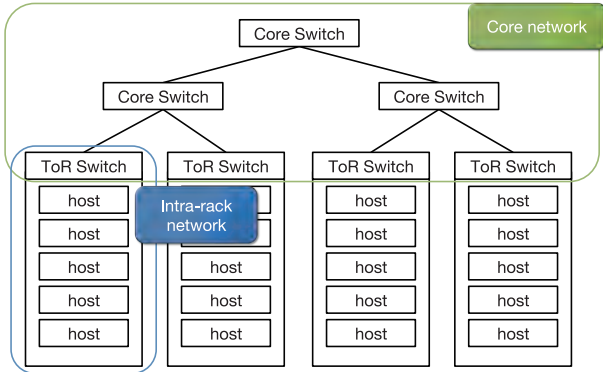


Optical Path Scheduling Methods Considering Host Bandwidth in Data Center Networks

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Introduction

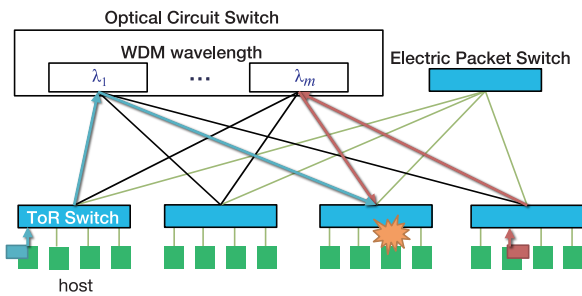
Data centers always need to process large amounts of data and to transfer it at high speeds. Data centers have a high-speed network and a large number of hosts and switches.



Current data center network architectures with electric packet switching consume large amounts of energy. Therefore, in recent years, all optical network technologies have been studied. By using wavelength division multiplexing (WDM), all-optical network is possible to transmit large amounts of data in low energy consumption.

Challenges

In all optical network, it is important to establish optical paths efficiency. We need the effective path establishment method which has a minimum and sufficient number of transmission times. Helios, a data center network architecture with optical circuit switching, does not consider collisions with connections to the same destination host. If one destination host has many connections, there is a possibility that collisions between connections occur and many packets are lost.

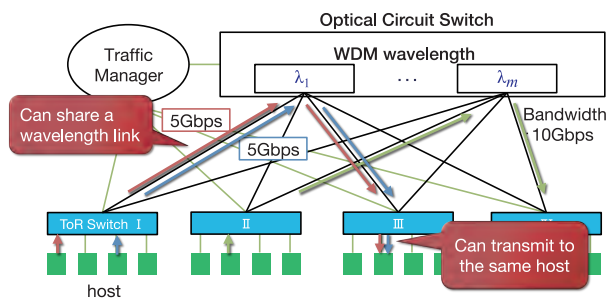


Our Target

We propose path establishment methods considering available bandwidths for each hosts, not only between racks, for data center network architectures with optical circuit switching.

Our Approach

Our proposed method can establish paths as long as the total required bandwidth does not exceed the maximum bandwidth for all link between hosts.

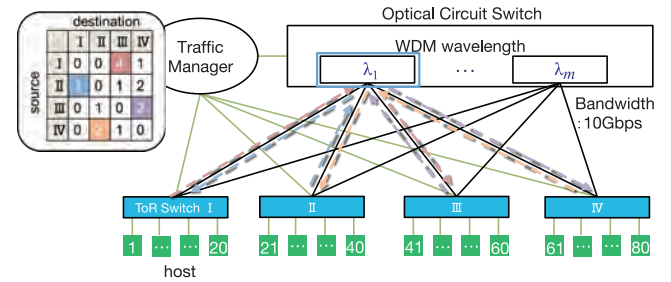


The path establishment method occupying wavelength

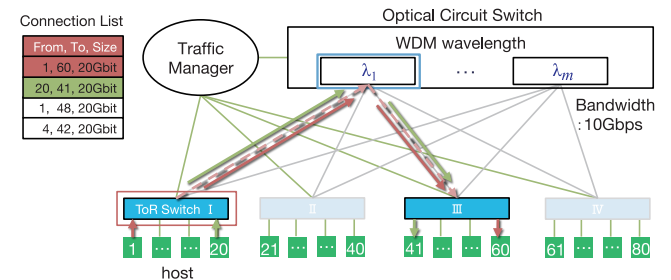
In this study, traffic is sent optically across source destination racks. The traffic manager calculates and establishes optical paths across racks from the number of connections which required path across each rack as well as Helios. In order to do this, the traffic manager has a traffic table that aggregates the total number of connections across all source-destination rack pairs from each ToR switches.

In the proposed method, the path is established through the two-step.

- First, the path between racks are established by using connection lists sent from Top of Rack switches. From connection table between racks, traffic manager establish the path between racks that can send the most connection.

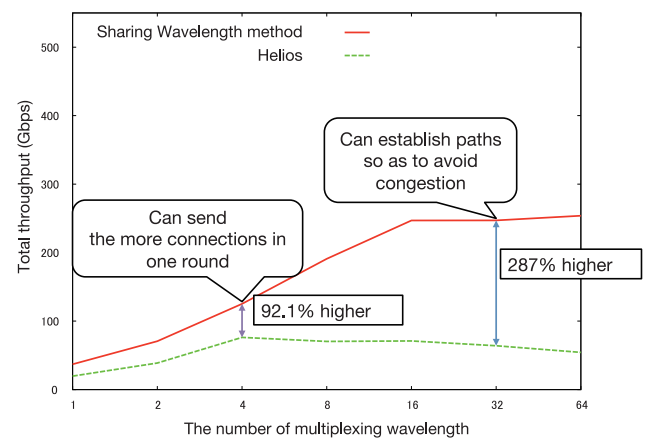


- Second, the traffic manager establishes the paths between hosts based on the path between racks. The traffic manager checks lists for all rack pairs with wavelength, all wavelengths. If the required bandwidth of a connection is less than the available bandwidth between hosts, the connection is established.



Evaluation

We evaluate these path establishment method to compare the proposed system with Helios through simulation. We use the value, the throughput which is calculated from the received data size.



If the number of multiplexed wavelength is small, the path establishment method sharing wavelength has higher throughput than the path establishment method of Helios because this method can send more connections in one round. On the other hand, if the number of multiplexed wavelength is large, the path establishment method wavelength has higher throughput than the Helios because this method can establish paths so as to avoid congestion.