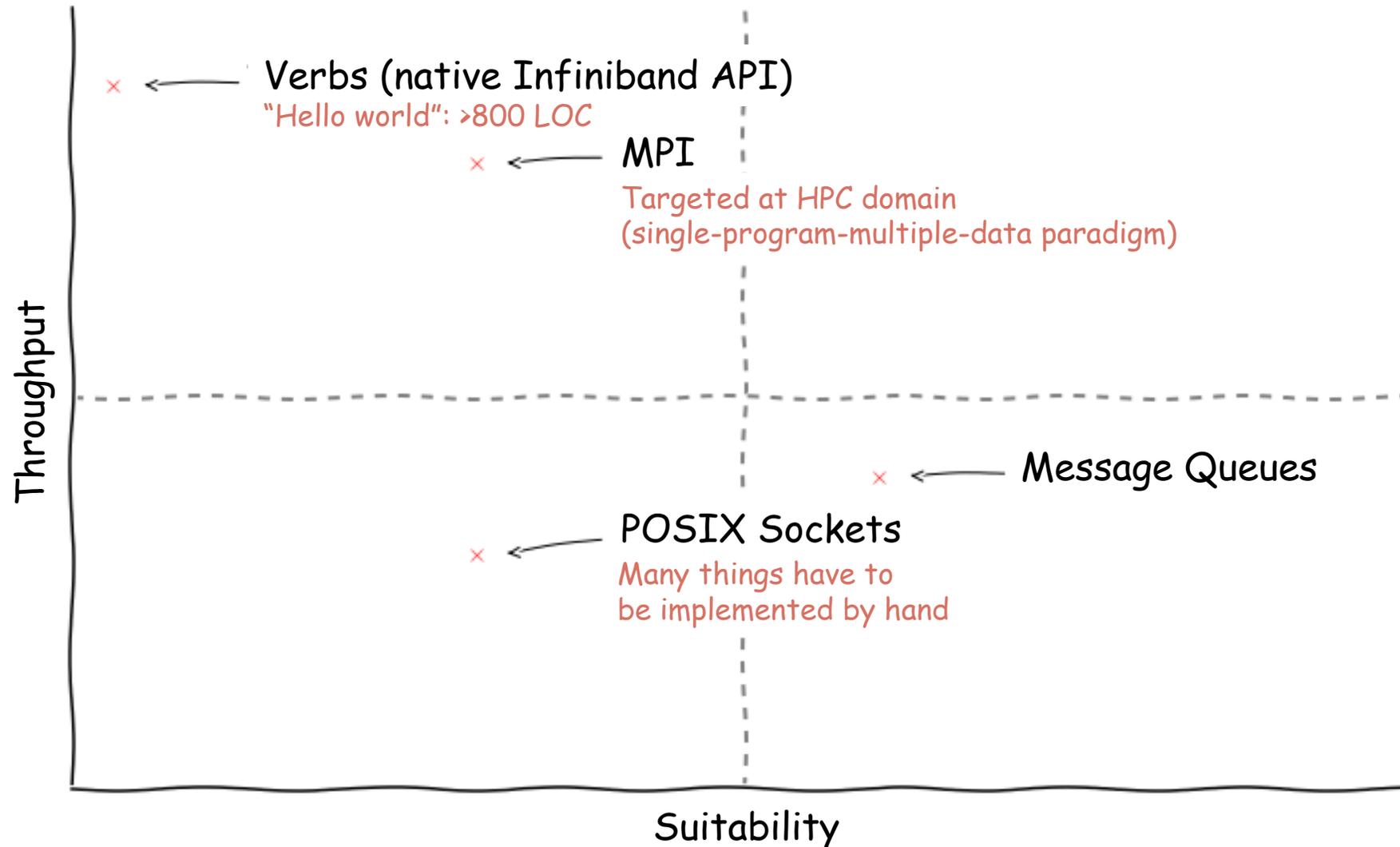
Programming Models (subjective)



