Prof. Yuanyuan Yang is Awarded NSF grant for Data Center Research

Prof. Yuanyuan Yang has received a National Science Foundation grant to investigate a certain type of interconnection network called a “fat tree” for use in data centers. Massive modern data centers consisting of tens of thousands of servers have emerged to form the backbone of a variety of power distributed computer frameworks. Services such as Google and Facebook maintain multiple data centers. Many companies are also moving their services such as e-commerce, scientific computing and social networking to a “cloud” supported by various data centers.

In such large-scale distributed computing frameworks, efficient communication is often required among huge datasets stored in tens of thousands of servers across a data center. The data center network that connects different servers could become the bottleneck of the system. Its performance is essential to the successful operation of a data center. Moreover, many online applications and back-end infrastructural computations hosted by data centers require one-to-many or multicast communication from a server to a group of servers.

This research aims to investigate fundamental and challenging issues that arise in developing design techniques for cost-efficient multicast fat tree data center networks with guaranteed performance by exploring some unique and novel features in data centers. A “fat tree” is an interconnection network connecting servers that has a tree type structure, and branches whose network traffic carrying capacity is adjusted to meet the demand for capacity in different parts of the tree.

This project combines theoretical analysis, algorithm design, network optimization, simulation and prototyping techniques to provide a comprehensive working solution that enables high performance multicast in fat tree data center networks. The outcome of this research has the potential to boost the performance of cloud computing applications currently hosted in data centers, and facilitate the cloud adoption for future applications that rely on group communication and demand predictable high bandwidth. As cloud computing is penetrating into all aspects of society, this research will have a profound impact on society and help change the world.

Prof. Yang has been a member of Stony Brook’s electrical and computer engineering department’s faculty since 1999. She received the PhD degree from The Johns Hopkins University in Baltimore, Maryland. Prof. Yang has been Graduate Program Director of the ECE department for a number of years and is also the Director of the Communications and Devices Division of the New York State Center for Excellence in Wireless and Information Technology (CEWIT) at Stony Brook. Prof. Yang is a Fellow of the IEEE.
Fig. A level-3 fat-tree data center network, where servers are placed in different level-2 fat-trees (pods). Each pod consists of Top-of-Rack (ToR) switches and aggregation switches, and pods are interconnected by core switches.