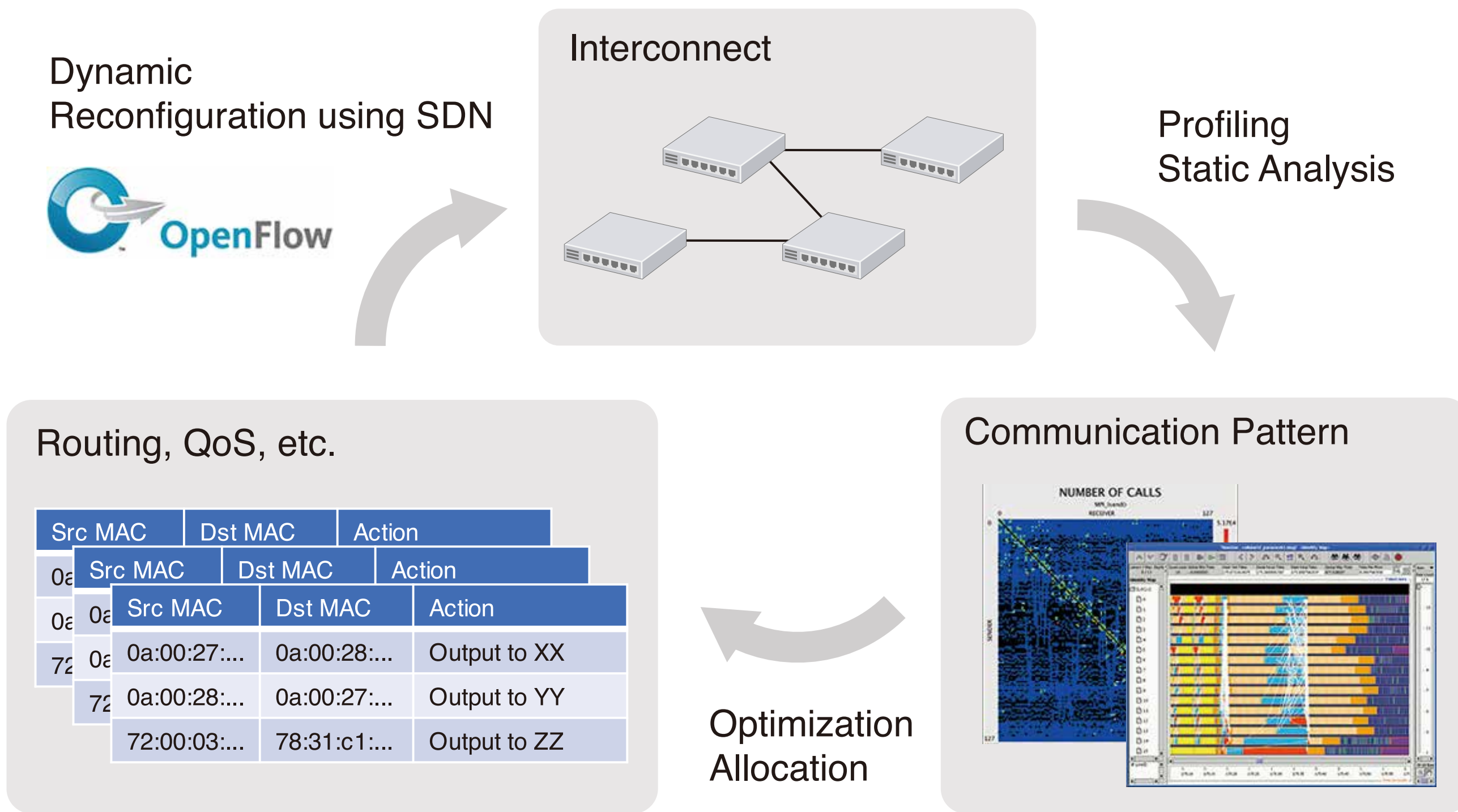


Dynamically Optimized Interconnect Architecture Based on SDN

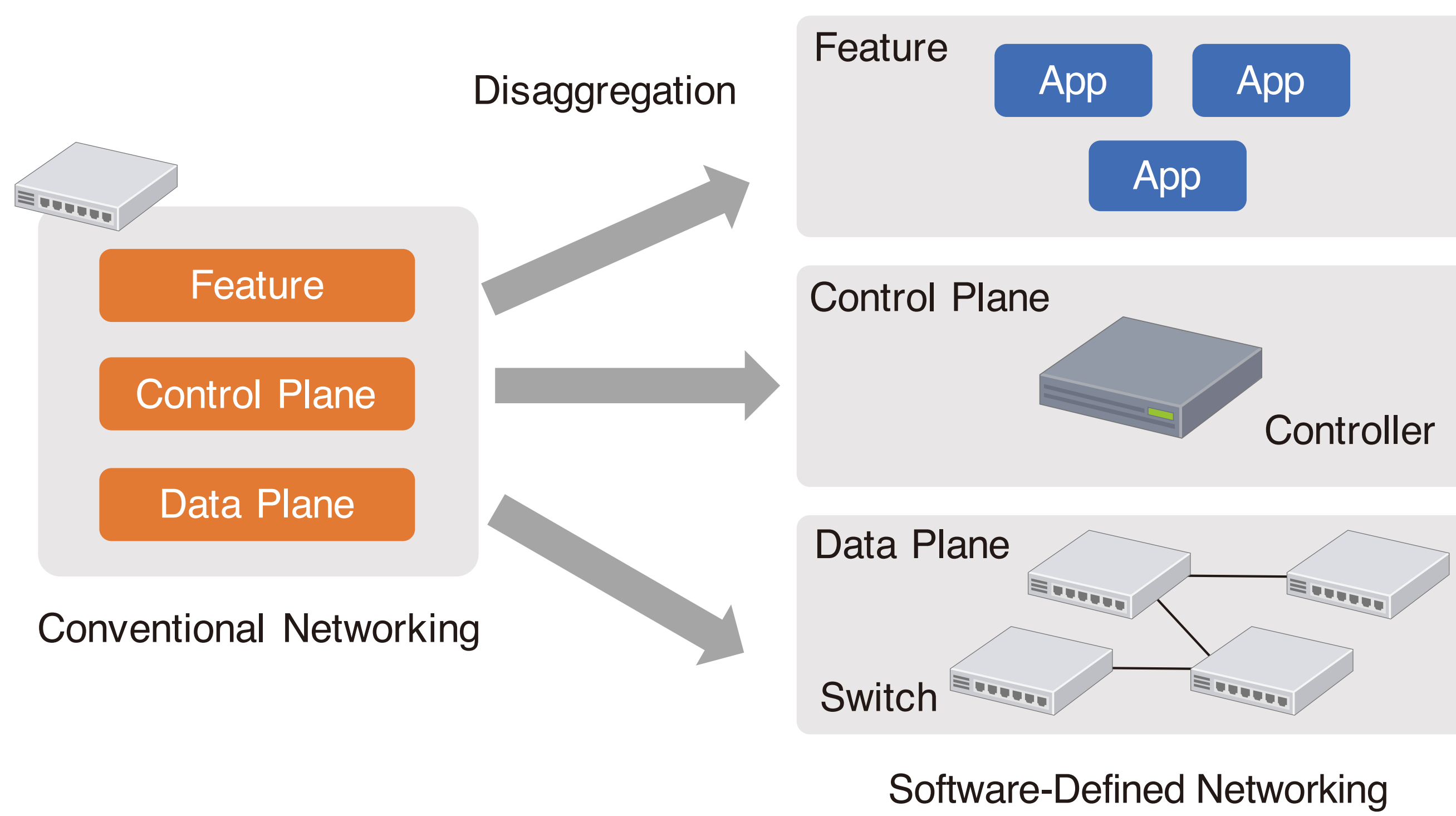
Fundamental Idea of SDN-enhanced MPI

Can we accelerate MPI communication and improve the utilization of interconnect by leveraging the network programmability of SDN?