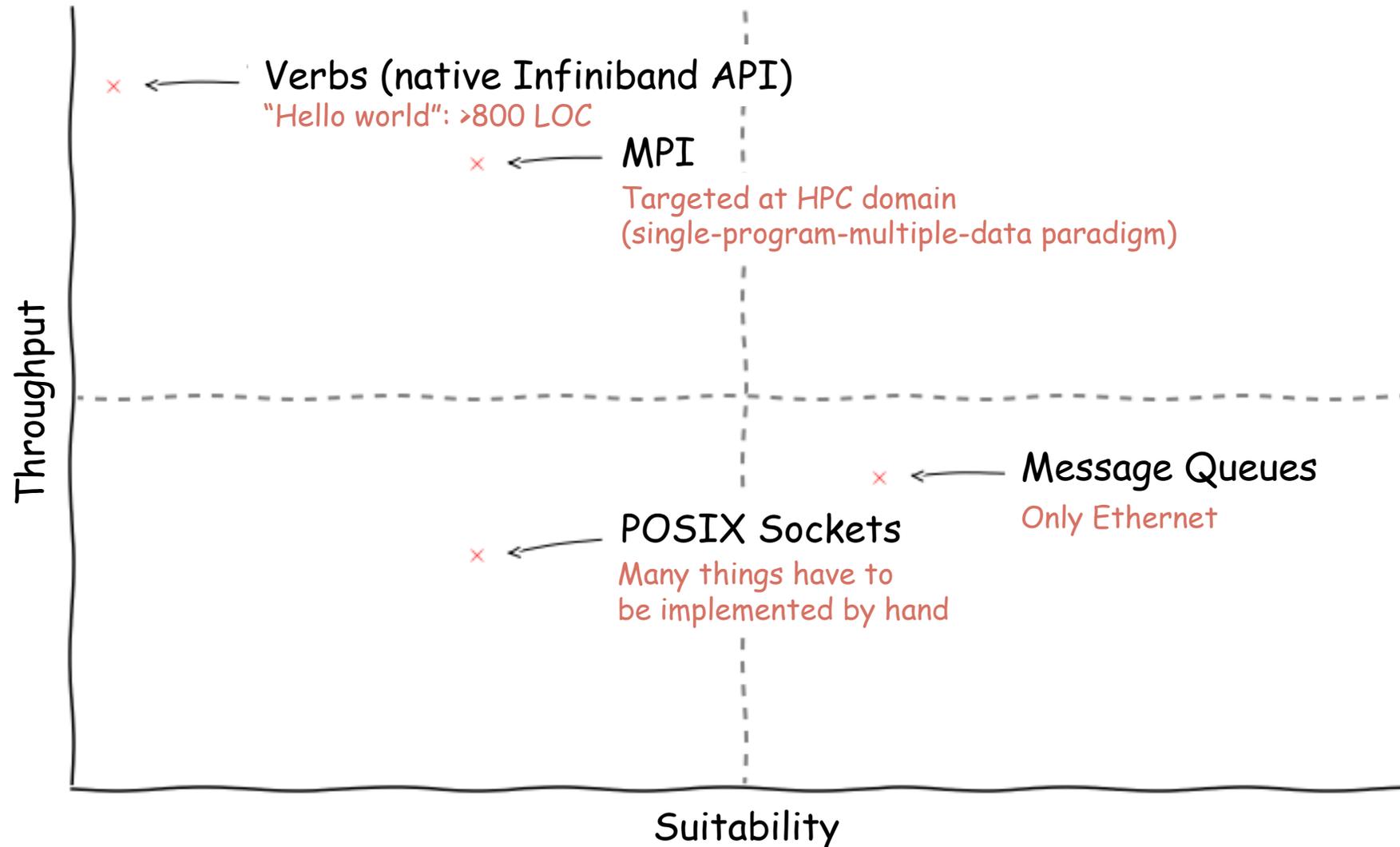
Programming Models (subjective)



