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Summary

*Challenge*

The distributed RL training **generates orders of magnitude more iterations with much smaller sized but more frequent gradient aggregations**. This is the major bottleneck in distributed RL training which occupies up to 83.2% of the execution time of each training iteration.

*Contribution*

1. Propose iSwitch, an in-switch acceleration solution that moves the gradient aggregation from server nodes into the network switches.
2. Rethink the distributed RL training algorithms and also propose a hierarchical aggregation mechanism to further increase the parallelism and scalability of the distributed RL training at rack scale
3. Extend network protocol. To support in-switch computing for distributed RL training, they propose to build their own protocol and packet format based on regular network protocols.
4. Implement iSwitch using a real-world programmable switch NetFPGA board and extend the control and data plane of the programmable switch to support iSwitch without affecting its regular network functions.

*Innovation Points*

The iSwitch conducts the in-switch aggregation at the granularity of network packets rather than the entire gradient vectors (consisting of numerous network packets).

*Result*

The accelerator support for both synchronous and asynchronous distributed RL training with improved parallelism. Experiments show that iSwitch offers a system-level speedup of up to 3.66× for synchronous distributed training, and 3.71× for asynchronous distributed training, compared with state-of-the-art approaches.