V-NDN and Car-Fi: Connectivity Solutions for Moving Vehicles

Mots clés :

- Directeur de thèse : Giovanni Pau
- 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 into the (smart city) infrastructure as information providers and service consumers, sensors, and actuators. In the short 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 still in their infancy, there is no doubt that in-vehicle telematics will evolve to embrace consumer electronics, thus opening the space for new ecosystems that will include the “bring-your-own-device” paradigm. Users will be allowed to connect their portable devices to the car platform, and will use their tablets and phones to both monitor and set their highly customized in-vehicle services, such as car climate and seat settings. Several scientific, social, and economic 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 geographic location, communication capabilities, vehicle nature, operating scenario, and so on. Furthermore, as the context changes, connected cars need to quickly adjust to the changing dynamics of the vehicle inhabitants and the surrounding environment. Understanding mobility is a key factor in supporting services and applications while on the go. Properly modeling urban mobility to consider user behaviors, and correlations between different users and their activities is essential for the design and evaluation of new communication protocols. For instance, a detailed knowledge of user mobility may help to efficiently deliver bandwidth-intensive content such as video to strategic connectivity points along the way, e.g., access points installed on top of a traffic light. The research community has responded to the new emerging needs designing a number of applications, algorithms, and protocols to cope with the vehicular environment. Vehicular networks present several new challenges with respect to conventional IP-based ad-hoc networks, including: high-speed mobility of the nodes (resulting in a relatively short contact time), constrained mobility patterns, harsh propagation environment, high radio interference, and frequent network disruption in sparse traffic. However, many years of research in VANETs and delay-tolerant networks are still far from completion and less likely to deploy. We believe the root cause of the overwhelming issues faced by most efforts in connecting vehicles lies in IP’s communication model. IP creates its own addressing space, assigns IP addresses to every communicating end-point, and then encapsulates each piece of application data into an IP packet, thus insulating applications from the data-delivery layer. Hence, a totally new approach to mobile networking is needed. We explore a new generation of communication protocols that are able to exploit multiple communication channels at the same time and benefit from in-network caching. This brings about a radical change to the protocol stack and to the communication paradigm common to all applications. Specifically, our vision for the connected car develops in two directions: 1. The application of Named Data Networking (NDN), a newly proposed Internet architecture, as the new network layer for (vehicle-to-vehicle) (V2V) communications; 2. The design of a fast link setup mechanism that allows mobile devices and cars to benefit from (vehicle-to-infrastructure) (V2I) communication opportunities offered by Wi-Fi access points available along the road.