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



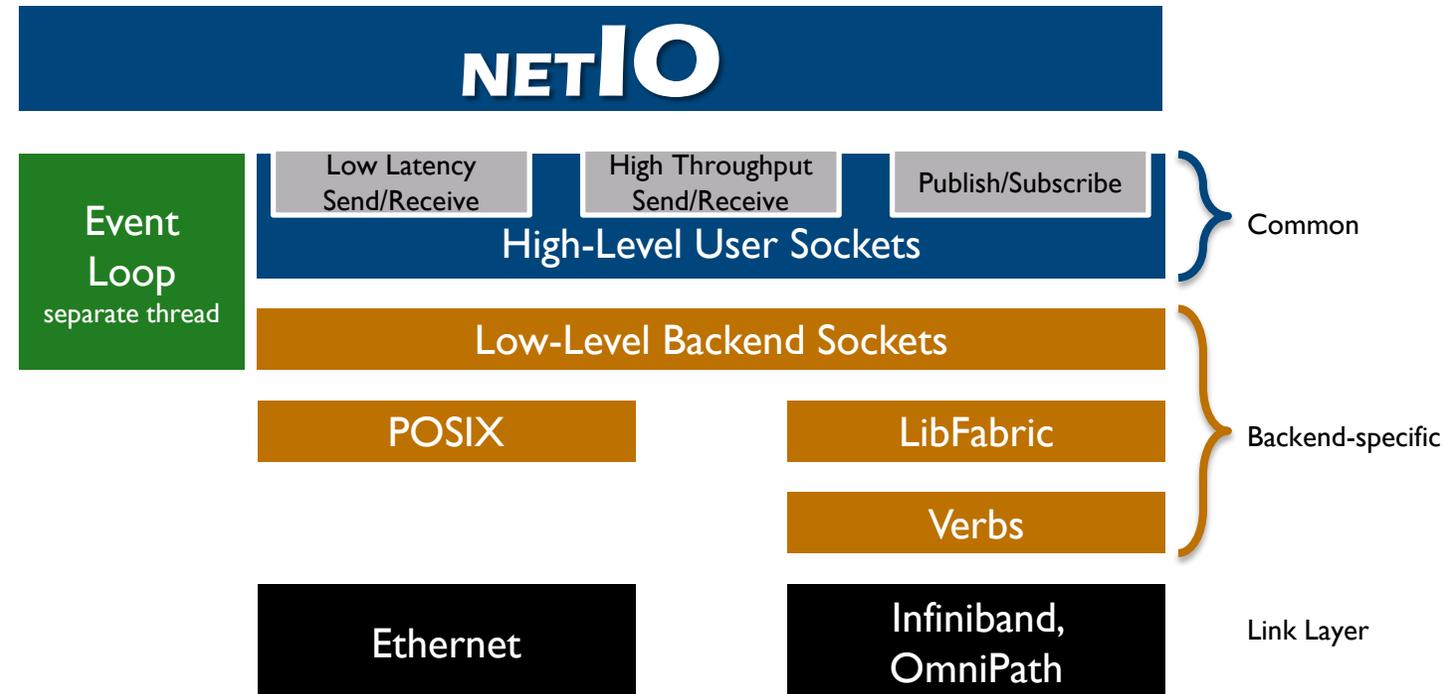
See talk by Soo Ryu on FELIX

NetIO

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

High performance
(high throughput, low latency)

