

Tutorial 1 (9.00-12.30)

Performance Challenges and Optimization Potential of Current P2P Overlay Technologies

Tobias Hossfeld and Simon Oechsner (University of Würzburg, DE)

Abstract

There are currently three main overlay types that are in wide-spread use in the Internet. These are search overlays, file-sharing overlays and video-streaming overlays. A common feature that sets these types of overlay apart from the large number of theoretic approaches is that they are all implemented in real applications and are in use under realistic conditions. As a result, they face challenges that are not only of academic interest, but that stem from problems faced during actual operation. Thus, the identification of these challenges and according optimization of the overlays leads to results that have practical relevance.

In this tutorial, we:

- describe the relevant applications and protocols (Chord, Kademia, BitTorrent, NICE, Tribler)
- discuss the challenges they experience in their deployment (User perceived quality, traffic management)
- and present current solutions and optimization approaches (one-hop DHTs, application layer traffic optimization, scalable video codecs)

Tutorial 2 (9.00-12.30)

Optical Network Design and Management: Scalable Optimization Techniques.

Brigitte Jaumard (CIISE, Concordia University, CA)

Abstract

Design and planning of WDM optical networks, whether access, metropolitan or backbone networks is a multi dimensional problem. Indeed, although the main criteria that first comes in mind is deployment cost, there are several other aspects that need to be considered in the design decision process. The flexibility in bandwidth allocation, scalability, and resiliency are among other important aspects that must be considered in the choice of a particular design strategy because they lead to various tradeoffs among several design parameters and cost.

The high bandwidth brought by WDM access technology has prompted network operators to extensive deployment of WDM in access, metro, and backbone networks. Edges of networks have been pushed and transport capacity significantly increased, making the design, planning and management tasks harder. Consequently, efficient and scalable optimization tools are, more than ever, needed to help network designers.

Most of the design, planning and management problems arising in optical WDM network are large scale optimization and hard combinatorial ones that cannot be tackled efficiently with the classical Integer Linear Programming (ILP) approaches. The Column Generation (CG) technique is an efficient optimization tool which has been shown to be very effective for solving particular classes of large scale problems, especially optical networks. Indeed, combined with classical ILP tools, the CG technique offers a valuable tool for the design of highly efficient global search heuristics with an indication on the distance to the globally optimal solution when an exact solution is not possible.

The objective of this tutorial is to provide an in-depth understanding on the potential and the use of CG and ILP tools throughout different network design examples arising in the design and planning of WDM networks. We will discuss several practical design problems, and show that such tools, contrary to classical ILP solution methods, are highly efficient, flexible and scalable.

Detailed outline of topics covered

1. Large scale optimization
 - Generalities
 - Explicit vs. Implicit Enumeration
 - Column Generation
 - Integer Linear Programming (ILP)
 - An example
2. WDM Optical Network Design Optimization Tools: Some Examples
 - Logical Topology Configuration and Reconfiguration
 - Cross-Layer Design
3. WDM Optical Network Planning Optimization Tools: Some Examples
 - Resource Allocation in Optical Grid Computing
 - Nodal Equipment Planning Upgrade in Core Optical Networks
4. WDM Optical Network Management Optimization Tools: Some Examples
 - GRWA - Grooming, Routing and Wavelength Assignment in Mesh Networks
 - Protection Paradigms
 - Classical Protection Paradigm

- Envelope Paradigm with p -Structures
5. Conclusions

Biography of speaker

Brigitte Jaumard holds a Concordia University Research Chair, Tier 1, on the Optimization of Communication Networks in the CIISE - Concordia Institute for Information Systems and Engineering - Institute at Concordia University. She was previously awarded a Canada Research Chair - Tier 1 - in the Department of Computer Science and Operations Research at Université de Montréal. She is an active researcher in the application of large scale optimization techniques for solving various telecommunications problems, both for optical and wireless networks. Recent contributions include (i) the development of efficient methods/designs for working and protection schemes in optical networks and grids, including cost and QoS (Quality of Service) concerns, (ii) the design of lossless OBS networks thank to the use of translucent architectures as an effective compromise between loss and end-to-end delays. B. Jaumard has organized several international conferences, including an annual Workshop on the Optimization of Optical Networks (with an attendance of 120 attendees), and the forthcoming INFORMS Telecom Conference 2010. B. Jaumard has published over 200 papers in international journals in Telecommunications and Operations Research.

