**Project Optimizations**

CPU:

SIMD Vectorization AVX2/AVX512,

Cache Optimization Prefetching,

Branch Prediction Hints.

Memory:

Memory Pools and Pre-allocation,

Data Alignment Cache Lines,

NUMA Awareness Local Access.

Concurrency:

Lock-Free Algorithms CAS Operations,

Thread Affinity CPU Pinning,

SPSC/MPMC Queues Ring Buffers.

I/O:

Zero-Copy sendfile/splice,

Batch Processing Aggregation,

Async I/O io\_uring.