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



NetIO: Libfabric Backend

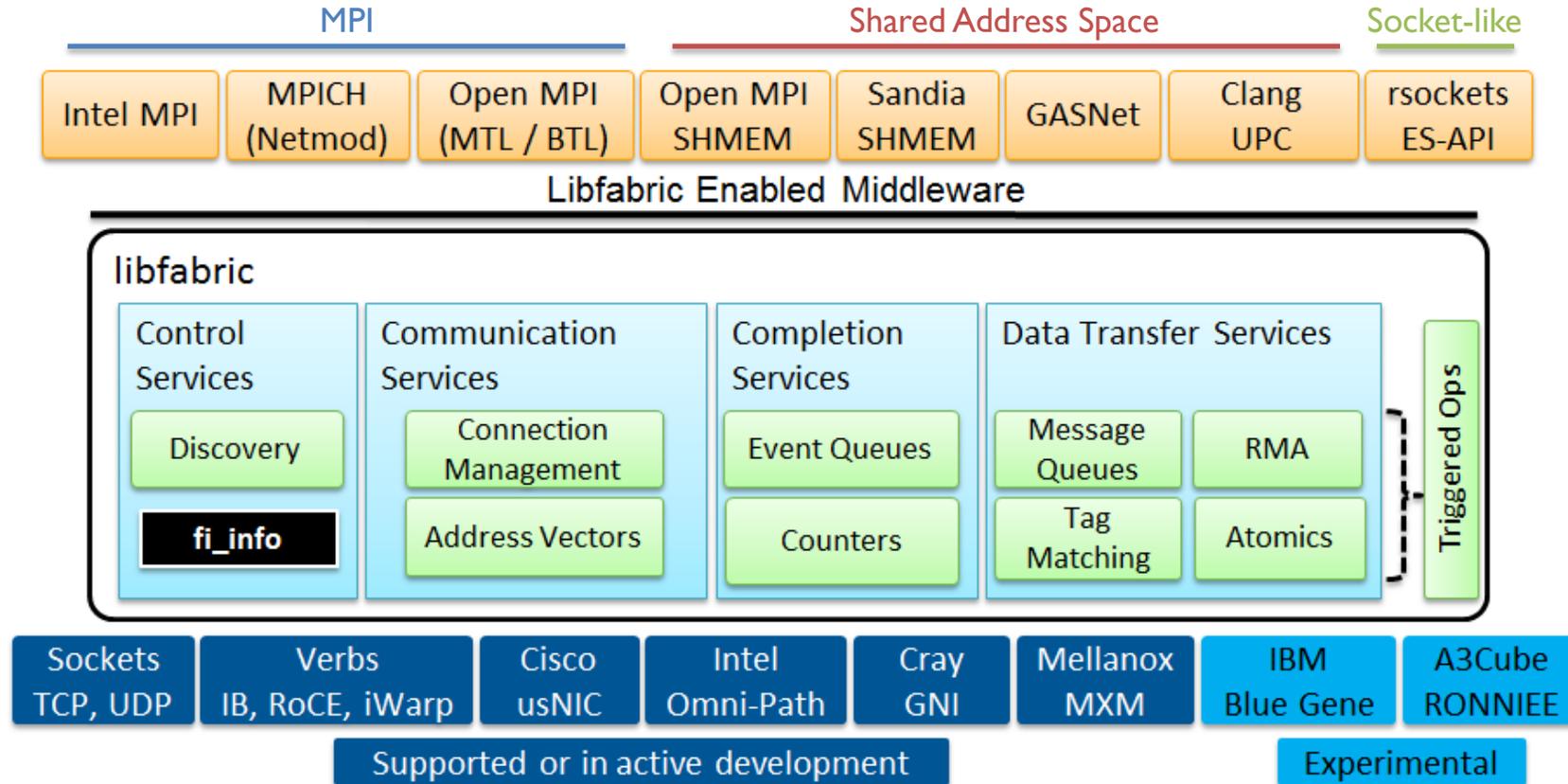


Image source: OFI Working Group

NetIO: Libfabric Backend

