

## Tutorial 2A

### **Content Delivery Networks: Overlay Networks for Scaling and Enhancing the Web**

#### **Speakers:**

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#### **Abstract**

The emergence of Web as a ubiquitous media for sharing content and services has led to the rapid growth of the Internet. At the same time, the number of users accessing Web-based content and services are growing exponentially. This has placed a heavy demand on Internet bandwidth and Web systems hosting content and application services. As a result, many Web sites are unable to manage this demand and offer their services in a timely manner.

Content Delivery Networks (CDNs) have emerged to overcome these limitations by offering infrastructure and mechanisms to deliver content and services in a scalable manner, and enhancing users' Web experience. Applications of CDNs can also be found in many communities, such as academic institutions, advertising media and Internet advertisement companies, data centers, Internet Service Providers (ISPs), online music retailers, mobile operators, consumer electronics manufacturers, and other carrier companies. Along with the proliferation, formation, and consolidation of the CDN landscape, new forms of Internet content and services are coming into picture while distribution and management of content is introducing new challenges in this domain. This raises new issues in the architecture, design and implementation of CDNs. The technological trends in this domain need to be explored in order to provide an exclusive research roadmap to the CDN community.

The proposed tutorial, entitled "*Content Delivery Networks: Fundamentals, Insights and Applications*" builds on the book "Content Delivery Networks", edited by the tutorial presenters, highlighting academic and industrial research and developments, and case studies that are being carried out at many different institutions around the world. This tutorial enables the readers to understand the basics, to identify the underlying technology, to summarize their knowledge on concepts, ideas, principles and various paradigms which span on broad CDNs areas. Therefore, aspects of CDNs in terms of basics, design process, practice, techniques, performances, platforms, applications, and experimental results are presented in a proper order. Fundamental methods, initiatives, significant research results, as well as references for further study are also provided. Comparisons of different design and development approaches are described at the appropriate places so that new researchers as well as advanced practitioners can use the CDNs evaluation as a research roadmap. The tutorial is organized in an appropriate order to maintain consistency so that any reader irrespective of their level of knowledge and technological skills in CDNs could get the most out of it.

This tutorial is organized into three parts, namely, Part I: CDN Fundamentals; Part II: CDN Modeling and Performance; and Part III: Advanced CDN Platforms and Applications. The first part focuses on the basic ideas, techniques, and current practices in CDNs; the second part concentrates on the economic and mathematical modeling of CDNs and their performance; and the final part of the tutorial delineates advanced CDN platforms and applications with wide appeal. The organization ensures the smooth flow of material as successive parts build on prior ones.

#### **Biography of the speakers:**

**Dr. Rajkumar Buyya** is an Associate Professor of Computer Science and Software Engineering; and Director of the Grid Computing and Distributed Systems (GRIDS) Laboratory at the University of Melbourne, Australia. He is the founding CEO of Manjrasoft Pty Ltd., a spin-off company of the University, commercializing innovations originating from the GRIDS Lab. He has authored over 220 publications and three books. The books on emerging topics that Dr. Buyya edited include, High Performance Cluster Computing (Prentice Hall, USA, 1999) and Market-Oriented Grid and Utility Computing (Wiley, 2008). Dr. Buyya has contributed to the creation of high-performance computing and communication system software for Indian PARAM supercomputers. He has pioneered Economic Paradigm for Service-Oriented Grid computing and developed key

Grid technologies such as Gridbus that power the emerging e-Science and e-Business applications. He received "Research Excellence Award" from the University of Melbourne for productive and quality research in computer science and software engineering in 2005. The Journal of Information and Software Technology in Jan 2007 issue, based on an analysis of ISI citations, ranked Dr. Buyya's work (published in Software: Practice and Experience Journal in 2002) as one among the "Top 20 cited Software Engineering Articles in 1986-2005". He received the Chris Wallace Award for Outstanding Research Contribution 2008 from the Computing Research and Education Association of Australasia, CORE, which is an association of university departments of computer science in Australia and New Zealand.

Dr. Buyya served as the first elected Chair of the IEEE Technical Committee on Scalable Computing (TCSC) during 2005-2007 and played a prominent role in the creation and execution of several innovative community programs that propelled TCSC into one of the most successful TCs within the IEEE Computer Society. In recognition of these dedicated services to computing community over a decade, President of the IEEE Computer Society, USA presented Dr. Buyya a "Distinguished Service Award" in 2008. For further information on Dr. Buyya, please visit: <http://www.buyya.com>

**Mukaddim Pathan** is a Researcher at the Grid Computing and Distributed Systems (GRIDS) Lab of the University of Melbourne, Australia. His research interests include resource allocation, load balancing, and coordination policies in wide-area distributed systems, CDN internetworking, grid computing, utility computing, and peer-to-peer networks. He is actively engaged in research and development projects for the next-generation content networking, service oriented grid, utility computing and their applications (under the flagship project GRIDBUS). He is the editor of the book *Content Delivery Networks*, Lecture Notes in Electrical Engineering, Vol. 9, Springer-Verlag, Germany. He has authored and co-authored about 30 research papers in internationally recognized journals and conferences. He is a member of IEEE, IEEE computer society, and ACM. He is involved as a co-chair in the organization of the UPGRADE-CN'08 and IDCS'08 workshops and is a PC member of several international conferences. He also serves as the reviewer of a few renowned journals and magazines such as IEEE Transactions on Circuits and Systems for Video Technology (TCSVT), Computer Networks, Computer Communications, and IEEE Software.

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