Tutorial 3 (14.00-17.30)

Energy-aware Networks

Dario Rossi, (Telecom ParisTech, FR)

Abstract

Reduction of unnecessary energy consumption is becoming a major in wired networking, in reason of both the potential economical benefits and its forecast environmental impact. These issues, usually referred to as "green networking", relate to embedding energy-awareness in networks design, devices and protocols. In this tutorial, we first phrase a more precise definition of the „Green" attribute, identifying furthermore a few paradigms that are the key enablers of energy-aware networking research. We then overview the current state of art, providing a taxonomy of the relevant work: from a high level perspective, we identify four branches of green networking research, that stem from different observations on the root causes of energy waste. Such branches can be identified, namely, as (i) Adaptive Link Rate, (ii) Interface proxying, (iii) Energy-aware infrastructures and (iv) Energy-aware applications. The covered material will not only dig into specific proposal pertaining to one of the above branches, but also offer a perspective look on the open research point.

Biography of speaker

Dario Rossi (M'02) received his M.Sc. and Ph.D from Politecnico di Torino in and 2005 respectively. Between September 2003 and August 2004 he held a visiting researcher position in the Computer Science division at University of California, Berkeley. Since October 2006, he is an Associate Professor at Telecom ParisTech, in Paris, France, where he is responsible for several European research projects, such as FP7 NAPA-WINE, Celtic TIGER, TIGER2 and TRANS. He has co-authored about 50 papers in leading conferences and journals, holds 4 patents and he participated in the program committees of several conferences including IEEE ICC, IPCCC and Globecom. His research interests include peer-2-peer networks, Internet traffic measurement and energy-aware networks.

Tutorial 4 (14.00-17.30)

Innovative Solutions for Wireless Systems LTE Radio Network Planning

Sławomir Pietrzyk (Innovative Solutions, PL)

Abstract

LTE radio interface (i.e., E-UTRA) is built around OFDMA, SC-FDMA and MIMO. This is a different set of radio transmission techniques than the one used in the previous 3GPP standards (such as GERAN or UTRAN). OFDMA and SC-FDMA allow to utilize the parallelism in the frequency domain and to manage the spectral resource with the high level of granularity. MIMO provides yet another domain, namely space. These schemes cause that the radio planning process for LTE is different than that of the previous standards. In this tutorial we highlight the important differences in the radio interface architecture, draw conclusions on how they impact the process of radio network planning and formulate a set of recommendations on how to deal with these differences.

Detailed outline of topics covered

This tutorial provides an overview of the most important issues that need to be taken into account during the LTE radio network design process. We start by characterization of the E-UTRA radio interface, putting special emphasis on its most important features and explaining their influence on the network performance. This includes the frequency domain parallelism and multiuser diversity, peak-to-average power ratio problem (PAPR), the influence of the Cyclic Prefix, transmit power concentration and subchannelization gain, as well as the role of schedulers. We outline the applicable propagation models and give special attention to the usage of MIMO. Then we review the radio network design process by addressing the RF planning issues, link budget calculations and the co-channel interference challenges of the reuse one system scenario. We outline the key methods of interference control and show how to estimate the capacity of the LTE radio network. Finally, we address the problem of configuration of the key LTE radio procedures, such as synchronization, cell search and random access.

This tutorial is suitable for researchers, practicing engineers and technical managers. It can be of special interest to all professionals interested in topics such as: LTE, WiMAX, 4G and radio network planning.

After completing this tutorial, the participants will be able to:

- describe the E-UTRA radio interface
- outline the key features of the new radio interface having impact on the radio planning of the network
- explain basic methods of interference management typical for LTE
- solve basic network configuration problems

Biography of speaker

Dr Sławomir Pietrzyk is the founder and CEO of Innovative Solutions, a consulting and development company supporting its clients in design and implementation of cutting-edge wireless access systems and specializing in OFDMA/MIMO-based radio interface. He is the author of the first book on OFDMA, entitled "OFDMA or Broadband Wireless Access", published in 2006 by Artech House. Sławomir completed his Ph.D. degree in the area of wireless Access systems at the Delft University of Technology in the Netherlands in 2005. He holds M.Sc. in telecommunications and postgraduate diploma in management. Prior to Innovative Solutions, Dr Pietrzyk worked for Polska Telefonia Cyfrowa (a T-Mobile daughter company) and Ubiquitous

Communication Program at the Delft University of Technology. His international experience includes also Interuniversity Microelectronics Center (IMEC) in Leuven, Belgium, OTE (national telecom operator) in Greece and TP SA (national telecom operator) in Poland. Dr Pietrzyk is the author of several papers on communication technologies and a reviewer for IEEE journals and conferences including Transactions on Communications, Journal on Selected Areas in Communications, ICC, Globecom and VTC.