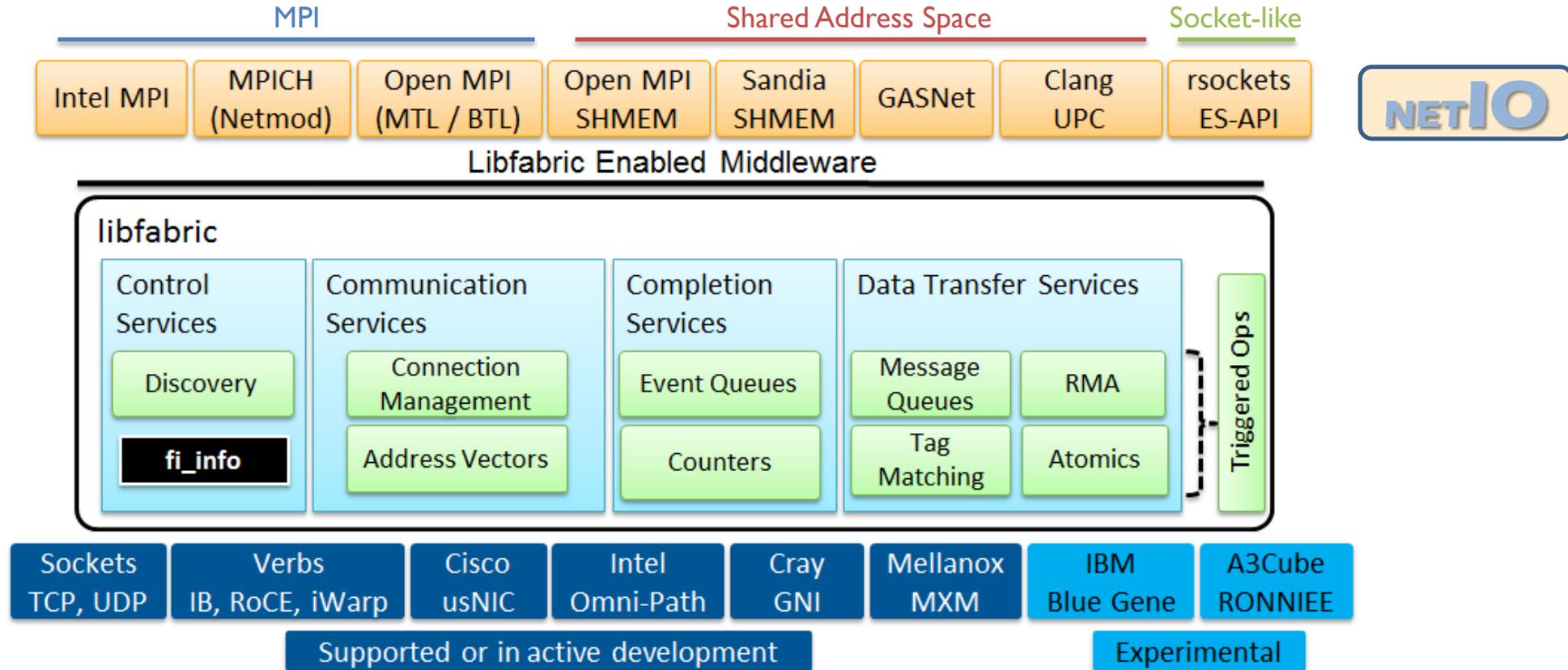


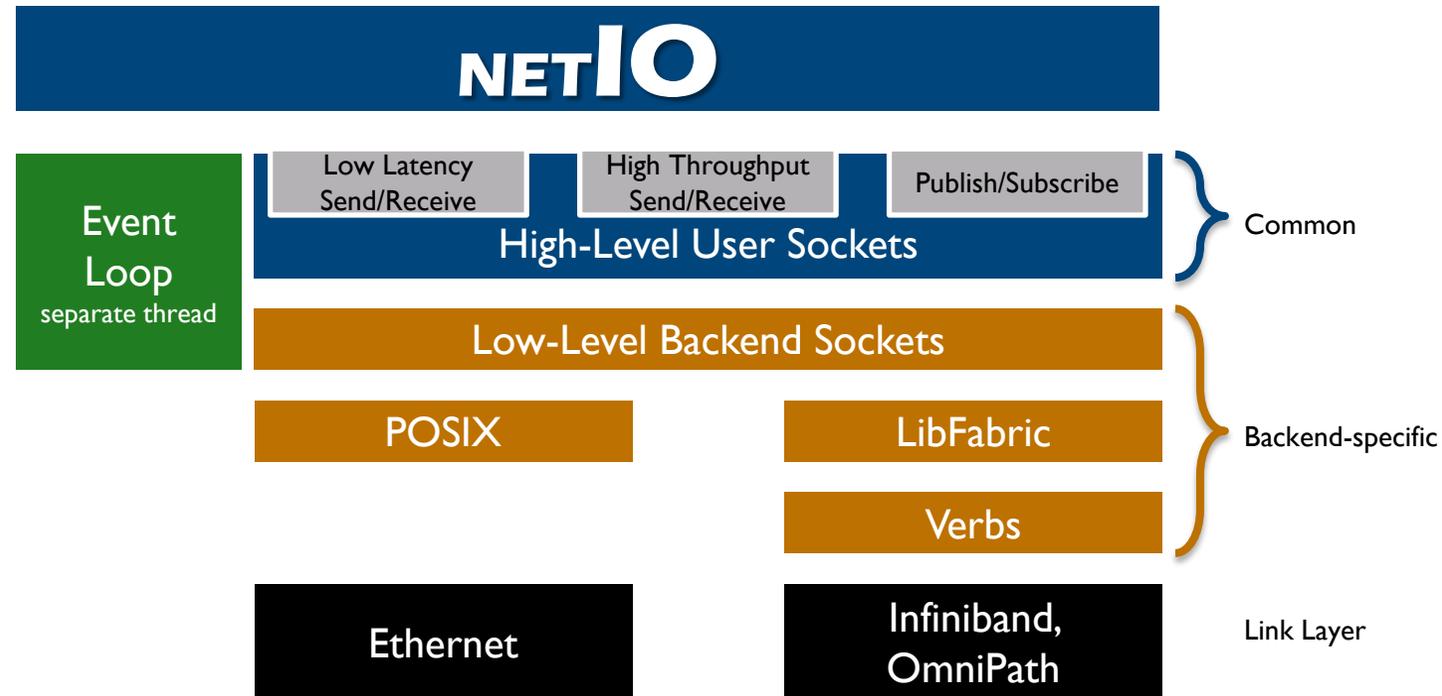
Image source: OFI Working Group

NetIO

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

High performance
(high throughput, low latency)

