WiNeMO – COST IC0906
Summer Training School on
"Enabling the Future of Intelligent Transportation Systems"

Grecian Bay Hotel
Ayia Napa, Cyprus
18 - 20 June 2012
http://medhocnet2012.cs.ucy.ac.cy/wss/index.html

Sponsors

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Med-Hoc-Net 2012
11th Annual
Mediterranean Ad Hoc Networking Workshop

Local Organizers

University
of Cyprus

FREDERICK
UNIVERSITY

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This Summer Training School is jointly organized by the COST Action IC0906 on Wireless Networking for Moving Objects (WiNeMO) and the MedHocNet 2012 Workshop.

The aim of the school will give an overview of the research and technology trends in the field of Vehicular Ad-hoc Networks (VANETs) and their potential in supporting the future of Intelligent Transportation Systems (ITS).

Ten lectures in three days will cover aspects related to the theory of transportation systems and traffic control, models for handling networked vehicle movement in intelligent environments, standards and protocols enabling vehicle-to-vehicle and vehicle-to-infrastructure communication, safety and security issues, and vehicular networking applications. Many lectures will include the exposition of case studies and the lessons learned from real-life deployments. Demonstration of simulation environment for VANETs is also offered. The interesting topic of Content Proliferation and Caching as it applies, not only to vehicular networks, but also to all Future Internet Architectures will be addressed as well.

All lectures will be given in a relaxing environment inducing learning by renowned academics actively working in the field.

Application (due May 29th, 2012)

Prospective applicants should be graduate students (PhD/MSc students), research associates, or early-stage PhD holders (up to 3 years of experience since completion of PhD; proof of correctness may be requested).

Applicants must send the following items to Dr. Chrysostomos Chrysostomou at ch.chrysostomou@frederick.ac.cy (with Subject title: WiNeMO Summer School Application):

> --> Letter of Interest – LoI (max. 1 page)

> --> Full C.V.

**Priority will be given to applicants hosted by the WiNeMO Cost Action member countries. If so, please indicate it to the LoI.

Registration (Applicable to approved candidates' applications):

Registration Fee: 300 EUR (Incl. coffee breaks, buffet lunches, welcome reception, summer school material)
Registration deadline: June 8th, 2012
Registration via Website: http://medhocnet2012.cs.ucy.ac.cy/registration.html

**The WiNeMO COST action is offering up to 10 Grants of 800 EUR to participants hosted by its member countries (based on budget availability). If interested, please apply for a grant by explicitly indicating it in the LoI.

Organizing Committee:
Yevgeni Koucheryavy, Tampere University of Technology, Finland (IC0906 Chair)
Andreas Pitsillides, University of Cyprus, Cyprus (Med-Hoc-Net'12 General Chair)
Chrysostomos Chrysostomou, Frederick University, Cyprus (IC0906 Cyprus MC Member)
Geert Heijenk, University of Twente, Netherlands (Med-Hoc-Net'12 TPC co-chair and IC0906 Vice Chair)
Vasos Vassiliou, University of Cyprus, (Med-Hoc-Net'12 TPC Co-chair)

WiNeMO – COST IC0906 Summer Training School on "Enabling the Future of Intelligent Transportation Systems" PROGRAM

Times/days	18/6 Monday	19/6 Tuesday	20/6 Wednesday
8:00-9:00	Registration and Welcome		
9:00-10:30	Prof. Andreas Pitsillides "Information Dissemination and Routing in Vehicular Ad Hoc Networks"	Dr. Gérard Le Lann "Novel Communication and System Constructs for Integrated Safety and Efficiency in Intelligent Vehicular Networks"	Prof. Leandros Tassiulas "Content Proliferation and Caching in Future Internet Architectures"
10:30-11:00	Coffee break		
11:00-12:30	Dr. Yiannos Mylonas "Simulation Environment for VANETs through Demonstrations"	Dr. Claudio Casetti "Inter-Vehicular Communication: Standards, Protocol Design, and Integrated Security Metrics, Part 1"	Prof. Francisco Barcelo-Arroyo "Localization of Terminals Using Wireless Technologies and Applications to Mobile Ad-Hoc Networks (MANET)"
12:30-14:00	Lunch		
14:00-15:30	Dr. G. Pallis "The Dynamics of Vehicular Networks in Urban Environments"	Dr. Claudio Casetti "Inter-Vehicular Communication: Standards, Protocol Design, and Integrated Security Metrics, Part 2"	Prof. Carla-Fabiana Chiasserini "A Path toward Mobile Services in Vehicular Networks"
15:30-16:00	Coffee break		
16:00-17:30		Prof. Mario Gerla "Vehicular Cloud Computing"	Prof. Yevgeni Kucheryavy "Technologies for Communications Between Moving Objects"
18:00-18:30			Closing Session
20:00-22:00		Cocktail Reception at Thalassa Museum	

