Proposition de recherche doctorale

Connected Cars: Mobility and Connectivity challenges.

Mots clés :

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- **Co-encadrant(s)** :
- **Unité de recherche** : Laboratoire d'informatique de Paris 6
- **Ecole doctorale** : École Doctorale Informatique, Télécommunications, Électronique de Paris
- **Domaine scientifique principal**: Divers

Résumé du projet de recherche (Langue 1)

We envision connected vehicles as the next transformative technology that enables a wide range of personalized services including safety applications, predictive maintenance, infotainment, personal communication, smart mobility, and pervasive sensing just to name a few. Vehicles will be integrated in the smart-city infrastructure as information provider and service consumer, sensors, and actuators. In particular, electric vehicles will play an important role in the smart-grid supply-consumption chain. In the shorter term, intelligent transportation systems will contribute to report air quality, traffic levels, and reduce dangerous pollution hot spots through eco-friendly car navigation and car-as-a-service programs. Although connected vehicles are is still in their infancy, there is no doubt that in a near future in-vehicle telematics will evolve to embrace consumer electronics thus opening the space for new eco-systems which will include on the “bring-your-own device” paradigm. Users will be allowed to connect their portable device to the car platform thus using their tablets and phones to both monitor and set their highly customized in-vehicle services such as for example car climate and seats setting. The same device will allow users to control some of the vehicles tuning knobs as well as to perform the traditional tasks of a smart phone/tablet. Several Scientific, Societal, and Economical challenges pave the road to bring this vision to reality. In particular, connected car services may need to adapt to the operating context in terms of in terms for example of geographical location, communication capabilities, vehicle nature, operating scenario, etc. Furthermore as the context changes connected cars need to adapt their services to the changing dynamics of the vehicle inhabitants and the surrounding environment. The Ideal Candidate will tackle at one of the scientific challenges focusing on the research problems that prevent a large-scale deployment of advanced in-car services at this stage.

Résumé du projet de recherche (Langue 2)

Mobility Challenge: Understanding mobility is key to support services and applications while on the go. Properly modeling urban mobility to factor in user behaviors, and correlations between different users and with activities is essential for the design and evaluation of new communication protocols. We plan to cooperate with the partners to analyze data from various installations and field trials with the aim of characterizing user mobility and exploit its feature in both protocol design and infrastructure design. For example a detailed knowledge of user mobility may help to deliver heavy content such as video to strategic connectivity points along the way such as for instance access points installed on top of a traffic light. Connectivity Challenge: A large number of advanced services require users to be connected to the Internet. The current model based on cellular operators is however showing its limits in both performance and costs. Operators are struggling to increase their ARPU while reducing their CAPEX therefore the market is shaped by per/byte contracts and relatively small forfeit (i.e. les than a full HD movie per month). A new approach to mobile network is needed. The chair will explore a new generation of communication protocols able to exploit multiple communication channels at the same time and to benefit from in-network caching. This will require a radical change in the protocol architecture and in the communication paradigm. Specifically we will investigate Information Centric Networks for connected vehicles. The ICN paradigm elects as communication endpoints the content rather than the communication node. This change in perspective leads to new network architectures able to take advantage of the best available link on a per-packet basis. The in-network caching, key part of Information Centric Networking is functional to eliminate unneeded wireless transmissions and to reduce the time needed to fetch contents from the network. Applications such as for example video-on-demand, maps update, and predictive maintenance would benefit from caching, and disruption tolerant delivery thus drastically reducing the needs for an always-on 3G connection. At the lower layers of the communication stack, closer to the technology, a fine tuning o the wireless capabilities is needed. The current IEEE8021.11 needs to be optimized and tuned to work in high mobility scenarios such as the V2V and V2I case. Specifically, there are several open challenges: (a) the design of fast-attach mechanism that would allow mobile devices to benefits from communication opportunities presented by access points available on the road; (b) channel sensing techniques to optimize the V2V communications towards a reduced packet loss probability and an increased delivery rate.

Informations complémentaires (Langue 1)

The candidate will be requested to travel to conferences and to spend at least 6 months abroad during the Ph.D. In particular the candidate may be requested to spend at least 6 months in the USA in a Research Laboratory or University.