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



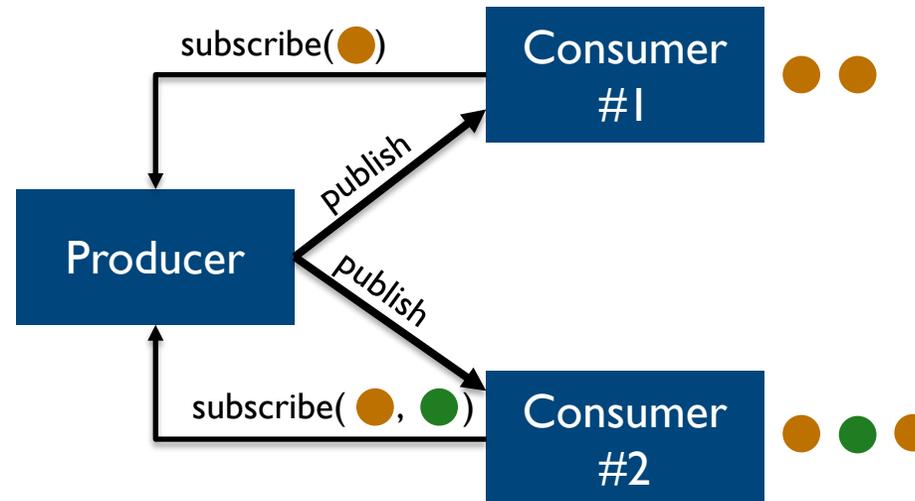
1) Low-Latency Send/Receive



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));

