

Applications (HPC, AI, ML, BigData)

MPICH, Open-MPI, etc.

OpenSHMEM, UPC, CAF, X10,
Chapel, etc.

Parsec, OCR, Legion, etc.

TensorFlow, Burst Buffer, etc.

UCX

UCP (Protocols) - High Level API

Transport selection, cross-transport multi-rail, fragmentation, software protocols for operations that are not supported by hardware

Message Passing API Domain:
Tag-Matching, Rendezvous

PGAS API Domain:
RMAs, Atomics

Task Based API Domain:
Active Messages

I/O API Domain:
Stream

UCT (Hardware Transports) - Low Level API

RMA, Atomic, Tag-Matching, Send/Recv, Active Messages

Transport for RDMA VERBs driver
(InfiniBand, ROCE, OPA)

RC

UD

DCT

Transport for
Gemini/Aries
drivers

GNI

Transport for intra-node host memory communication

SYSV

POSIX

KNEM

CMA

XPMEM

Transport for
GPGPU

NVIDIA
CUDA

AMD
ROCm

Ethernet

TCP/IP
Sockets

UCS (Services)
Common utilities

Utilities

Data
Structures

Memory
Management

UCM
Memory
Services

Memory
Hooks

RDMA Verbs Driver

Cray Driver

OS Kernel

ROCm/CUDA

OS Kernel

OS Kernel

Hardware