SOCIAL NETWORKS MEET MOBILE NETWORKS

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Advanced socio-technical systems, along with smart hand-held and mobile devices, have become a central part of daily life for billions of people worldwide, with applications ranging from communicating with friends to incorporating enterprise tasks to mobilizing masses in protests to exchanging photos with family to implementing crisis response and disaster management. These systems have helped in realizing the very essence of social media applications (such as, Facebook, Twitter, Flickr, YouTube, SecondLife, FourSquare, etc.), which facilitate sharing of information and endow a sense of always-connectedness. With the ever-increasing bandwidths offered by rapidly evolving wireless networks – 3G, 4G, WiMAX and beyond – powerful processing capabilities, smart, advanced, multimodal displays, user friendly and haptic interfaces, mobile platforms have shown a promising future for social computing applications. On a parallel front, advances in web technologies, such as HTML5 and AJAX, have led to the development of complex applications with rich user-interfaces that demand a nimble and robust architecture for social computing applications that is adaptive to the network constraints and bottleneck issues. These technological advancements have created a favorable environment for launching mobile-aware social computing applications, offering practitioners and researchers key architectural challenges with numerous fledgling opportunities.

Consequently, social media users are actively utilizing mobile applications now than ever before. A recent study by Ruder Finn[1] pointed out that 91 percent of the mobile subscribers engage in social computing applications as compared to the 79 percent of the desktop users. People in the United States, on the average, spend 2.7 hours per day on mobile devices, of which 45 percent post comments, 43 percent connect with friends, 40 percent share content with others and 38 percent share photos on social networking websites, making it an increasingly favorable platform for socializing. This has generated a deluge of social and behavioral data that holds great potential for exploring opportunities in social computing aware mobile networks. Specifically, the knowledge gathered from the social and behavioral data could be leveraged to
- Optimize wireless network designs
- Advance the protocol development for social media content and its dynamic distribution
- Apply social network theories in routing and gain deeper understanding
- Enhance network security protocols using trust/prestige metrics obtained from social network data, among several other research directions.

Through this special issue, we intend to create a platform by bringing together researchers and practitioners from disciplines, such as computer science and mobile multimedia Internet/networks as well as other related disciplines to share, exchange, learn, and develop preliminary results, new concepts, ideas, principles, and methodologies, aiming to advance mobile networks in the new generation of Information and Communication Technologies enabled by Web 2.0, also referred to as social media. This Feature Topic also serves as a collection of resources that can be used by researchers leading to a perpetual and synergistic advancement of the discipline.

The challenges that arise when social networks meet mobile networks are many, a few of which are posed by the following questions.

1. Is it possible that the wireless service providers and architects and designers of wireless networks could address some of the challenges by introducing context–awareness? Can context-awareness be introduced in mobile networks in a manner that is mindful of the need to ensure privacy of users?
2. Service providers are introducing IP Multimedia Subsystems (IMS) as the service and session management infrastructure in next generation networks. What modifications are required to the IMS infrastructure to facilitate social network awareness in next generation mobile networks?
3. While the power of IMS can be exploited to introduce such awareness at the higher application layers, can such awareness be introduced at the network, MAC, and physical layers? What are the "social metrics" that, when introduced into the layers of the network, can bring about such awareness?
4. When social network awareness permeates the various layers of a mobile network, does the network become more vulnerable to attacks? If it does, what are the countermeasures that can be undertaken to thwart such attacks?

In this issue of *IEEE Communications Magazine*, we are pleased to deliver to the readers of this issue four papers that address the challenges that arise when "social networks meet mobile networks." Specifically, these four articles, respectively, address the four challenges/questions raised in the preceding paragraph.

In the first article, "Context-awareness in Wireless and Mobile Computing Revisited to Embrace Social Networking" Roussaki *et al.*, present a review of various aspects of context management in pervasive computing systems and propose an architecture for context management to combine pervasive services with social networking.

The second article by Foschini, Cardone, and Corradi titled, "Socio-Technical Awareness to Support Recommendation and Efficient Delivery of IMS-Enabled Mobile Services," proposes a

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[1] http://www.prnewswire.com/news-releases/new-study-shows-intent-behind-mobile-internet-use-84016487.html

recommendation engine based on users' service usage and classification of services based on social context. The article proposes the use of IMS to provide service composition capabilities to users based on socio-technical awareness of service usage. The authors look at promoting a socially-aware recommendation system to foster a more efficient delivery of mobile services.

In the third article, "Improving MAC Layer Association through Social-Based Metrics in Mobile Networks," Guardalben *et al.*, propose the use of social metrics to improve the efficiency of layer 2 associations in mobile networks in terms of stability and overall traffic performance. The authors determine a variety of social metrics that quantify the relationships between nodes at the MAC layer that include, neighborhood nodes friendship estimation, associated nodes friendship estimation, and community nodes friendship estimation. We envisage the possibility of incorporating such induced socio-technical behavior patterns of the users mined from social applications into network infrastructure and the implemented protocols at physical layer enabling a virtuous cycle of innovation, creating greater synergies between social networks and mobile networks.

In the fourth and final article of this Feature Topic titled "SocialMesh: Can networks of meshed smartphones ensure public access to Twitter during an attack?" Krishnamoorthy and Srikrishna describe a wireless mesh architecture that can survive under attack. Using comparable hardware and software, the authors have examined the feasibility of designing SocialMesh, a peer-to-peer, self-organizing mesh network of user-friendly smartphones with Internet access, for public deployment by citizens who are under attack.

These four articles represent only a subset of the vast current research topics in this interdisciplinary area but most certainly help us envisage the burgeoning opportunities and unique challenges. One such challenge arises from the fact that the emergence of mobile social networks will likely contribute to exponential growth in signaling within mobile networks [1]. This special issue will hopefully contribute to the emerging field's advancement, foster greater capabilities, and open many doors for innovations in blending mobile networks and social networks. We anticipate that innovative ideas and ingenious theories will emerge in the not too distant future.

The advances in both Web paradigm and mobile devices have induced phenomenal socio-technical behavioral changes in the users of these technologies. The advent of social applications has invigorated the user-content creation and sharing at an unprecedented scale. Further, pushing these applications onto mobile devices has intensified content generation by leaps and bounds. Users can share whatever they like and wherever and whenever they want. However, the impact of advances in both the sectors and the resulting interaction between them has not been fully explored and understood. There exists a plethora of exciting opportunities and intricate challenges, as explained in this Feature Topic, to mutually leverage the advancements in each sector to the benefit of the other in offering a rich user experience.

We express our gratitude to the authors, whose submissions made this special issue possible and showed how active and exciting this emerging interdisciplinary field is, the reviewers whose tremendous efforts in reading and offering constructive comments helped the authors see their work from a different perspective and improve their articles, the IEEE Communications Magazine editorial board for its guidance in the process, and the IEEE editorial-production staff members who helped us manage the submissions. We also gratefully acknowledge the fact that this effort was supported in part by the National Science Foundation's Social-Computational Systems (SoCS) Program within the Directorate for Computer & Information Science & Engineering's Division of Information & Intelligent Systems (Award numbers: IIS — 1110868 and IIS — 1110649) and the EPSCoR Program (Award number: EPS — 0701890) as well as the U.S. Office of Naval Research (Grant number: N000141010091).

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BIOGRAPHIES

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