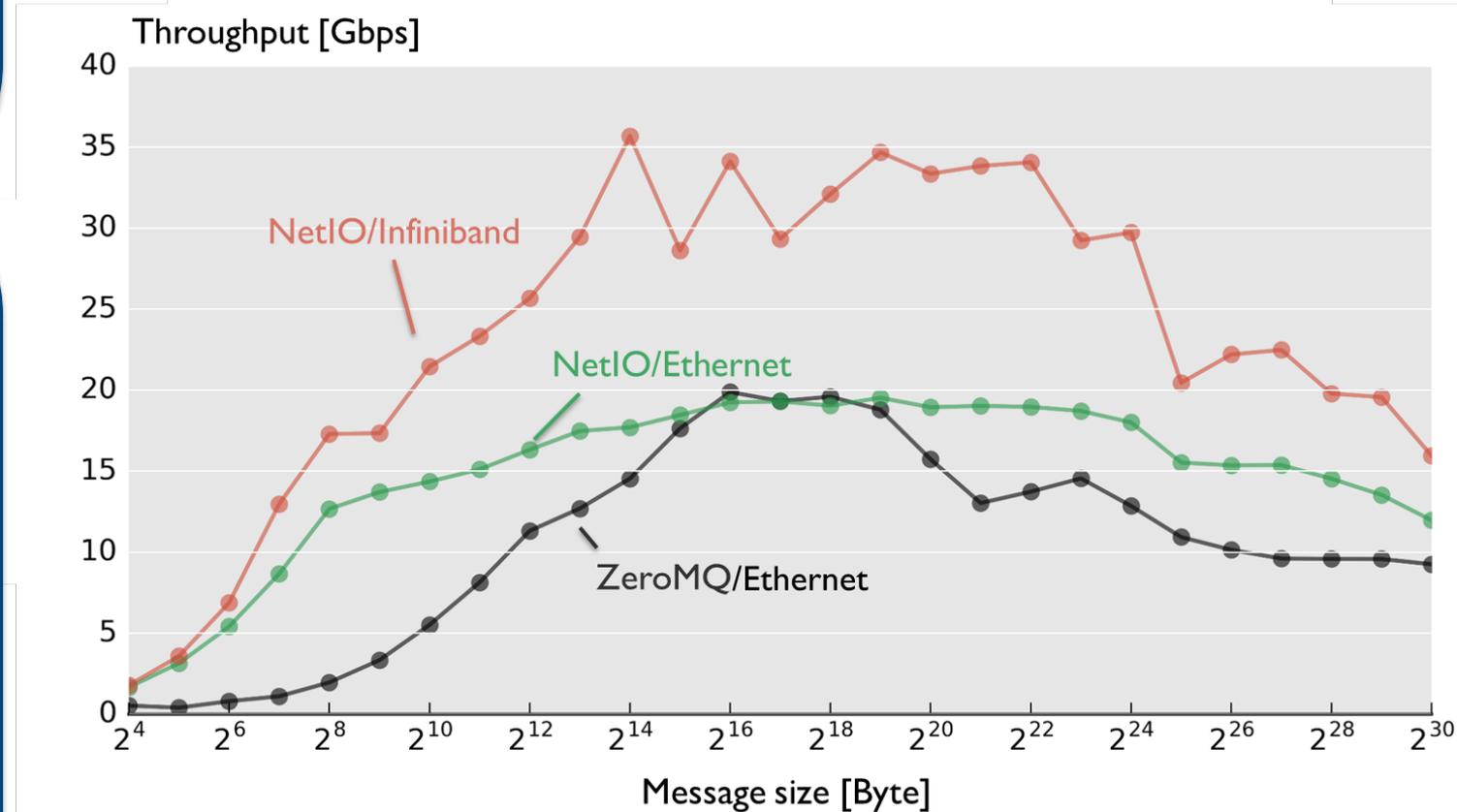
    while(1) {
        netio::message m;
        socket.recv(m);
        std::cout << m.data_copy().data() << std::endl;
    }
}
```

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

High performance
(high throughput, low latency)

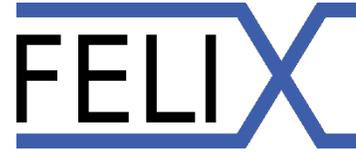
Message-based, high-level user interface with
use-cases for typical DAQ applications

NetIO Performance on Infiniband and Ethernet



NetIO Development Status

