IMPROVING CONTENT DISSEMINATION USING SOCIAL INFORMATION

(joint PhD Institut Telecom – Paris 6 University)

Nowadays, multimedia content is responsible for a major portion of the Internet traffic and its importance will grow in the coming years [1]. For instance Netflix [2], a video distribution platform in North America, already generates 33% of the downstream traffic in that continent as reported by the last Snadvine report from fall 2012 [3]. In addition, the same report shows that BitTorrent, the most important p2p application for file sharing, is responsible for a major portion, around 30%-40%, of the upstream traffic in North America and Europe. Aligned with these evidences the proliferation in the use of smartphones and tablets all over the world has led to an exponential increase in the access to multimedia content from mobile devices. Cisco envisions that by 2014 video content will account 66% of the global mobile data traffic.

In parallel, the irruption of On-line Social Networks (OSNs) in the Internet arena is changing the way in which human beings interact to each other. We have clear examples like Google+, which in less than 1 year have attracted more than 100M users, or Facebook that in few years have overpassed 1000M users. These OSNs include a large amount of valuable information such as users' profile, activity, tastes, recommendations, etc.

This scenario opens a novel research line to enhance multimedia content distribution by using social information to more efficiently manage the vast amount of multimedia content traffic dominating the current Internet.

We believe that information available through OSNs can be used to improve the distribution of multimedia content in the Internet. By collecting and processing information available at OSNs we can study:

- **Geo-popularity of content**: Many users utilize OSNs to declare their interests and tastes. For instance, a user that watches a TV Show and likes it can report such interest in its OSN by posting it or using available facilities like "+1" in Google+ or "like" in Facebook. In addition, many users also report in their profiles the current city where they are living, and even more the current city where they physically stay at a given time when they are travelling. Therefore OSNs make available together multimedia content interests and geographic position that allows predicting future geographic consumption patterns.

- **Optimal storage locations to serve multimedia content:** If we are able to collect a large number of users that have declared a common interest in a particular multimedia content (e.g. weekly TV Show broadcasted through Internet) we can come up with more efficient algorithms to decide the most

suitable storage/delivering servers that can (i) reduce the cost of the content provider and operator, and (ii) improve the QoS (e.g. lower delay) experienced by end-users.

- **<u>Peer-assisted multimedia content delivery:</u>** OSNs enable the generation of a huge number of communities either proactively (i.e. the users join a group, or become fan of a company, celebrity, artist, etc) or indirectly (e.g. users that share a common interest but they do not explicitly join a group or follow somebody). Many of this communities can be related to multimedia content, for instance we can find the group of users that like a particular film director, artist, rock singer, Tv Show, etc. Then, content providers, ISPs (which are actually major content providers nowadays), hosting services, etc can use users on those communities to help on the delivery/sharing of multimedia content making use of end-users resources to reduce their costs.

- **<u>Improve recommendation systems return:</u>** Using previous described communities based on information made available through OSNs we can design more efficient recommendation systems. For that we need to improve current community detection mechanisms and adapt them to exploit information available in OSNs. The goal is to find out communities of users with a higher probability of responding positively to the received recommendations, thus increasing the success rate of advertisement and marketing campaigns. Therefore, the communities should be formed by users whose profiles are adequate to the product, service, content, etc that is being recommended. In the particular area of multimedia content distribution the use of recommendations systems will be focused to engage a larger number of users in the consumption of such content.

Aligned to these research tasks, the Service Architecture lab at Institut Mines-Télécom SudParis is member of the EU FP7 eCOUSIN project (Enhanced Content distribution with Social Information) [4].

In the introduced context the expected tasks to be realized during the PhD are:

- Design and implementation of crawling tools to gather social information from main On-line Social Networks (OSNs) like Facebook, Twitter, Google+, LinkedIn, etc.
- Design and implementation of crawling tools to gather information from main Internet content providers like youtube, BitTorrent, mobile apps stores, etc.
- Application of data mining techniques to analyze the large amount of collected data.
- Design novel algorithms to find optimal storage locations of contents in order to reduce network load and improve users' Quality of Experience (QoE).
- Design novel peer-assited algorithms and protocols to improve multimedia content distribution based on social information
- Design of novel OSN-based community detection algorithms to be applied to social-based recommendation systems
- Implementation of a prototype that includes the designed algorithms

The objectives to disseminate the obtained results are:

- Publish results in major conference and Journals in the area of computer science and networking.
- Contribution to standardization bodies in case the obtained results are applicable to some of the on-going working groups
- Explore potential interest of industrial partners that would be interested on exploiting the obtained results

References

[1] Cisco, "Visual Networking Index: Forecast and Methodology, 2011- 2016," May 2012.
[2] http://www.netflix.com
[3] Sandivine, "Sandvine global internet phenomena complete'," Spring 2011, Fall 2011, Spring 2012, Fall 2012.
[4]http://cordis.europa.eu/search/index.cfm?fuseaction=proj.document&PJ_LANG=EN&PJ_RCN=13456709&pid=70&q=941A80AAA199E09BFC0ED97A24BF3B1F&type=rap

Requirements

- Recent master in Computer Science, Electrical Engineering.
- Research background in any domain in communication and networking technologies. Experience in writing scientific articles is appreciated.
- Talented individuals with strong motivation, team spirit.
- English skills are a prerequisite. French is not needed as English is the working language.

Start of the PhD

According to CSC.

Contact

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Bio: Noël Crespi, professor, holds a Master's from the Universities of Orsay and Kent, a diplome d'ingénieur from Telecom ParisTech, a Ph.D and an Habilitation from Paris VI University. From 1993, he worked at CLIP, Bouygues Telecom and then joined France Telecom R&D in 1995 where he was involved in Intelligent Network paradigms for value added services. For Orange he led the Mobicarte prepaid service project to define, architecture and deploy an infrastructure that now hosts more than 10 million mobile subscribers. He has played an active role in standardisation as a delegate in a number of committees and as a editor for CAMEL; he was appointed as a the coordinator for France Telecom's activities for

Core Network standardisation and then for all GSM/UMTS standards. In 1999, he joined Nortel Networks as Telephony Program manager for France and Middle East-Africa. He was responsible for the evolution of the switching area, and led key programmes for the evolution of Nortel products. He has also worked for ETSI as an independent contractor. He joined Institut Telecom in 2002 and is currently professor and Programme Director, leading the Network and Services Architecture lab. He coordinates the standardisation activities for Institut Telecom at ITU-T, ETSI and 3GPP. He is also a Visiting Professor at the Asian Institute of Technology and is on the 4-person SAB (Scientific Advisory Board) of FTW, Austria. His current research interests are in Service Architectures, Communication Services, P2P Social Networks, and Internet of Things/Service. He is the author/co-author of more than 230 papers and contributions in standardisation and is an IEEE senior member.

Institut Telecom, Telecom SudParis

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The Institut Mines-Télécom is a member of the Allistene, Aviesan and Athena national alliances for research planning. In addition, the quality and intensity of its ongoing research in partnerships were rewarded by two Carnot Institut labels in 2006, renewed in 2011. Every year, 100 business start-ups are created within the schools' incubators.