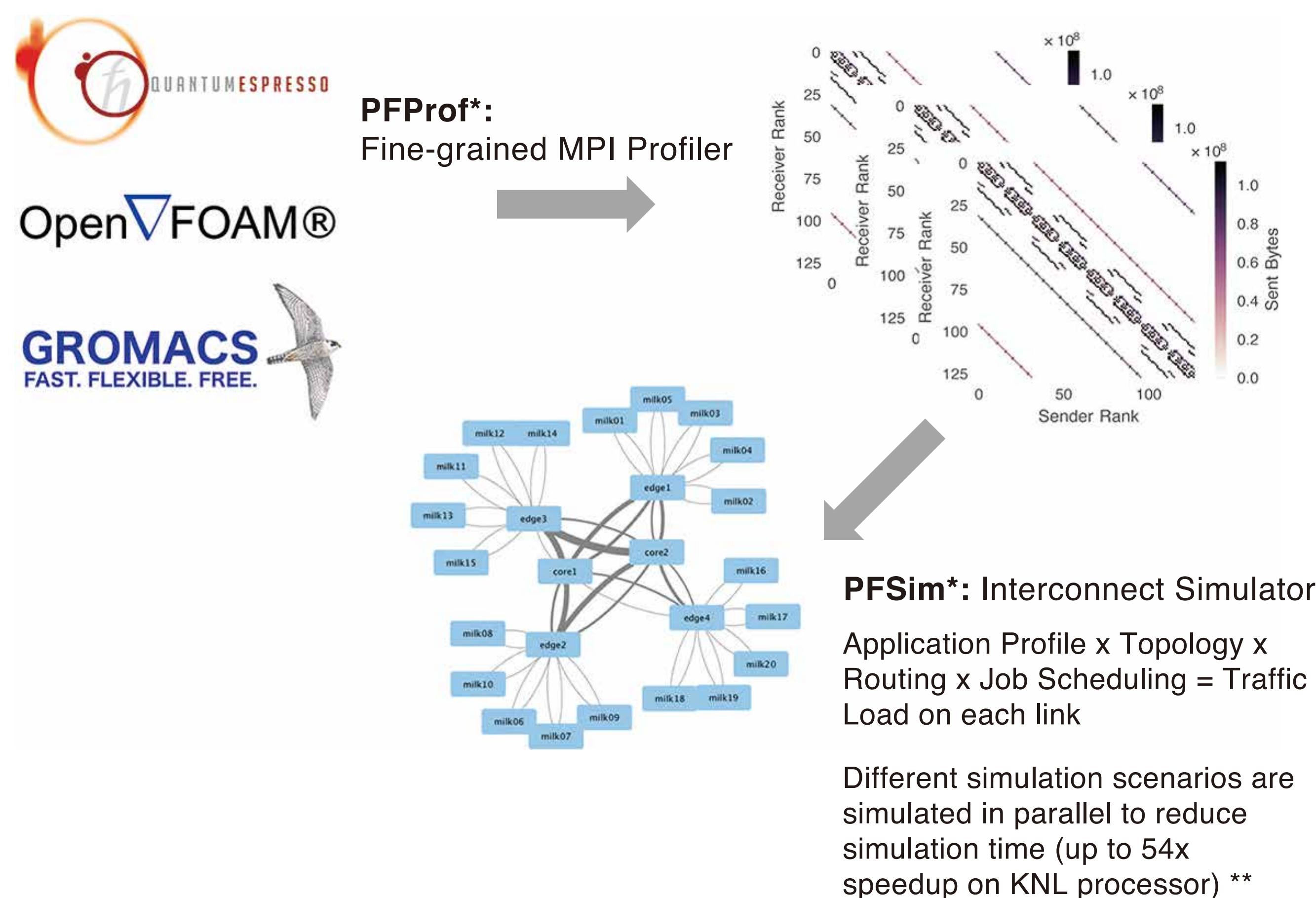


What is Software-Defined Networking (SDN)?

Software-Defined Networking (SDN) is a novel network architecture that decouples conventional networking function into a programmable control plane (responsible for deciding how to control the packets) and a data plane (responsible for the actual packet delivery).



