IPTV: challenges and future directions

Oscar M. Bonastre · Marie-José Montpetit ·
Pablo Cesar

Published online: 9 October 2010
© Springer Science+Business Media, LLC 2010

Abstract The move to IP Protocol Television (IPTV) has challenged the traditional television industry by opening the Internet to high quality real time television content delivery. Thus it has provided an enabling set of key technologies to understand and foster further innovations in the multimedia landscape and to create dynamics in the TV value chain. This editorial provides a brief overview of this special issue. It begins with a short introduction to IPTV Technology and then summarizes the main contributions of the selected papers for this special issue, highlighting their salient features and novel results.

Keywords IPTV · IP video · Networked video · Quality of service · IPTV technologies

1 Introduction

Internet Protocol Television (IPTV) is capable of delivering a rich set of ancillary services along with high quality TV content through Internet Protocol (IP) networks. Commercial IPTV usually is distributed over a form or another of Virtual Private

Special Issue—Multimedia Tools and Applications—Springer-Verlag 2011

O. M. Bonastre
Operations Research Centre, Miguel Hernandez University, Av. Universidad s/n, 03202 Elx, Spain
e-mail: oscar.martinez@umh.es

M.-J. Montpetit
Research Lab for Electronics (RLE), Massachusetts Institute of Technology (MIT), 77 Massachusetts
Avenue, Cambridge, MA 02139-4307, USA
e-mail: mariejo@mit.edu

P. Cesar (✉)
CWI: Centrum Wiskunde & Informatica, Science Park 123, 1098XG Amsterdam, The Netherlands
e-mail: P.S.Cesar@cwi.nl

Network or VPN to ensure end-to-end quality of the delivery. The use of IP networking implies that media located in different sources can be distributed over any IP network to reach a large number of consumers and be rendered over an increasingly diverse set of end devices. Moreover, media content may be re-assembled at the end points to satisfy different consumer needs using locally executed software and personalization engines. This increased level of connectivity and convergence has fostered the development of new platforms that makes possible to aggregate information and entertainment, meeting individual user requirements.

IPTV technology also provides attractive business model for telecommunication service providers and creates new challenges in research along the television value chain. Furthermore, it is also appealing to service and application providers, who can offer personalized content and widgets, individually customized to individual's TV programs or localized to a specific region or community. For example, one main revenue source in the IPTV industry is expected to be recommendation systems in conjunction with top existing social media providers.

Television as a monolithic distribution medium is undergoing a radical transformation: from unidirectional broadcasting to Internet-connected. New challenges are emerging: how to deliver a world of content to “any device, anytime, anywhere” and innovative new means of interacting with content and other viewers such as Social TV? As a result, IPTV technology will evolve rapidly from its original concept of “me-too” TV over IP to encompass services usually associated with the web, gaming and social networking and change the way we access information and entertainment in the near future.

2 Summary of selected papers for this special issue

The first paper, by Avramova et al., studies the performance of scalable video coding for VBR TV channels transport with multiple device resolutions and required video quality. The work characterizes the fluctuations of the bit rate associated with one TV channel. The authors explore the conditions under which different transport schemes will be efficient. They compare a simulcast and a scalable video coding (SVC) transport scheme in several realistic use-cases with different encoding modes.

The second paper, by Montpetit, Klym and Mirlacher, presents a vision of IPTV in the next future combining social and mobile aspects. New innovative approaches offer a number of value-added services for operators, and content producers as well as for emerging social networking operators. For example, social networking sites could become “virtual operators” and offer personalized TV services on top of social connectivity. The article addresses the architecture, the value chain and the technical and business challenges associated with connected mobile and social TV. To put the architecture into a context, the authors also present a use case of the distributed community Digital Video Recorder (DVR) as an implementation of this vision.

The third paper, by Stockhammer, Heiles and Lüken, addresses the high bandwidth demands of IPTV. The authors explore Content Download Services (CDSs) as an alternative for operators' current distribution models. The main contribution of the paper is in the development of selected use cases with CDS architecture and technology as well as their mapping to operators' business models.

In the fourth paper, Cruz et al., describe the development, implementation and evaluation of a SIP based IPTV architecture with a new dynamic QoS adaptation method and signaling

structure. Prototype implementations are described as well as the results of field tests carried out across different fixed and mobile access networks, for each of the signaling methods presented.

Finally, the fifth paper, by Palau et al. proposes an architecture for Wireless IPTV, making traditional IPTV and related services available in heterogeneous networks. They propose an alternative CDN-based architecture to distribute contents to different access networks, creating a triple screen distribution platform. The paper is focused on the wireless components of the system. They analyze their architecture and its performance, based on video coding, and the efficiency obtained by the judicious placement of the streaming servers.

3 Final thoughts

We believe that the aforementioned five papers cover some major challenges in IPTV technologies and provide a valuable reference for further research on multimedia networking. The targeted audience of the special issue is not limited solely to the research community, but encompasses designers, field engineers, operators, business analysts and software and content developers who can benefit from the findings reported in this special issue. Based on the variety of topics and on the quality of the articles, we infer that IPTV is a lively and robust research area. We hope that the readers will be interested by the research presented here and motivated to apply it to their specific area of activities and research.

