8th IEEE International Conference on NETWORKS 2000
5 - 8 September 2000
Singapore

With Guest of Honour
Dr. Brian Chen
Chief Technology Officer
Infocomm Development Authority of Singapore

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National Taiwan University of Science and Technology, Taiwan

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Helsinki University of Technology, Finland

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Synopsis

Multi-Protocol Label Switching (MPLS) is an emerging technology that promises to change the way service providers run and manage their network. From its beginning as simply a faster way of forwarding packets, MPLS has turned out to be an enabling technology that allows for easy provision of new network services such as differentiated services, VPN and traffic engineering. This tutorial will start with a review of basic MPLS concepts and mechanisms. We then move on to examine the label distribution protocols, including LDP/CRLDP and RSVP. We will then cover some interesting applications enabled by MPLS: traffic engineering, virtual private networking and differentiated services. We will conclude with short discussion of current state of MPLS standardisation within IETF and some new work items.

Biographies

AJITH NARAYANAN

AJITH NARAYANAN (ajithn@sg.ibm.com) led an MPLS R&D effort at IBM's Emerging Technology Centre in Singapore. His past work includes the design and development of network protocol stacks as well as networked application. While at ITI, he was involved in major national initiatives such as National High Speed TestBed (now SingaREN) and SingaporeONE. He also served in various technical committees in the industry. He received his B.Eng degree from Nanyang Technological University and a M.Sc degree from University of Essex.

Synopsis

The increasing volume and evolving types of Internet applications have been demanding enhanced services, both in terms of performance and quality of service (QoS), from the Internet infrastructure. The current best-effort service model of the Internet and the web servers are not suitable for fast growing applications such as, continuous media, e-commerce, and several other business services. To provide better services to these important and expanding classes of applications, it is necessary for the Internet infrastructure to provide service differentiation. The Internet infrastructure includes not only the network components but also the web servers (includes proxy servers, application servers, etc.). This tutorial targets QoS issues at both the network level as well as server level.

The differentiated service (DiffServ) model proposed by the Internet Engineering Task Force (IETF) has received wider acceptance in the research community and is being actively considered for possible implementation in the next generation Internet. Unlike integrated services, DiffServ does not require end-to-end resource reservation or any state maintenance at the core routers of the Internet domains. Rather than the per-flow basis model, DiffServ routes packets based on the concept of per-hop behavior (PHB) model, in which packets are marked at the edge routers and are routed by the core routers based on the markings. The markings relate to the QoS requirements. Both the markings and the PHB are handled on an aggregated basis. In addition to providing service differentiation in the Internet, DiffServ architecture is a scalable, feasible, and economical. We will do a detailed study of the various issues involved in DiffServ, its basic support requirements, characteristics, and several other research and implementation aspects. Two different approaches for DiffServ expedited forwarding and assured forwarding - will be analyzed. We will also discuss other approaches for providing DiffServ, such as relative differentiation and QoSguaranteed DiffServ. In addition, we will discuss the role of TCP in supporting differentiated services. The goals of DiffServ architecture may not be met if it is implemented only at the network level. To provide end-to-end QoS, Internet server must also be capable of providing differentiated services. Unfortunately, the research on the server-level service differentiation has not kept on par with the network-level service differentiation. The current generation Internet servers provide service on a first-come-first serve basis, which is inadequate for QoS-aware applications. We will propose and discuss in detail about service differentiating Internet servers (SDIS). Resource management is the key issue in providing efficient service differentiation at the server level. Thus, we will analyze scheduling, admission control, and other implementation details of SDIS.

The capacity planning of Internet servers are based on the average workload characteristics. However, Internet workload is very indeterministic; the maximum bandwidth or computation requirements may exceed the corresponding average value by several orders of magnitude. Thus overload control is a critical issues in managing the server loads. We will explore the issues involved in the implementation of efficient overload control techniques. In this tutorial we will present the state of the art issues on the proposed topic as well as introduce new and novel avenues for research and development.

Future work on important issues like multicasting and security will also be discussed.

Audience

This tutorial is aimed both at researchers and practitioners. It will also immensely help students pursuing research in Internet and other networking issues. The discussions can be useful for both beginners and intermediate level audiences. The prior knowledge required for this tutorial is a basic understanding of computers networks.

Biography

Prasvant Mohapatra received his Ph.D. in computer engineering from the Pennsylvania State University in 1993. He was an assistant professor and then an associate professor in the Department of Electrical and Computer Engineering at Iowa State University from 1993 to 1999. Since then he has been an associate professor in the Department of Computer Science and Engineering at Michigan State University. During the summers of 1998 and 1999, he worked in the Panasonic Information Networking and Technologies Laboratory (PINTL) and at the Server Architecture Laboratory of Intel Corporation, respectively.