Day One – Monday, June 18

8:00 – 8.45 Registration

8:45 – 9:00 Welcome by WiNeMO Action Chair and Summer School Organizers

9.00 – 10.30 "Information Dissemination and Routing in Vehicular Ad Hoc Networks"
Prof. Andreas Pitsillides, University of Cyprus

10:30 Coffee break

11.00 – 12.30 "Simulation Environment for VANETs through Demonstrations"
Dr. Yiannos Mylonas, University of Cyprus

12.30 Lunch

14.00 – 15.30 "The Dynamics of Vehicular Networks in Urban Environments"
Dr. George Pallis, University of Cyprus

15.30 Coffee break

16.00 – Free Time

Day Two – Tuesday, June 19

9.00 – 10.30 "Novel Communication and System Constructs for Integrated Safety and Efficiency in Intelligent Vehicular Networks"

        Dr. Gérard Le Lann, IMARA Team – INRIA, France

10.30   Coffee break

11.00 – 12.30 "Inter-Vehicular Communication: Standards, Protocol Design, and Integrated Security Metrics, Part 1"

        Dr. Claudio Casetti, Politecnico di Torino, Italy

12.30   Lunch

14.00 – 15.30 "Inter-Vehicular Communication: Standards, Protocol Design, and Integrated Security Metrics, Part 2"

        Dr. Claudio Casetti, Politecnico di Torino, Italy

15.30   Coffee break

16.00 – 17.30 "Vehicular Cloud Computing"

        Prof. Mario Gerla, University of California at Los Angeles, USA

20:00   Cocktail Reception at Thalassa Museum

Day Three – Wednesday, June 20

9.00 – 10.30 "Content Proliferation and Caching in Future Internet Architectures"

        Prof. Leandros Tassiulas, Computer Engineering and Telecommunications, University of Thessaly, Greece and Center for Research and Technology Hellas

10.30   Coffee break

11.00 – 12.30 "Localization of Terminals Using Wireless Technologies and Applications to Mobile Ad-Hoc Networks (MANET)"

        Prof. Francisco Barcelo-Arroyo, Universitat Politècnica de Catalunya, Spain

12.30   Lunch

14:00 – 15:30 "A Path toward Mobile Services in Vehicular Networks"

        Prof. Carla-Fabiana Chiasserini, Telecommunication Networks Group, Politecnico di Torino, Italy

15:30   Coffee break

16.00 – 17.30 "Technologies for Communications Between Moving Objects"

        Prof. Yevgeni Kucheryavy, Tampere University of Technology, Finland

18.00   Closure

"Information Dissemination and Routing in Vehicular Ad Hoc Networks"