4 Reviewers

Konstantinos Chorianopoulos, Ionian University, Greece
Cristian Hesselman, Novay, Netherlands
Rodrigo Laiola Guimaraes, CWI, Netherlands
Marianna Obrist, University of Salzburg, Austria
Robert Seeliger, Fraunhofer Institute, FOKUS, Germany
Alberto Gil Solla, University of Vigo, Spain
Ishan Vaishnavi, CWI, Netherlands
Stefan Arbanowski, FOKUS' Media Interoperability Lab, Germany
Hassnaa Moustafa, France Telecom Research (Orange Labs), France

Acknowledgements We wish to acknowledge all the authors for considering this special issue of the Multimedia Tools and Applications Journal as a venue for publishing their research. We express our gratitude to all reviewers who devoted time in providing valuable feedback on the papers submitted for this special issue. We particularly extend our thanks to Dr. Maja Matijašević from the Faculty of Electrical Engineering and Computing at the University of Zagreb for making this issue a reality. We thank Project MTM2008-06778-C02-01 from the Spanish Ministry of Science and Innovation for supporting and promoting IPTV technology research. We extend our gratitude to the Editor-in-Chief of the Multimedia Tools and Applications, Professor Borko Furht, for his contribution to the success of this issue. Finally, we would like to take this opportunity to acknowledge the valuable help from Laura Lander and Maria Mhanilet de Leon at Springer: their unconditional support throughout the preparation of this issue was greatly appreciated.

Oscar M. Bonastre (oscar.martinez@umh.es) is an Assistant Professor at the Miguel Hernandez University of Elx (Spain) where he teaches Advanced Distributed Systems and Content Distribution to PhD students in Telecommunications. Dr. Bonastre is also a contributor to the Operations Research Centre at the same university. He received his M.Sc. in Computer Engineering at University of Alicante (Spain) and Ph.D. in Telecommunication Engineering at the Polytechnic University of Valencia (Spain). He is a Cisco Certified Network Professional Instructor in the Cisco Networking Academy Program (CNAP). During 2001-2002, he was a visiting lecturer at one of the associated centers of the Ajman University of Science and Technology Network supported by the United Arab Emirates where he taught Computer Graphics and System Programming. Dr. Bonastre is a member of the Board of Directors of the IEEE Spain Education Section and an Associate Editor of the IEEE Transactions of Education. His research interests include the development of congestion control, of reliable and layered multicast techniques for multimedia and IPTV content distribution and of new solutions for IPTV and Social TV content distribution using Game Theory, Semantic Web and other multidisciplinary techniques. He is involved in research projects supported by the European Union and the Spanish Ministry of Science. He is a member of numerous scientific international committees and was the Chair of the IEEE Communication Society supported “International Workshop on IPTV Technology and Multidisciplinary Applications” in 2009 and 2010. Dr. Bonastre is a Senior Member of the IEEE Society.

Marie-José Montpetit (mariejo@mit.edu) is a scientist at the Research Lab in Electronics at MIT focusing on video convergence, IP based video, network coding applications and social TV. In 2007-2008 Dr. Montpetit was an invited scientist at the MIT Media Laboratory where she is still involved in a class on converged video applications. Dr. Montpetit received a Ph.D. in EECS from the Ecole Polytechnique in Montreal, Canada. She is a member of the IEEE Standing Committee on DSP and a collaborator to the ETSI BSM working group on aspects of convergence. She was the recipient of the Motorola Innovation Prize in 2007 for the development of a multi-screen and multi-network video mobility system. Her work on converged video applications and multiscreen IPTV has gotten her many invited papers and keynote

presentations and a MIT Technology Review “TR 10” recognition for the new technologies that will be influential in the future in May 2010. She is a reviewer for the European Union for proposal and projects in the wireless networking and future Internet fields and an editor of many journals and publications. She has served on numerous conference technical program committees in telecommunication, IP technology and video networking. Dr. Montpetit is a Senior Member of the IEEE.

Pablo Cesar (P.S.Cesar@cwi.nl) is a tenure track researcher in the Distributed Multimedia Languages and Infrastructures research group at CWI (The National Research Institute for Mathematics and Computer Science in the Netherlands). He received his PhD from the Helsinki University of Technology in 2006. He has (co)authored over 40 articles (conference papers and journal articles) about multimedia systems and infrastructures, social media sharing, interactive media, multimedia content modeling, and user interaction. He is involved in standardization activities (e.g., SMIL from W3C) and has been active in a number of European projects such as Passepartout, SPICE, iNEM4U, and Ta2. He is coeditor of the book “Social Interactive Television: Immersive Shared Experiences and Perspectives” and has given tutorials about multimedia systems in prestigious conferences such as ACM Multimedia and the WWW conference. Webpage: <http://homepages.cwi.nl/~garcia/>