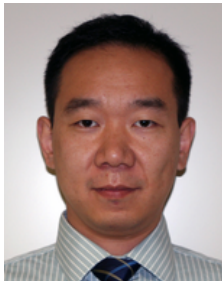


Performance Evaluation Laboratory



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The laboratory mission in the broad sense is to contribute to:

- Cost-Efficient Data Center Networking for Big Data Applications
- Resilient Information Management System for Disaster Recovery
- Software-Defined Networking: Security, Rule Placement and Traffic Engineering

Cost-Efficient Data Center Networking for Big Data Applications

With the explosion of big data, processing large numbers of continuous data streams, i.e., big data stream processing (BDSP), has become a crucial requirement for many scientific and industrial applications in recent years. By offering a pool of computation, communication and storage resources, public clouds, like Amazon's EC2, are undoubtedly the most efficient platforms to meet the ever-growing needs of BDSP. Public cloud service providers usually operate a number of geo-distributed datacenters across the globe. Different datacenter pairs are with different inter-datacenter network costs charged by Internet Service Providers (ISPs). While, inter-datacenter traffic in BDSP constitutes a large portion of a cloud provider's traffic demand over the Internet and incurs substantial communication cost, which may even become the dominant operational expenditure factor. As the datacenter resources are provided in a virtualized way, the virtual machines (VMs) for stream processing tasks can be freely deployed onto any datacenters, provided that the Service Level Agreement (SLA, e.g., quality-of-information) is obeyed. We explore the inter-datacenter network cost diversities to optimize both VM placement and load balancing towards network cost minimization with guaranteed SLA.

Resilient Information Management System for Disaster Recovery

We design and implement a resilient information management (RIM) system applicable under network-isolated environment. RIM can be set up immediately after a disaster happens to serve people as an information collection and distribution system in disaster area, regardless of the Internet availability. It consists of several distributed information centers, each of which is capable of wireless communication covering a limited area. With such system, people can share and acquire information from any information center distributed in the disaster area via their mobile devices like smartphones.

Software-Defined Networking: Security, Rule Placement and Traffic Engineering

Software-defined network (SDN) is the next generation of networking architecture that is dynamic, manageable, cost-effective, and adaptable, making it ideal for the high-bandwidth, dynamic nature of today's applications. In SDN, network management is facilitated through software rather than low-level device configurations. However, the centralized control plane introduced by SDN imposes a great challenge for the network security. We present a secure SDN structure, in which each device is managed by multiple controllers, not just a single as in a traditional manner, with the dynamic and isolated instance provided by the cloud. It can resist Byzantine attacks on controllers and the communication links between controllers and SDN switches. Furthermore, we study a controller minimization problem with security requirement and propose a cost-efficient controller assignment algorithm with a constant approximation ratio.

In addition, we study the scheme to use Ternary Content Addressable Memory (TCAM). As a critical hardware storing rules for high-speed packet processing in SDN-enabled devices, it can be supplied to each device with very limited quantity because it is expensive and energy-consuming. We propose a rule multiplexing scheme, in which the same set of rules deployed on each node apply to the whole flow of a session going through but towards different paths. Based on this scheme, we study the rule placement problem with the objective of minimizing rule space occupation for multiple unicast sessions under QoS constraints. We formulate the optimization problem jointly considering routing engineering and rule placement under both existing and our rule multiplexing schemes.

Summary of Achievement

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- [sguo-48:2014] Song Guo. Cloud Networking for Cost-Efficient Big Data Service Delivery, 2014.
PI, University of Aizu Competitive Research Fund

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- [sguo-49:2014] Seigo Maki. Graduation Thesis: Analysis of fundamental frequency interval for Speech Synthesizer System, The University of Aizu, 2014.
Thesis Advisor: Song Guo

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Master Supervisor: Song Guo

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PhD Supervisor: Song Guo

[sguo-54:2014] Lin Gu. PhD Thesis: Cost Efficient Resource Management in Geo-distributed Data Centers, The University of Aizu, 2014.

PhD Supervisor: Song Guo

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