Prof. Andreas Pitsillides, University of Cyprus

Abstract: VANETs harness the potential of information and communication technologies to create a safer, smarter and more efficient transportation network. Many of the applications of VANETs, especially the safety related ones, set up requirements for information dissemination and routing with unique challenges such as stringent delay requirements, high reachability, and addressing geographical areas in which data needs to be cooperatively collected, distributed and maintained (information hovering / geo casting / geo tagging). Design challenges are posed by the variable node density along the transportation network, the high mobility, the confined but often unpredictable movement of the vehicles, and the unreliable radio channel. The first part of this course will discuss broadcast dissemination in a freeway setting. We will show the existence of phase transitions, and also that these are dependent on the traffic density, which in turn can be related to vehicle speed. Thus using the vehicle speed one can infer the state of the freeway (traffic density), hence a critical rebroadcast probability value, which can be adaptively selected to achieve high reachability, whilst maintaining low latency of message delivery. Next the course will present an adaptive information hovering scheme which is based on the application of epidemic routing within the hovering area and probabilistic flooding outside the hovering area. A unique feature of the proposed protocol is that it is adaptive in the sense that the rebroadcast probability outside the hovering area is adaptively regulated based on estimates of the vehicle density within the hovering area. Then, the course will present information routing outlining the derivation of the probability of information propagation on intersections and its utilization in estimating the message delivery probability over long distances in a predetermined time interval. Finally the course will present the evaluation of the presented schemes on different sections of the freeway system in the City of Los Angeles, using an integrated platform combining the communication networks simulator, OPNET Modeler, and the road transportation simulator, VISSIM.

"Simulation Environment for VANETs through Demonstrations"

Dr. Yiannos Mylonas, University of Cyprus

Abstract: This tutorial covers the simulation process and methods to carry a realistic simulation in VANETs. This can be done by integrating numerous tools such as PeMS (Performance Measurement System), Google Earth, VISSIM simulator (transport simulator) and OPNET simulator (network simulator). This tutorial shows the integration of these tools through demonstrations.

"The Dynamics of Vehicular Networks in Urban Environments"

Dr. George Pallis, University of Cyprus

Abstract. Vehicular Ad hoc NETworks (VANETs) have emerged as a platform to support intelligent inter-vehicle communication and improve traffic safety and performance. The road-constrained, high mobility of vehicles, their unbounded power source, and the emergence of roadside wireless infrastructures make VANETs a challenging research topic. A key to the development of protocols for inter-vehicle communication and services lies in the knowledge of the topological characteristics of the VANET communication graph. The first part of this course will explore the dynamics of VANETs in urban environments and investigate the impact of these findings in the design of VANET routing protocols. Using both real and realistic mobility traces, we will study the networking shape of VANETs under different transmission and market

penetration ranges. In the second part of the course, we will describe VIVAGr, a graphical-oriented real time visualization tool for vehicular ad-hoc network connectivity graphs. This tool enables the effective synthesis of structural, topological, and dynamic characteristics of VANET graphs, with a variety of parameters that affect the shape and characteristics of a vehicular ad hoc network (wireless range, mobility models, road-network topology, market penetration ratio, and exhibited interference). Our design allows researchers to explore and understand problems and issues related with vehicular ad-hoc networks that face today significant design challenges. The tool is able to present all active connection of the network in real-time mode using mobility traces.

"Novel Communication and System Constructs for Integrated Safety and Efficiency in Intelligent Vehicular Networks"

Dr. Gérard Le Lann, IMARA Team – INRIA, France

Abstract: We present the cohort and the group constructs which are aimed at reconciling safety and efficiency for intelligent vehicular networks (IVNs) on roads and highways. We show how platoons and vehicular ad hoc networks can be structured as cohorts and groups, taking advantage of omnidirectional and unidirectional communications. Fundamental implications of safety requirements are reviewed. A rationale for on-board systems based on diversified functional redundancy is developed, illustrated with the concept of neighbor-to-neighbor (N2N) periodic beaconing based on short range unidirectional communications meant to withstand telemetry failures. Worst-case analytical results are given for safe inter-vehicle spacing in cohorts despite inaccurate vehicle space-time coordinates and failing telemetry capabilities. The group construct is based on prefixing usage of sensing-based solutions with medium range V2V omnidirectional communications. Benefits resulting from prefixing vehicle maneuvers with vehicle role assignments are examined and illustrated with the on-ramp-merging safety-critical scenario. Augmenting IVNs with cohorts and groups has profound implications, opening up new horizons, which will be discussed.