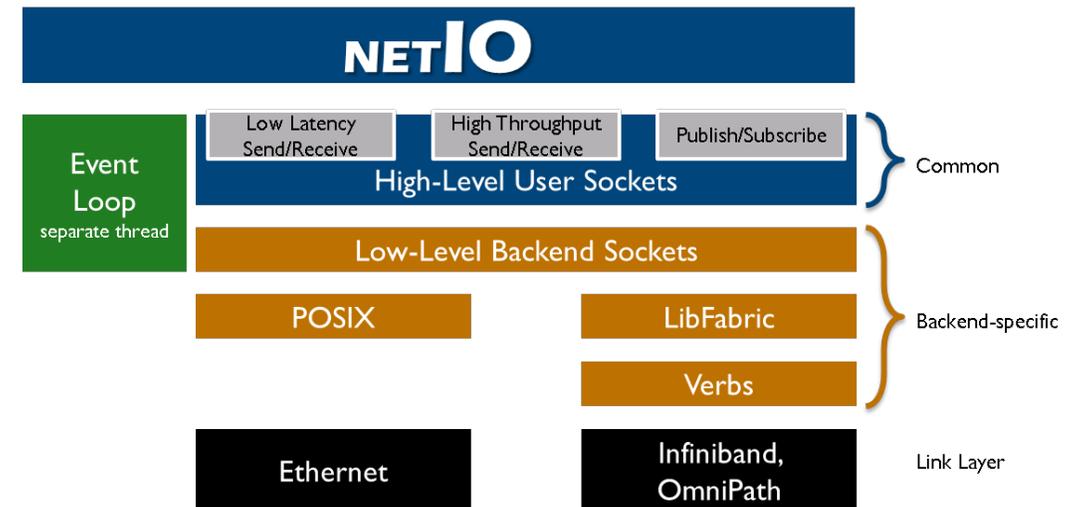
Actively in use in the ATLAS FELIX project



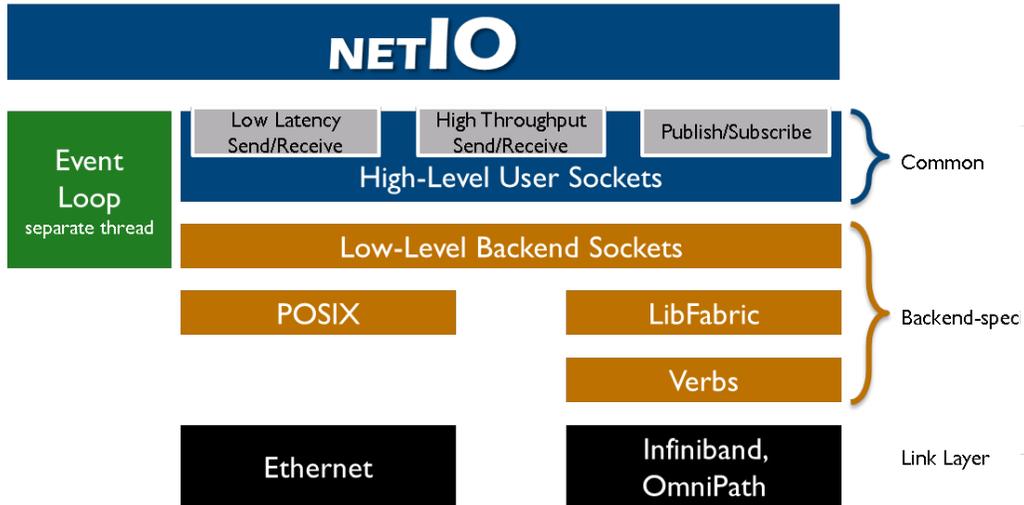
High-Throughput sockets (point-to-point and publish/subscribe) work reliably

Low-latency sockets need more tuning

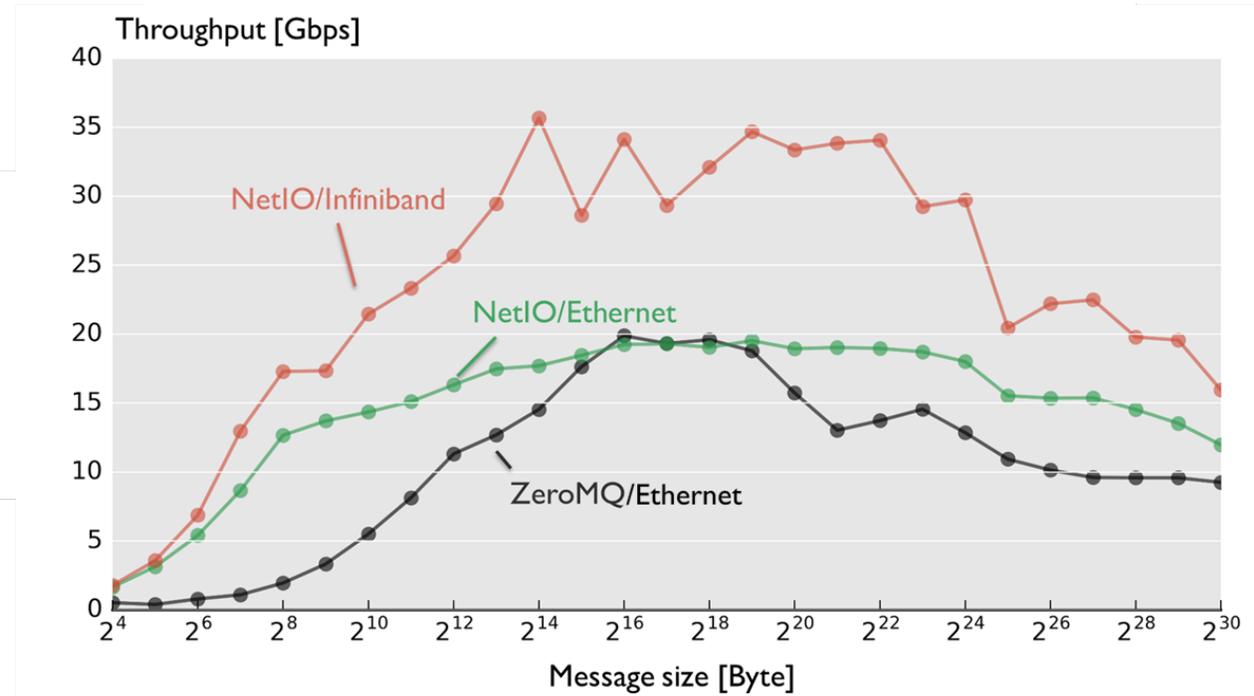
Add support for more backends (Intel OmniPath)



NETIO



NetIO Performance on Infiniband and Ethernet



If you are interested in NetIO, please contact

Joern.Schumacher@cern.ch