Dr. Mohapatra has published extensively in various international journals and conferences, and has two patents pending in the internetworking area. He has been an invited speaker at several universities and other organizations. He has taught several advanced courses in computer networks, architecture, performance evaluation, and multimedia systems. Dr. Mohapatra has graduated three Ph.D. students and about fifteen Masters students, and is current guiding about five Ph.D. and four Masters students. His research work has been funded and collaborated by National Science Foundation, EMC Corporation, Panasonic Technologies, Rockwell International, and Intel Corporation.

Dr. Mohapatra is a senior member of the IEEE and a member of the ACM. He is currently on the editorial board of the IEEE Transactions on Computers. He has been on the program committees of several international conferences. In 2000, he is the Program Chair of the workshop on Performance and Architecture of Web Servers (PAWS) to be held in conjunction with the SIGMETRICS conference.
Tutorial 3: Satellite Communications

Instructor: Dr. Cheng Heng Seng, Singapore Advanced Research and Education Network (SingAREN)
Date: Tuesday, 5 September 2000
Venue: EA-02-15
Time: 0900-1300

The following topics are covered:

1) Introduction to satellite communications
2) Introduction to satellite antennas
3) Modulation schemes
4) Forward error correction (FEC) for satellite links
5) Satellite access methods
6) Very small aperture terminals (VSATs)
7) Planning a Satellite System
8) Direct video broadcasting (DVB) over satellite links
9) Mobile satellite communications
10) Integration of networking and satellite communications
11) Business opportunities in satellite communications
12) Future Trends in Satellite Communications

Biography

Dr. Cheng Heng Seng received a PhD degree in Engineering from University of Aberdeen in the United Kingdom for his research in satellite communications, specifically in the enhancement of asynchronous transfer mode (ATM) over satellite links. Dr. Cheng's research was sponsored by the Defence Evaluation and Research Agency (DERA) and he also received an Overseas Research Student (ORS) award from the Committee of Vice-Chancellors and Principals in the UK. After graduation, Dr. Cheng spent another six months at University of Aberdeen as a post-doctoral research fellow to carry out research and development for DERA.

Since May 1999, Dr. Cheng has been with the Singapore Advanced Research and Education Network (SingAREN) where he continues to work in the area of satellite communications. At SingAREN, he designed a satellite ATM network which can be used for the provision of internet protocol (IP) services and has successfully carried out trials of transmitting ATM cells across a high-speed satellite link. He has also performed satellite trials to investigate the performance of various coding schemes (e.g. rate ½ convolutional coding, rate ¾ convolutional coding, Reed-Solomon coding). He is also developing techniques to enhance the performance of ATM over satellite links.

Currently, Dr. Cheng’s main area of work is the design and construction of a time division multiple access – demand assigned multiple access (TDMA-DAMA) based satellite network which is more efficient in the use of satellite bandwidth and which will be used for connecting SingAREN’s network with the research and education centres in countries whose terrestrial telecommunication infrastructure is inadequate. Dr. Cheng has also advised the Infocomm Development Authority (IDA) on projects involving satellite communications.

Prior to his postgraduate study, Dr. Cheng has worked as a service engineer and development engineer in Singapore Electronics and Engineering Limited (SEEL) where he developed software for testing digital systems and a video system.

Tutorial 4: Convergence in Communications: Industry, Technology and Service Perspectives

Instructor: Dr. Wang Weiguo, CTO, Alcatel (Singapore) Pte Ltd
Date: Wednesday, 6 September 2000
Venue: EA 02-15
Time: 0900-1230

Synopsis:

Exponential growth of IP based network technology and business is making tremendous impact to the communications industry, the network technologies and services. There is a trend for convergence in all of these aspects. This tutorial aims to share with the audience the current development and discuss on future trends in these aspects.

1. Driving forces of telecommunications industry
   - De-regulation
   - Technology

2. Industry trends
   - More plays
     - Incumbent (national) operators
     - Competitive operators (new comers)
     - ISPs
     - Regionalization
     - Mergers

3. Technology Convergence
   - Data over Voice
     - Toll by-pass, Signaling gateway,
     - ISP whole-sale, Broadband wholesale

4. Service Convergence
   - Brief Intro to IN
   - Internet Call waiting
   - Intelligent call centres
     - Unified messaging
   - Multi-terminal portals
   - Location based services