Toolset for Analyzing Application-aware Dynamic Interconnects

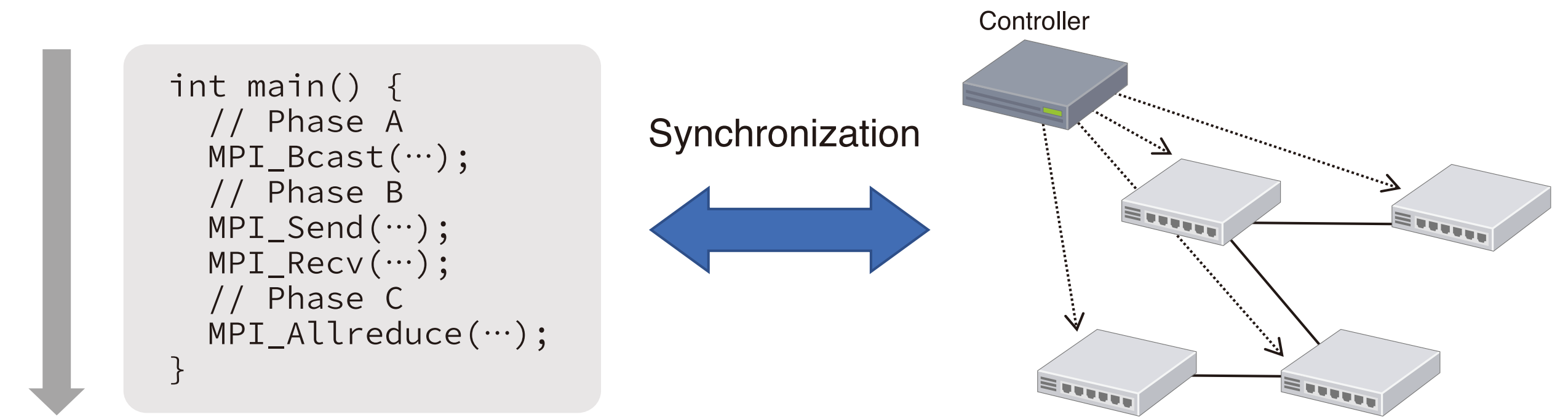


* Keichi Takahashi, Susumu Date, Khureltulga Dashdavaa, Yoshiyuki Kido, Shinji Shimojo, "PFAnalyzer: A Toolset for Analyzing Application-aware Dynamic Interconnects", the Monitoring and Analysis for High Performance Computing Systems Plus Applications (HPCMASPA) Workshop, Cluster 2017, pp. 789-796, Honolulu, Hawaii, Sep. 2017.

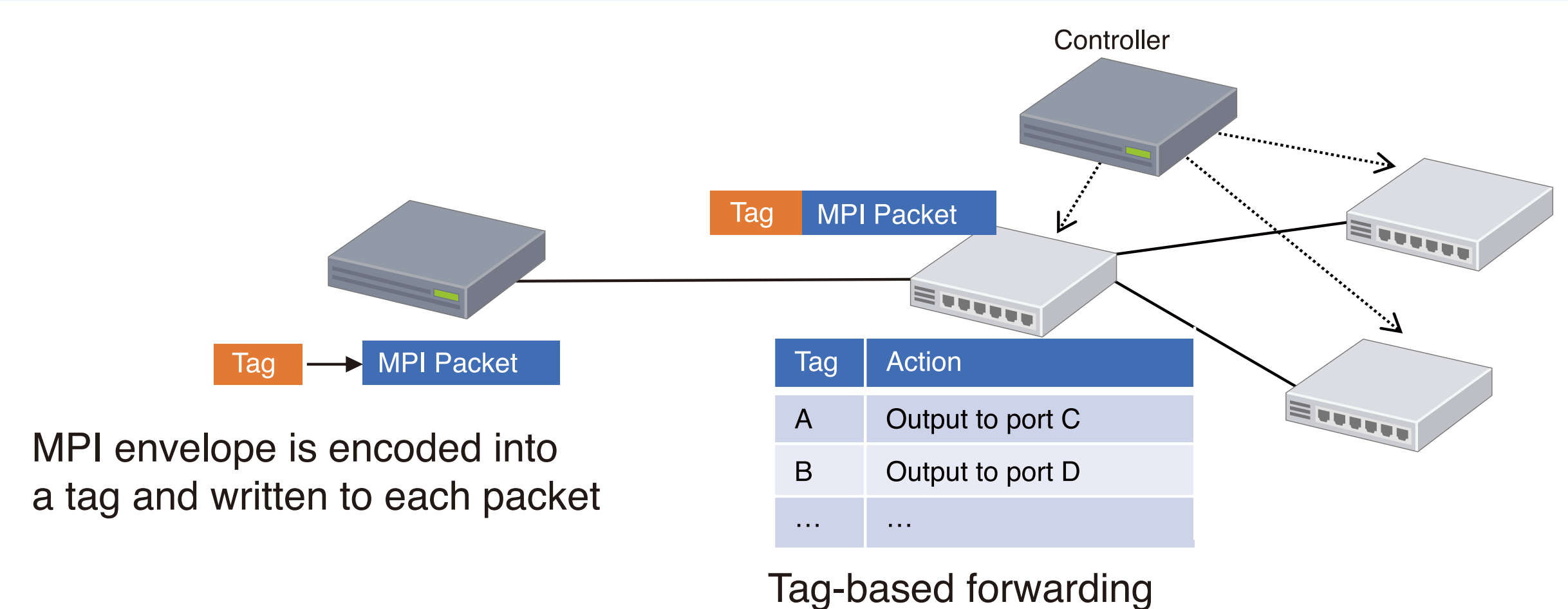
** Yohei Takigawa, Keichi Takahashi, Susumu Date, Yoshiyuki Kido, Shinji Shimojo, "A Traffic Simulator with Intra-node Parallelism for Designing High-performance Interconnects", The 2018 International Conference on High Performance Computing & Simulation (HPCS 2018), July 2018.

