



Colorado State University's
Information Science and Technology Center (ISTeC)
presents two lectures by



Dr. K.K. Ramakrishnan

**Distinguished Member of Technical Staff
AT&T Labs-Research**

ISTeC Distinguished Lecture
In conjunction with the
Electrical and Computer Engineering Department and
Computer Science Department Seminar Series

“Networking the Cloud: Enabling Enterprise Computing and Storage”

Monday, March 31, 2014
Reception with refreshments: 10:30 am
Lecture: 11:00 am – 12:00 noon
Location: Morgan Library, Event Hall



Electrical and Computer Engineering Department Special Seminar *Sponsored by ISTE C*

**“NetVM: High Performance and Flexible Networking using Virtualization on Commodity
Platforms”**

Monday, March 31, 2014
Lecture: 3:00 – 4:00 pm
Location: Morgan Library Event Hall

ISTeC (Information Science and Technology Center) is a university-wide organization for promoting, facilitating, and enhancing CSU's research, education, and outreach activities pertaining to the design and innovative application of computer, communication, and information systems. For more information please see ISTeC.ColoState.EDU.

Abstracts:

Networking the Cloud: Enabling Enterprise Computing and Storage

Cloud computing has been changing how enterprises run and manage their IT systems. Cloud computing platforms provide customers with flexible, on demand resources at low cost. It also offers the opportunity to lower costs for enterprises in deploying disaster recovery solutions. However, while existing offerings are useful for providing basic computation and storage resources, they have not provided the transparency, security and network controls that many enterprise customers would like. This lecture will start with a brief introduction on Cloud Computing. We propose a Virtual Cloud Pool abstraction to logically unify cloud and enterprise data center resources, and present the vision behind CloudNet, a cloud platform architecture which utilizes Virtual Private Networks to securely and seamlessly link cloud and enterprise sites. CloudNet opens new opportunities for cross data center load balancing and dynamic application placement based on metrics like latency to users or energy cost. Cloud hosting promises economies of scale and on-demand provisioning that are a perfect fit for the infrequent yet urgent needs of disaster recovery. We build on CloudNet to solve the difficult problem of disaster recovery to Cloud sites that are geographically separated from the enterprise's primary site. The WAN latency between a cloud site and an enterprise can become a major performance bottleneck when synchronously replicating an application's data into the cloud. I will describe our proposal called 'Pipelined synchrony' to address this problem.

NetVM: High Performance and Flexible Networking using Virtualization on Commodity Platforms

NetVM brings virtualization to the Network, by enabling high bandwidth network functions to operate at near line speed, while taking advantage of the flexibility and customization of low cost commodity servers. NetVM exploits Intel's DPDK libraries to minimize the overhead of packet processing, and extends this framework and the KVM hypervisor to provide high throughput, low latency networking in virtualized environments. These techniques allow customizable processing capabilities such as firewalls, proxies, and routers to be embedded within the network, thus enabling the vision of software defined networking. NetVM runs network functions on commodity hardware using virtualization software, making it easy to dynamically scale, deploy, and reprogram services. This provides far greater flexibility than existing purpose-built, sometimes proprietary hardware. Complementing the control plane capabilities of SDNs, NetVM allows the system to perform the full range of packet processing required in network elements, including forwarding, implementing policies such as firewalls, and full packet inspection to determine subsequent processing. It does so with dramatically higher throughput than existing software router platforms. We have implemented NetVM on the KVM virtualization platform and detail many of the challenges we have solved such as adding support for high-speed inter-VM communication through shared huge pages and enhancing the CPU scheduler to prevent overheads caused by inter-core communication and context switching. NetVM allows true zero-copy delivery of data to VMs both for packet processing and messaging among VMs within a trust boundary. Our evaluation shows how NetVM can compose complex network functionality from multiple pipelined VMs and still obtain throughputs up to 10 Gbps, an improvement of more than 250% compared to existing techniques that use SR-IOV for virtualized networking.

Speaker Biography:

Dr. K. K. Ramakrishnan until recently was a Distinguished Member of Technical Staff at AT&T Labs-Research. He joined AT&T Bell Labs in 1994 and has been with AT&T Labs-Research since its inception in 1996. Prior to 1994, he was a Technical Director and Consulting Engineer in Networking at Digital Equipment Corporation. Between 2000 and 2002, he was at TeraOptic Networks, Inc., as Founder and Vice President.

Dr. Ramakrishnan is an AT&T Fellow, recognized for his fundamental contributions on communication networks and lasting impact on AT&T and the industry, including his work on congestion control, traffic management and VPN services. He is an IEEE Fellow, and has received other awards. His work on the "DECbit" congestion avoidance protocol was recognized in the 1995 retrospective issue of ACM Sigcomm Computer Communication Review as one of the 16 most important papers published over the previous 25 years in ACM Sigcomm publications. The work once again received the ACM Sigcomm Test of Time Paper Award in 2006. He has published nearly 200 papers and has more than 120 patents issued in his name. K.K. has been on the editorial board of several journals and has served as the TPC Chair and General Chair for several networking conferences and has been a member of the National Research Council Panel on Information Technology for NIST. K. K. received his MS from the Indian Institute of Science (1978), MS (1981) and Ph.D. (1983) in Computer Science from the University of Maryland, College Park, USA. His web page can be found at:

www.research.att.com/archive/people/Ramakrishnan_Kadangode_K

To arrange a meeting with the speaker, please contact Anura Jayasumana, Anura.Jayasumana@ColoState.EDU 970-491-7855