5. Trends
   - Industry
   - Technology
   - Services

Biography

Dr. Wang is the Chief Technology Officer at Alcatel Singapore. His primary role is to provide network solutions in emerging opportunities in the converged voice and data communication market. Dr Wang obtained his MA and PhD in Computer Science at Boston University, USA in 1985 and 1991 respectively. He spent more than 8 years in Kent Ridge Digital Labs, Singapore's national IT R&D lab. The majority of his R&D career was in the areas of broadband networking, multimedia services and open architectures and programmable networks. He was instrumental in building up the Singapore National High-speed ATM test network in 1995, and involved in the conceptualization and realization of the Singapore ONE network.
### Tutorial 5: Application Service Providers - A New Trend in Internet-Based Business

**Instructor:** Dr. Borko Furht, Florida Atlantic University, USA  
**Date:** Wednesday, 6 September 2000  
**Venue:** EA 02-15  
**Time:** 1330 – 1700

**Description and Objective**
The objective of this tutorial is to provide an in-depth survey of technologies, systems, and Internet architectures for Application Service Providers. The first wave of Internet-based business included Internet Service Providers (ISPs) that linked business and consumers via the Internet. We are presently at the verge of the second, much larger wave – Application Service Providers (ASPs), which lease software applications to businesses and consumers via the Internet. In this tutorial we will introduce components of the ASP model and discuss new multi-tier Internet architectures for ASPs. We will present key technologies that enabled the ASP model, including advances in networking technologies, Internet deliverable software, and improvements in distributed systems management software. We will then discuss types of ASP applications, from personal and collaborative to E-commerce, vertical, and analytical applications and present the ASP software is created. We will complete the tutorial introducing leading ASP companies and their products and services.

**Target Audience**
This tutorial is intended for system designers, engineers, and programmers who are interested in receiving an overview of the state-of-the-art in Application Service Providers. This course assumes little familiarity with Internet systems and technologies. This tutorial can also be beneficial for managers and engineers involved in Internet-based business and applications.

**Tutorial Material**
1. Class notes including copies of all transparencies
2. Key articles on ASPs

**Speaker’s Biography**
Borko Furht is a professor of computer science and engineering at Florida Atlantic University (FAU) in Boca Raton, Florida. He is the founder and director of the Multimedia Laboratory at FAU, funded by National Science Foundation. Before joining FAU, he was a vice president of research and a senior director of development at Modcomp, a computer company of Daimler Benz, Germany, a professor at University of Miami in Coral Gables, Florida, and senior scientist at the Institute “Boris Kidric”-Vinca in Belgrade, Yugoslavia. Professor Furht received BSEE (Dipl.Eng.), M.Sc. and Ph.D. degrees in electrical and computer engineering from the University of Belgrade. His current research is in multimedia systems, Internet computing and applications, video coding and video databases. He is the author of numerous books and articles in the areas of multimedia, computer architecture, real-time computing, and operating systems. He is a founder and editor-in-chief of the Journal of Multimedia Tools and Applications (Kluwer Academic Publishers). Recently, he was editor-in-chief of the following handbooks – Handbook of Internet Computing (2000), Handbook of Multimdia Computing (1999), and Handbook of Internet and Multimedia Systems and Applications (1999), published by CRC Press. He has received technical and publishing awards, and has consulted for many high-tech companies including IBM, Hewlett-Packard, Xerox, General Electric, JPL, NASA, Honeywell, and RCA. He has also served as a consultant to various colleges and universities. He has given many invited talks, keynote lectures, seminars, and tutorials. He is a senior member of the IEEE and member of the ACM.

**Tutorial Outline**
- From Internet Service Providers to Application Service Providers
- ASP Model
- Types of ASP Applications
- Key ASP Market Trends
- Key Technologies that Enabled ASP Model
- Driving Trends in ASP
- ASP Implementations
- ASP Internet Architectures
- Application Server Technologies
- ASP Companies and Their Products and Services

### Tutorial 6: Mobile Ad Hoc Networks

**Instructor:** Prof. C.K. Toh, Director, Mobile Multimedia & HiSpeed Network Lab, School of Electrical and Computer Engineering, Georgia Institute of Technology  
**Date:** Wednesday, 6 September 2000  
**Venue:** EA 02-11  
**Time:** 0900-1700

**Synopsis**
Wireless communications, wireless access and wireless networking are essential elements to support mobile computing. Just as the saying ‘the network is the computer’, wireless networking is mobile computing. Performing work on a laptop is not truly mobile computing since there is no provision for information ‘push’ and ‘pull’ capability. The ability to be networked anytime and anywhere results in no boundaries in the way we communicate and work. Devices nowadays are getting more intelligent and autonomous - they are gradually being ‘detached’ from the wired networks, i.e., the bond between mobile devices and wireless base stations are detached. A new paradigm comprising of autonomous mobile ‘network-capable’ devices known as ad hoc mobile networking has evolved. This tutorial provides insights into the technical know-how of ad hoc wireless networking, the various current ad hoc unicast and multicast routing protocols. Applications and future technical challenges will also be discussed in this tutorial. In this talk, I will present the vision and technical details behind these two emerging industry standards. I will describe how these technologies complement each other and yes, how they have the potential of ‘revolutionizing’ wireless communications, networking and computing.

