Guest Editorial
Video Distribution Over Future Internet

Cedric Westphal, *Senior Member, IEEE*, Tommaso Melodia, *Member, IEEE*, Wenwu Zhu, *Fellow, IEEE*, and Christian Timmerer, *Senior Member, IEEE*

I. Introduction

THE CURRENT Internet is under tremendous pressure due to the exponential growth in bandwidth demand, fueled by the transfer of video consumption to online distribution, IPTV, streaming services such as Netflix, and from phone networks to videoconferencing and Skype-like video communications. The Internet has also democratized the creation, distribution and sharing of user-generated video contents through services such as YouTube, Vimeo or Hulu. The situation is further aggravated by the emerging trends of adopting higher definition video streams, requesting more and more bandwidth. Indeed, the Cisco Visual Networking Index (VNI) projects that video consumption will amount to 90% of the global consumer traffic by 2017. Another shift predicted by Cisco VNI is that most data communications will be wireless by 2018.

To cope with the bandwidth growth, the shift to wireless, and to solve other related issues (e.g., naming, security, etc) with the current Internet, new architectures for the future Internet have been proposed and prototyped. Examples include Content-Centric Networks (CCN) or Named Data Networking (NDN), or some content-based extensions to Software-Defined Networking (SDN), among others. None of these emerging architectures deal specifically with video distribution, as they need to support a wider range of services, but all would have to support videos in an efficient manner. Therefore, the study of video distribution over the future Internet is of primary importance and raises many questions: how well does the future Internet architecture facilitate video delivery? What new video distribution mechanisms need to be created to run on the future Internet? How will video be supported in the wireless portion of the future Internet? Can the current video distribution mechanisms (such as end-to-end dynamic rate adaptation schemes) be used or even enhanced for the future Internet? What are subjective/objective metrics for performance measurement? How to provide real-time guarantees for live and interactive video streams?

While the topic is quite wide, we will narrow the focus of this special issue on the fundamental problems of video distribution and delivery in the future Internet. We invited submissions of high-quality original technical and survey papers on video distribution in the future Internet, including the following non-exhaustive list of topics.

Special Issue Overview:

We selected seventeen papers to be part of this special issue, covering a wide range of topics, which were representative of the roughly sixty submissions with received. The issues covered in the papers can be categorized into several focus areas: how to improve video delivery in future wireless networks; how to support ubiquitous caching as a key element of the future Internet; how rate adaptation mechanisms (and adaptive video streaming in general) should evolve; and what the transport layer should look like in a future Internet architecture. We grouped the accepted papers into these thematic areas. We describe these papers in more detail in the next section.

II. Accepted Papers

Five papers in this special issue address optimizations to caching. In “Scalable Cache Management for ISP-Operated Content Delivery Services,” Tuncer et al. present an efficient and scalable distributed method to place content in the caching points of a content delivery network. “Enabling Secure and Efficient Video Delivery Through Encrypted In-Network Caching” considers the issue of caching encrypted content as future networks are expected to follow more stringent privacy guidelines, but HTTP does not allow transparent operator caching. Pre-fetching and preloading is the form of caching considered in “Take-Away TV: Recharging Work Commutes With Predictive Preloading of Catch-Up TV Content”. The content in this approach is prefetched to the users’ device prior to mobility events using a supervised machine learning model. Similarly, “Proactive Content Caching for Mobile Video Utilizing Transportation Systems and Evaluation Through Field Experiments” prefetches content for trains using CCN protocols.” Finally, “Pricing and Resource Allocation via Game Theory for a Small-Cell Video Caching System” formulates a Stackelberg game to maximize the profit of the network service provider that hosts small-cell caches, and of the video retailers which leases these caches.

The following five papers focus on rate adaptation for video streaming, and its evolution for the future Internet. “Investigating the Performance of Pull-Based Dynamic Adaptive Streaming in NDN” looks at the performance gap between a client-based rate adaptation and the theoretical optimum in a Named Data Networking (NDN) architecture. “Perceptual Quality of HTTP Adaptive Streaming Strategies: Cross-Experimental Analysis of Multi-Laboratory and

C. Westphal is with Huawei Innovations, Santa Clara, CA 95050 USA, and also with the University of California at Santa Cruz, Santa Cruz, CA 95064 USA (e-mail: cedric.westphal@huawei.com).

T. Melodia is with Northeastern University, Boston, MA 02155 USA (e-mail: melodia@ece.neu.edu).

W. Zhu is with Tsinghua University, Beijing 100084, China (e-mail: wwzhu@tsinghua.edu.cn).

C. Timmerer is with Alpen-Adria-Universität, Klagenfurt 9020, Austria (e-mail: christian.timmerer@itec.aau.at).

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Crowdsourced Subjective Studies" attempts to isolate the impact on QoE of different adaptation parameters, such as data chunk length, rate switching amplitude, switching frequency and recency, to provide design guidelines. "Adaptive Video Streaming: Rate and Buffer on the Track of Minimum Rebuffering" describes an Adaptation & Buffer Management Algorithm (ABMA), which ensures that the rebuffering probability is under given threshold for the duration of a video stream, using some queueing analysis. "A Scalable User Fairness Model for Adaptive Video Streaming Over SDN-Assisted Future Networks" focuses on providing a fair allocation of resources of users of adaptive streaming, where Software Defined Networks (SDN) and OpenFlow in particular, are the technologies underpinning a future network architecture. Finally, "SVC-Based Multi-User Streamloading for Wireless Networks" presents the joint rate allocation and quality selection for a novel video streaming scheme called Streamloading.