Coordination Mechanism of Computation and Communication

How do we reconfigure the interconnect in accordance with the execution of application?



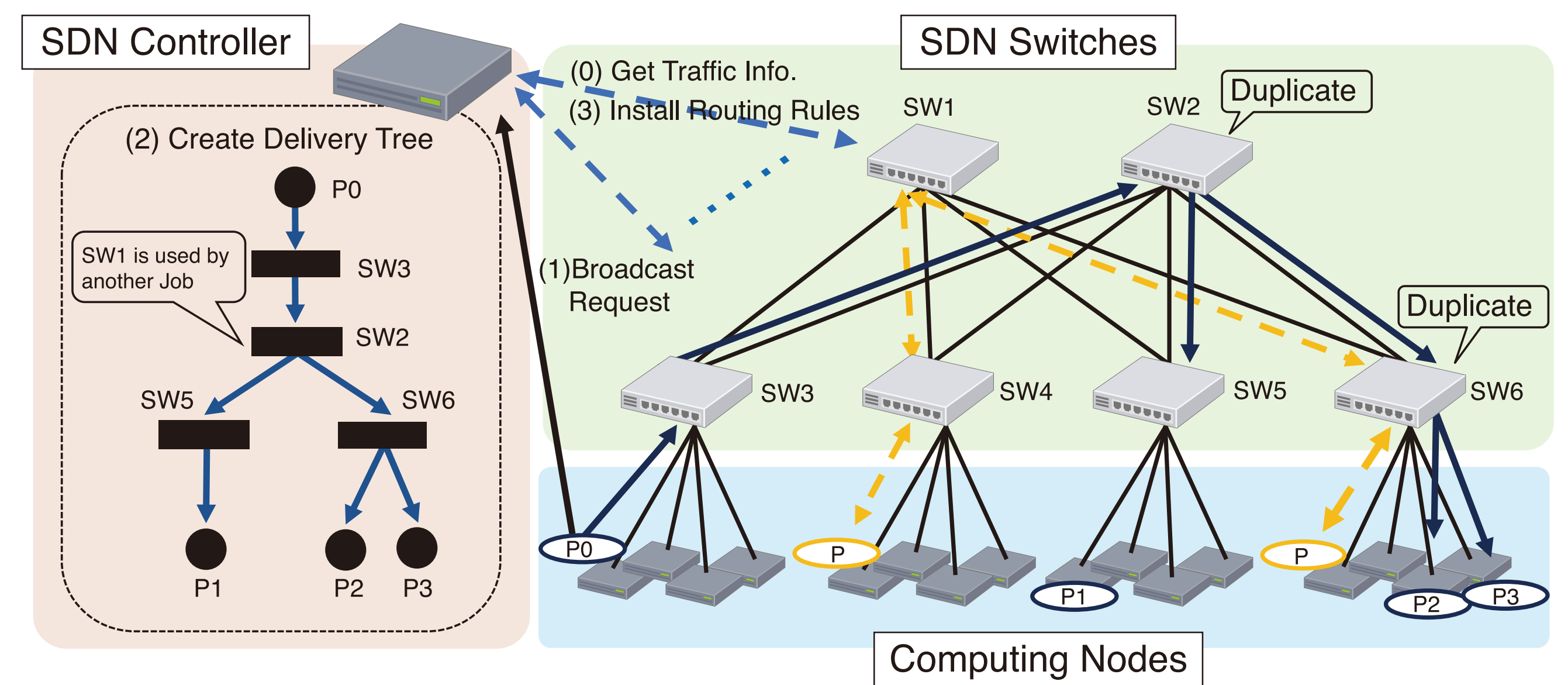
Encode the MPI envelope into a tag and embed into each packet in the kernel



Keichi Takahashi, Susumu Date, Dashdavaa Khureltulga, Yoshiyuki Kido, Hiroaki Yamanaka, Eiji Kawai, Shinji Shimojo, "UnisonFlow: A Software-Defined Coordination Mechanism for Message-Passing Communication and Computation", IEEE Access, vol. 6, no. 1, pp. 23372-23382, 2018.

