

## Enabling Vehicle V2X in Urban Landscapes

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**Dr. Giovanni Pau**

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### Abstract

Autonomous driving relies on machine learning algorithms, which require in-vehicle sensor data to develop models that improve the driving experience over time. Tesla and others are building systems that use sensor information from thousands of vehicles to build models that will help them build safe and reliable autonomous vehicles.

Today, vehicles rely solely on cellular connectivity for Advanced Driver Assistance Systems (ADAS), head-unit updates, map-updates, as well as Intelligent Transportation Systems (ITS) services. Looking ahead, in the near future, it is expected that cars will become Internet hot-spots providing commodity connectivity as well as entertainment services to drivers and passengers. Unfortunately, while cellular networks are great in that they provide nearly ubiquitous connectivity, they are expensive and operators frequently enforce caps on data plans.

Another emerging trend is the growing use of Dedicated Short Range Communications (DSRC) as the go-to technology for Vehicle-to-Vehicle (V2V) applications with a focus on safety. In contrast, Wi-Fi has largely been overlooked. Wi-Fi infrastructure is pervasive in large cities and metropolitan areas and it can provide fast and economic connectivity to vehicles if the lengthy connection/authentication time is fixed.


Prof. Pau will argue that together, Wi-Fi and DSRC are excellent candidates for speeding up the transformation of the connected cars dream to a mass market reality. To make this case he will present two systems - CarFi and VNDN. CarFi is a mechanism that inexpensively enables Vehicle-to-Infrastructure (V2I) communications over existing Wi-Fi networks. At the heart of CarFi is fast association and authentication to community Wi-Fi networks. He and his team have implemented CarFi on embedded devices and successfully tested it in Paris and Los Angeles. There they showed reduced connectivity time - from an average of 10 seconds to an average of 1 second. Dr. Pau's second system, VNDN, uses Information Centric Networking (ICN) for DSRC based vehicular telematics applications. Borrowing concepts from Named Data Networking (NDN) he shows how VNDN enables important V2V applications including congestion monitoring and parking availability, both with relatively low overhead

*Reception in Dunn Hall 336 - 1:30pm*

## About the Speaker

Giovanni Pau is the ATOS/Renault smart mobility Chair Professor at the University Pierre et Marie Curie, Paris France. He holds the Italian Laura in Computer Science and a PhD in Computer Engineering awarded by the University of Bologna in 1998 and 2002 respectively. Before joining UPMC, Dr. Pau was a Senior Research Scientist at the UCLA Computer Science Department. Dr. Pau's core research interests are in Network Systems with a focus on Vehicular Networks and pervasive mobile sensor systems. He designed and built the UCLA campus vehicular testbed and the UCLA/MPI urban sensing testbed designed to enable hands-on studies on vehicular communications and urban sensing. His research contributions lead to the VERGILIUS and CORNER simulation suites designed to support mobility and propagation modeling in urban environments. More recently, Dr. Pau designed and developed VNDN the Named Data Network (NDN) protocol stack specifically adapted to work on mobile-to-mobile scenarios. Dr. Pau has published more than 80 papers in International Conferences and Archival Journals. His work on vehicular networks has been widely cited by the community and reported on in the general media including BBC Radio, Discovery Channel, The Guardian, Wired, Corriere della Sera, and the Italian National Television.

### Media Attention:

	<a href="#">Mesh Networking on the Move with Video Conferencing in the Car</a> World Technology Show Digital Planet
	In Italian <a href="#">pdf</a>
	The RAI-Italian National Television PIXEL, Tecnologia sostenibile In Italian, <a href="#">AVI</a> ~10MB

### Recommended Reading:

1. VANET via named data networking." Computer Communications Workshops (INFOCOM WKSHP), 2014 IEEE Conference on. IEEE, 2014.
2. Navigo: Interest forwarding by geolocations in vehicular Named Data Networking." World of Wireless, Mobile and Multimedia Networks (WoWMoM), 2015 IEEE 16th International Symposium on a. IEEE, 2015.
3. Car-Fi: Opportunistic V2I by Exploiting Dual-Access Wi-Fi Networks." Proceedings of the 21st Annual International Conference on Mobile Computing and Networking. ACM MobiCom, 2015, demo.
4. ParkMaster: Leveraging Edge Computing in Visual Analytics." Proceedings of the 21st Annual International Conference on Mobile Computing and Networking. ACM MobiCom, 2015, poster.
5. CarFi on the web & demo - <http://www.carfi.mobi/>
6. Co-operative Downloading in Vehicular ad-hoc Wireless Networks. IEEE/IFIP Second Annual Conference on Wireless On-demand Network Systems and Services, 2005
7. Code torrent: Content Distribution using Network Coding in Vanet, ACM Proceedings of the First International Workshop on Decentralized Resource Sharing in Mobile Computing and Networking, 2006
8. On the effectiveness of an opportunistic traffic management system for vehicular networks, IEEE Transactions on Intelligent Transportation Systems, 2012