The next three papers consider issues at the transport layer. "MSPlayer: Multi-Source and Multi-Path Video Streaming" attempts to combine the bandwidth from multiple paths to multiple source copies of the content replicated over the content delivery network. "Speeding Up Future Video Distribution via Channel-Aware Caching-Aided Coded Multicast" uses coded multicasting jointly with channel-aware caching to design an achievable scheme. "Privacy-Aware Multipath Video Caching for Content-Centric Networks" combines network coding with caching to achieve both better caching performance and better cache privacy for video delivery in CCN.

The last four papers have a specific focus on wireless networks. "TCP-Oriented Raptor Coding for High-Frame-Rate Video Transmission Over Wireless Networks" presents a novel high-frame-rate (HFR) application-layer FEC framework to deliver real-time HFR video over TCP. "Spectrum Management for Proactive Video Caching in Information-Centric Cognitive Radio Networks" focuses on video dissemination in information-centric cognitive radio networks (IC-CRNs) and investigates the use of harvested bands for proactively caching video contents at the locations close to the interested users. "WhiteFi Infostation: Engineering Vehicular Media Streaming With Geolocation Database" uses the TV white spaces for enhancing vehicular multimedia streaming. The last paper in this issue, "Joint Caching, Routing, and Channel Assignment for Collaborative Small-Cell Cellular Networks" [17] formulates the problem of maximizing the throughput of a coordinated small-cell cellular system through a linear program with many variables.

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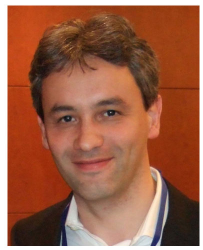
Cedric Westphal (M'00–SM'08) received the M.S.E.E. degree from Ecole Centrale Paris in 1995, and the M.S. and Ph.D. degrees in electrical engineering from the University of California, Los Angeles, in 1995 and 2000, respectively. He has served as a reviewer of the NSF, GENI, the EU FP7, and other funding agencies. He was the co-chair of the program committee of several conferences, including the IEEE ICC (NGN symposium) and the IEEE NFV-SDN. He was the General Chair of the IEEE Infocom 2016. He is currently a Principal Research Architect with Huawei Innovations, working on future network architectures, both for wired and wireless networks. He has also been an Adjunct Assistant Professor with the University of California, Santa Cruz, CA, USA, since 2009. He has authored and co-authored over 80 journal and conference papers, including several best paper awards, He holds over 30 patents. He was the Area Editor of the ACM/IEEE TRANSACTIONS ON NETWORKING (2009–2013), an Assistant Editor of the *Computer Networks Journal* (Elsevier), and a Guest Editor of the *Ad Hoc Networks Journal*, JOURNAL ON SELECTED AREAS IN COMMUNICATIONS, and so on.



Tommaso Melodia (M'07) received the Ph.D. degree in electrical and computer engineering from the Georgia Institute of Technology in 2007. He is an Associate Professor with the Department of Electrical and Computer Engineering, Northeastern University, Boston, MA, USA. His current research interests are in modeling, optimization, and experimental evaluation of networked communication systems, with applications to intra-body networks, software-defined networking, video streaming, and underwater networks. He serves on the Editorial Boards of the IEEE TRANSACTIONS ON MOBILE COMPUTING, the IEEE TRANSACTIONS ON WIRELESS COMMUNICATIONS, the IEEE TRANSACTIONS ON MULTIMEDIA, AND COMPUTER NETWORKS (Elsevier). He is a recipient of the National Science Foundation CAREER Award. He coauthored a paper that was recognized as the ISI Fast Breaking Paper in the field of computer science.

Wenwu Zhu (S'91–M'96–SM'01–F'10) received the Ph.D. degree in electrical and computer engineering from the New York University Polytechnic School of Engineering in 1996. He is currently a Professor and the Deputy Head of the Computer Science Department of Tsinghua University. Prior to his current post, he was a Senior Researcher and Research Manager with Microsoft Research Asia. He was the Chief Scientist and Director with Intel Research China from 2004 to 2008. He was with Bell Labs New Jersey as a member of Technical Staff from 1996 to 1999. His current research interests are in the areas of multimedia computing, communications, and networking. He has published over 260 referred papers in the above areas, and holds over 60 patents. He served/serves on various editorial boards, such as a Guest Editor for the PROCEEDINGS OF THE IEEE, the IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY, and the IEEE JOURNAL ON SELECTED AREAS IN COMMUNICATIONS; an Associate Editor of the IEEE TRANSACTIONS ON MOBILE COMPUTING, the IEEE TRANSACTIONS ON MULTIMEDIA, the IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY, and the IEEE TRANSACTIONS ON BIG DATA. He served on the steering committees of the IEEE TRANSACTIONS ON MOBILE COMPUTING from 2007 to 2010 and the IEEE TRANSACTIONS ON MULTIMEDIA in 2016. He is an SPIE Fellow and ACM Distinguished Scientist. He received five best paper awards, including ACM Multimedia 2012 and the IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY in 2001.

Christian Timmerer (M'08–SM'16) is an Associate Professor with Alpen-Adria-Universität Klagenfurt, Austria, and his research focus is on immersive multi-media communication, streaming, adaptation, and quality of experience. He has authored over 150 publications in his research area and was the General Chair of WIAMIS 2008, QoMEX 2013, and ACM MMSys 2016. He participated in several EC-funded projects, notably, DANAE, ENTHRONE, P2P-Next, ALICANTE, SocialSensor, and the COST Action IC1003 QUALINET. He also participated in ISO/MPEG work for several years, notably, in the areas of MPEG-21, MPEG-M, MPEG-V, and MPEG-DASH. He is a Co-Founder of Bitmovin and CIO and the Head of Research and Standardization.