SDN-enhanced MPI Broadcast

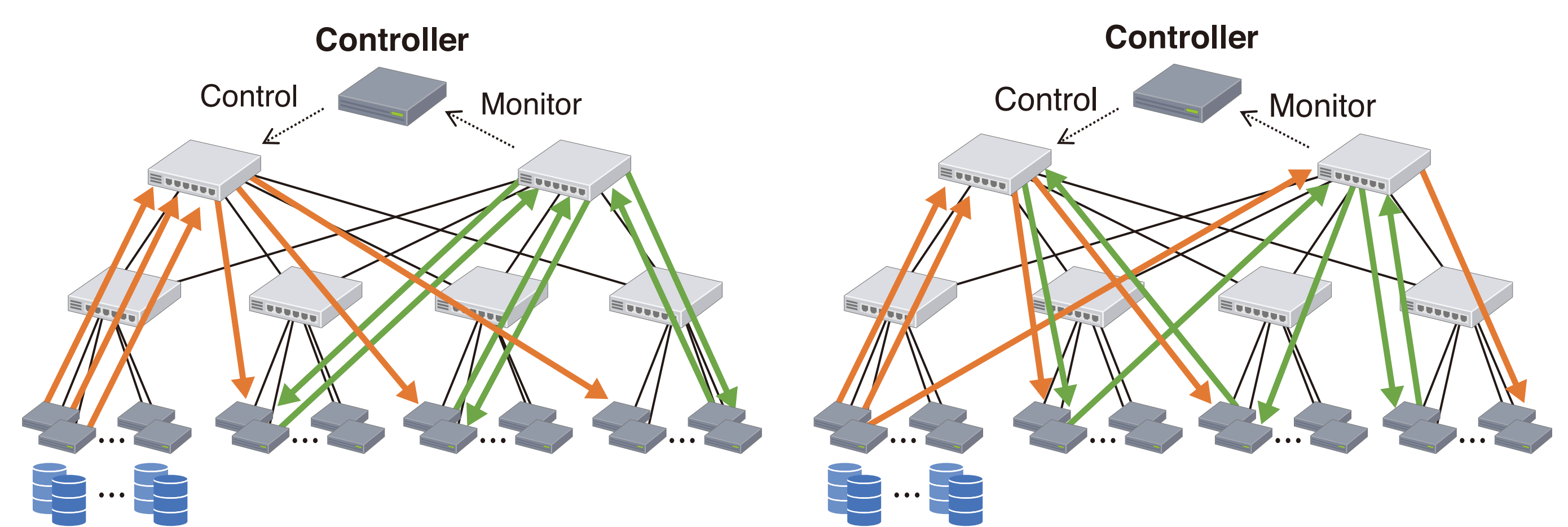
We propose an accelerated implementation of MPI broadcast using SDN (SDN-MPI_Bcast). In this implementation, the SDN controller dynamically installs broadcast route to SDN switches based on the topology of the interconnect and other jobs running in the same cluster.



Hiroaki Morimoto, Khureltulga Dashdavaa, Keichi Takahashi, Yoshiyuki Kido, Susumu Date, Shinji Shimojo, "Design and Implementation of SDN-enhanced MPI Broadcast Targeting a Fat-tree Interconnect", The 2017 International Conference on High Performance Computing & Simulation (HPCS 2017), pp.252-258, Genoa, Italy, July 2017.

Contention Avoidance of Stage IO Communication and Inter-process Communication

We proposed two conflict avoidance methods to investigate whether the conflict between both types of communication has mutual influence on the performance of communication.



Link Sharing Conflict Avoidance

Link Separation Conflict Avoidance

Arata Endo, Ryoichi Jingai, Susumu Date, Yoshiyuki Kido, Shinji Shimojo, "Evaluation of SDN-based Conflict Avoidance between Data Staging and Inter-Process Communication", The 2017 International Conference on High Performance Computing & Simulation (HPCS 2017), pp. 267-273, Genoa, Italy, July 2017.

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