A Low-cost High-performance Data Center Network for Cloud Computing (TD1b-10)

CAO Lei

Supervisor: Dr. Danny Hin-Kwok TSANG

Introduction
Cloud computing is one of the most promising web-based processing technologies to prevail in the near future. It is the technology where a cloud platform provides the operations, data storage and other computing resources to devices such as smartphones and PCs that are connected to them over the internet. The cloud computing technology leverages burdens which used to be on CPU and memory in PC on “clouds”, the data centers which are constituted by numerous computing and networking nodes such as servers and routers. Since the performance of a data center highly rely on the data transfer and communication between servers, cloud providers are calling for novel designs of low cost high performance internal network architectures to interconnect servers.

Aims and Objectives
In this project, the ultimate goal is to produce and then evaluate a workable flow-based network for cloud data center. The network is expected to be easily scalable, tolerant to link failure and provisioning high capacity under variant traffic load or other network conditions. It’s also preferably to incorporate a non-IP addressing mechanism and a flow-based routing & switching mechanism. Designs that avoid using switches to lower costs, accommodates overlay networks and sustain virtual machines are preferable.

Chord Data Center Design

Structure

Chord is adopted as the skeleton of the network structure for both its popularity in overlay network and its simplicity in interconnecting nodes. Servers in Chord Data Center (CDC) form a circle, with each node having links connection their finger table items.

Without further change, the network would look the same as a Chord with bi-directional finger table. This structure causes redundancy in link connections. To further improve link efficiency, server-pairs are used to replace single servers.

Routing Scheme

- **Traffic-Oblivious Routing** - the most straightforward routing algorithm to find the single shortest path to destination that resembles lookup procedure in Chord
- **Traffic-Aware Routing** - can extend to network failures and find alternative paths to the destination without performance degradation to achieve load balancing

Simulation Results

The first evaluation is designed to see how increasing the order of CDC network would cut off the network throughput regardless of routing scheme.

The second simulation is designed to compare TOR with TAR and to see how many more hops TAR takes that TOR on average, which indicates the increase in end-to-end delay.