**Outline**
1. Introduction to Wireless Networks
2. Fundamentals of Ad Hoc Wireless Networks
3. Routing Protocols for Ad Hoc Wireless Networks
4. Supporting Multicasting in Ad Hoc Wireless Networks
5. Potential Applications
6. Future Challenges

**Biography:**
C-K. Toh received his electrical engineering and computer science degrees from the University of Manchester Institute of Science & Technology and the University of Cambridge, England. Dr. Toh was awarded a US patent in the field of mobile ad hoc networks, and is Director of the Ad Hoc Wireless Networking & Computing Consortium. He is Editor for IEEE Journal on Selected Areas in Communications and IEEE Network. He is a Senior Member of IEEE, Fellow of Cambridge Philosophical Society and Chartered Electrica Engineer. He is listed in MARQUIS Who's Who in the World.
1. Learning-Automata-Based MAC Protocols for Photonic LANs
   Georgios Papadimitriou; Andreas Pomportsis
   Aristotle University, Greece

2. A Core-Stateless Buffer Management Mechanism for Differentiated Services
   Internet
   Y. Thomas Hou; Dapeng Wu; Zhi-Li Zhang
   Fujitsu Labs of America; Polytechnic University; University of
   Minnesota, USA

3. Modeling VBR Traffic With Autoregressive Gaussian Processes
   Jung-Shian Li
   National Cheng-Kung University, Republic of China

4. The Study of Applying the ODP/UML for the VPN Service Management
   Information Modeling
   Xuesong Qiu
   Beijing University of Posts and Telecommunications, P.R. China

5. UBR++: Improving TCP Performance over ATM-UBR using a New Packet
   Discard Scheme
   Aly El-Abd
   Arab Academy for Science & Technology, Egypt

6. Providing Minimum Bandwidth Guarantees to TCP Traffic in ATM
   Networks
   Xin Zhang; Chee Heng Tan
   Nanyang Technological University, Singapore

7. Modeling and Simulation of STTP, a Proactive Transport Protocol
   Rik Wade; Mourad Kara; Peter Dew
   University of Leeds, Great Britain

8. Weight-Based Fair Intelligent Bandwidth Allocation for Rate Adaptive
   Video Traffic
   Xiaomei Yu; Doan B. Hoang; David D. Feng
   University of Sydney, Australia

9. A Novel Priority Weight-based Explicit Rate Allocation Scheme for ATM
   ABR Services
   Dong Xu; Yew Hock Ang
   Nanyang Technological University, Singapore

10. QoS Fairness for Layered Video Transmission over the Internet
    Zhiyong Chen; Liwen Zhang
    Nanyang Technological University, Singapore

11. A Reliable Multicast Protocol for Mobile Networks
    Chun-Hung Lin
    National Chung Cheng University, Republic of China

Conference Location

Technical Session Track 1:
Blk EA-Engineering Auditorium

Technical Session Track 2:
Blk EA-02-11
Secretariat Room: Blk EA-01-06
Practice Room:
Blk EA-02-15 on 7 & 8 Sep 2000

All above venues are located in:
Faculty of Engineering, Blk EA
(Beside University Hall)
9 Engineering Drive 1
Singapore 117576

(please see conference facility map on last page)

Tutorial Notes

Notes for tutorials may be purchased at S$20.00
per copy, with the exception to the notes on
"Mobile Ad Hoc Networks", as notes for this
tutorial is not for sale.

Conference Proceedings

Additional proceedings can be purchased at S$100.00 per copy

Transportation Arrangements

Between NUS and Grand Plaza Parkroyal & Spa Hotel
Thur, 7 Sep 2000
0815 hours: From Hotel to NUS.
1800 hours: From NUS to Hotel.
Fri, 8 Sep 2000
0815 hours: From Hotel to NUS.
1745 hours: From NUS to Hotel.

Public Transport

Nearest MRT Station:
Clementi
From Clementi MRT/Bus Station:
Take bus no. 96.
Buses to NUS:
No. 33, 96, 151, 188
Preliminary Announcement

The 9th IEEE International Conference on Networks’2001
(IEEE ICON 2001)
October 9-12, 2001
Bangkok, Thailand

Schedule

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<tr>
<td>Paper Submission</td>
<td>April 3, 2001</td>
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<tr>
<td>Notification of Acceptance</td>
<td>June 15, 2001</td>
</tr>
<tr>
<td>Camera-ready Manuscript Submission</td>
<td>July 31, 2001</td>
</tr>
</tbody>
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Submission/Correspondence Address

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