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Information-Centric Networking for Multimedia Dissemination

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Inspired by the observation that the Internet is increasingly used for the dissemination of, or access to information, rather than for pair-wise communication between end hosts, Information-Centric Networking (ICN) [1] is based on identifying information at the internetwork layer and employing information-awareness as the means for addressing a series of limitations in the current Internet architecture. The Publish-Subscribe Internet (PSI) architecture [2], a clean-slate ICN approach for the future Internet, was designed to satisfy current and emerging user demands for pervasive information delivery.

After a brief introduction to ICN in general, this talk will provide an overview of the PSI architecture (developed through two European projects, PSIRP and PURSUIT) and will also present an overview of our new H2020 project POINT [3] with goal to demonstrate commercially viable deployment of existing services over ICN. PSI provides native support for network layer caching, multicast, multi-path and multi-source transport, security and privacy, and seamless mobility, which make it an excellent platform for ubiquitous multimedia information delivery for the future Internet. We will also present as case studies support for a few different applications and environments.

We begin with the observation that video constitutes the majority of all current Internet traffic and its share is expected to grow. Any future Internet architecture with a chance at success should provide some tangible benefits for video applications. ICN architectures were designed with the specific goal of improving content distribution on the Internet. We have attempted to answer the obvious question: is ICN appropriate and ready for video traffic and, if not, what is missing or should be modified? To this end, we considered two different ICN architectures, CCN/NDN and PSI, and examined their applicability to Video on Demand and Live Streaming applications [4]. Our goal was to clarify, at high level, what ICN already does well for video, what it still needs to do better, and, most importantly, what it could or should do differently.

We then present in some more detail how efficient delivery of real-time multimedia information can be supported in the PSI architecture, which places information at the heart of the network layer and decouples the forwarding, path formation and topology management functionalities. This design approach can be highly beneficial for real-time communications, as it enables the network to apply sophisticated mechanisms for multicast tree construction, such as delivery over optimal Steiner trees [5]. Initial experiments with a proof-of-concept implementation of PSI indicate the feasibility of realizing such optimization policies. Our results show that significant bandwidth savings can be achieved at the cost of small, un-noticeable to the end-users, delays in flow establishment [6].

We also consider and illustrate key functionalities and gains when using ICN, and PSI in particular, for integrating terrestrial and satellite networks, still a major component for multimedia distribution today, by jointly exploiting the advantages of each: transparent use of terrestrial multicasting and satellite broadcasting, content-based multipath transfer, and seamless mobility [7]. Also, in modern terrestrial access networks, ICN can be exploited in many ways to improve performance and robustness in a flexible way. E.g., we present two application scenarios that exploit key features of the PSI architecture: secure publication proxy and multi-source mobile video streaming [8].

Finally, Network Music Performance (NMP) is a time-critical service with substantial bandwidth requirements that often question its feasibility. Multipath content delivery with QoS routing are suitable solutions to this demanding problem, offering bandwidth aggregation while keeping service latency low. However, the realization of multipath QoS routing in IP networks is not inherently supported and requires complicated extensions to network operation. On the other hand, the PSI architecture natively supports multicast, source routing and centralized path selection, thus posing as promising terrain for QoS routing. We discuss the implementation of QoS multipath routing in PSI and experimental evaluation of potential NMP enhancements [9].

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