Proposition de recherche doctorale

Multi-relay cooperation protocols inspired by information theoretic advances in wireless networks

Mots clés :

- **Directeur de thèse** : HOUDA LABIOD
- **Co-encadrant(s)** :
- **Unité de recherche** : Laboratoire Traitement et Communication de l'Information
- **Ecole doctorale** : École Doctorale Informatique, Télécommunications, Électronique de Paris
- **Domaine scientifique principal**: Divers

Résumé du projet de recherche (Langue 1)

EQUIPE D'ACCUEIL DE LA THESE Thesis co-supervised by Houda Labiod and Daniela Tuninetti. The PHd student will be at Telecom ParisTech, Department INFRES. Dr. D. Tuninetti will be co-advising the student together with Dr. H. Labiod. They will join regular weekly meetings via skype. The PHd student will spend some short internships in the research team of D. Tuninetti at Electrical and Computer Engineering, University of Illinois at Chicago, Chicago, Illinois, USA. -* Contexte Scientifique Research Objective Design of optimal cooperation protocols for data delivery in Wireless Sensor Networks (WSNs) based upon recent advances in information theory regarding the ultimate capacity limits of wireless multi terminal networks. The node's cooperation strategy over time, as a function of the variations in the networks due to fading, mobility, bandwidth demands, etc., will meet application's quality-of-service requirements. -* Contenu Scientifique Focus of research work To the best of our knowledge, no work so far has jointly, that is physical and upper layers, tackled the cooperative communication problem in order to optimize the overall network performance. This motivates the proposed work. We will study the problem in the context of WSNs. WSNs have some interesting severe constraints in terms on energy requirements and protocol complexity in a quickly varying environment. We are interested in studying the behavior of nodes in a WSN based on the various cooperative/forwarding strategies and subsequently design routing and MAC algorithms that adapt quickly to dynamics of the network. In the first part, it is necessary to understand the impact of cooperative strategies so as to meet QoS application's requirements. A crucial part is to define the parameters characterizing such cooperation. The second part of this proposed research is to design actual routing and MAC algorithms to optimize data delivery and network performance. We will exploit the latest results from information theory to optimize network performance. Performance analysis, including analytical and simulation studies, will be performed. References S. Sharma, Y; Shi, Y. Thomas Hou, S. Kompella, An optimal algorithm for relay node assignment in cooperative ad hoc networks, IEEE/ACM Transact on networking, vol 19, no. 3, June 2011. Y. Yang, H. Hu, J. Xu, G. Mao, Relay Technologies for WiMAX and LTE-Advanced Mobile Systems, IEEE Communications Magazine, Volume: 47, Issue: 10, pp. 100 – 105, IEEE J.N. Laneman et al., Cooperative diversity in wireless networks: efficient protocol and outage behavior, IEEE Transactions Information Theory, vol. 50, no. 12, Dec 2004. M. Gastpar, M. Vetterli,On the capacity of large Gaussian relay networks,it,2005. Sung Hoon Lim and Young-Han Kim and Abbas El Gamal and Sae-Young Chung, Noisy Network Coding,IEEE Transactions on Information Theory,2010. Z. sheng et al., Cooperative wirelss networks: from radio to network protocol design, IEEE communication magazine, 2011. Ordentlich, O. and Erez, U., Interference alignment at finite SNR for time-invariant channels, Information Theory Workshop (ITW), 2011, IEEE.

Résumé du projet de recherche (Langue 2)

Cooperative communications has emerged in the past decade as a powerful means to manage interference in distributed wireless networks. Until recently it was conjectured that interference-prone channels, like wireless links, are fundamentally interference limited, and therefore resource division among independent information flows (in space, or time, or frequency or code) is necessary to guarantee a non vanishing throughput per data flow. This conjecture was proved to be not only wrong but extremely suboptimal. Some new techniques are proposed to achieve much performance. The question is how these techniques can be applied in practice in wireless networks taking into account real network constraints. This thesis will design and test media access and routing protocols that are inspired by the above mentioned recent advances on the capacity of wireless networks. To the best of our knowledge, no work so far has jointly, that is physical and upper layers, tackled the cooperative communication problem in order to optimize the overall network performance.

Informations complémentaires (Langue 1)

Les travaux de cette thèse s'inscrivent dans le cadre d'un projet de collaboration plus vaste amorcé sur le sujet de la coopération dans les réseaux sans fil. Le thésard aura a effectuer plusieurs séjours de recherche au sein d'équipes de renommée internationales (University of Illinois at Chicago USA, NTU Singapore)

Informations complémentaires (Langue 2)

-* Profil du candidat The ideal candidate for this Ph.D. work has a strong background in digital communications and networking, and has taken a first course in information theory. -* MOTS CLES : Cooperative communications, wireless sensor networks, information theory, routing, medium access control, noisy network coding, interference alignment