"Inter-Vehicular Communication: Standards, Protocol Design, and Integrated Security Metrics"

Dr. Claudio Casetti, Politecnico di Torino, Italy

Abstract: In a first part, we investigate the requirements on IVC ranging from traffic information systems to safety applications with real-time communication constraints. Typical IVC approaches are introduced including fully distributed as well as infrastructure-based, and centralized 3G/4G solutions. Emphasis is laid on the most recent standardization activities in the DSRC/WAVE context. We continue to discuss relevant protocols and communication principles to provide detailed information on which communication methods can be applied and how IVC protocols are developed. We study ad hoc routing approaches and their limitations to cover wide areas as well as recent geo-routing and broadcast-based data dissemination techniques. The main focus, however, will be on recently developed beaconing approaches that can easily be built upon the IEEE 802.11p protocol standard. The second part of the tutorial will focus on Secure IVC. Relying on broadcast transmissions, IVC solutions are exposed to multiple threats. Attacks are not easily prevented because of the ephemeral nature of IVC links and the constant movement of vehicles, as well as by the stringent timing requirements of IVC applications. We discuss the vulnerabilities of IVC solutions in terms of identity management, message authentication/protection/consistency, privacy protection and in-vehicle security. This overview will provide attendees with the state of the art as well as the open challenges in the field of secure IVC.

p"Vehicular Cloud Computing"

Prof. Mario Gerla, University of California at Los Angeles, USA

Abstract: Mobile Cloud Computing is a new field of research that aims to study mobile agents (people, vehicles, robots) as they interact and collaborate to sense the environment, process the data, propagate the results and more generally share resources. Mobile agents collectively operate as Mobile Clouds that enable environment modeling, content discovery, data collection and dissemination and other mobile applications in a way not possible, or not efficient, with conventional Internet Cloud models and mobile computing approaches. In this talk we discuss design principles and research issues in mobile cloud computing. We then focus on the Mobile Vehicular Cloud and review cloud applications ranging from urban sensing to intelligent transportation.

"Content Proliferation and Caching in Future Internet Architectures"

Prof. Leandros Tassiulas, Computer Engineering and Telecommunications, University of Thessaly, Greece and Center for Research and Technology Hellas

Abstract: The proliferation of storage at routers and other parts of the network hierarchy in combination with a paradigm shift in the nature of internet traffic that is becoming primarily content triggered, motivate recent explorations for novel internet architectures that are better suited to the new reality. Storage allows replication of information anywhere in the network, generalizing the paradigm of content distribution networks while supporting novel information access modes. In this presentation will address issues of information replication in relation to content popularity and spatial distribution of demand while propose schemes for efficient content management in caching hierarchies. Then will consider flat network architectures motivated by adhoc networks and explore the effect of caching in the many-node regime. Certain information replication schemes will be presented that are asymptotically optimal. Their investigation in growing network sizes will reveal smoother scaling behavior than what has been observed for adhoc networks without caching.

"Localization of Terminals Using Wireless Technologies and Applications to Mobile Ad-Hoc Networks (MANET)"

Prof. Francisco Barcelo-Arroyo, Universitat Politècnica de Catalunya, Spain.

Abstract: The localization of wireless terminals is key, not only as a standalone service informing the user about its position but also as a necessary support for other applications and network management. The use of GPS is not always viable due to several constraints; signal blocking in urban areas and excessive energy consumption are the main ones. During the last decade several methods were proposed for GPS-less localization of terminals in WLAN and WPAN networks including circular and hyperbolic trilateration, fingerprinting, signal strength, round trip time and angle of arrival. The localization procedures are more complex if the network works without infrastructure. Methods for locating terminals in MANETs where the existence of perfectly located references is not guaranteed are more sophisticated and in general lead to larger errors. The study of issues like scalability and energy consumption gains interest and complexity when localization solutions are applied to MANETs.

"A Path Toward Mobile Services in Vehicular Networks"

Prof. Carla-Fabiana Chiasserini, Telecommunication Networks Group, Politecnico di Torino, Italy

Abstract: This talk provides thoughts on how wireless mesh networks and vehicular networks can be combined and exploited to support Internet-based services to mobile users. Based on the recent studies in these fields, we will try to assess how well the currently available approaches and solutions meet the challenges of satisfying the user needs. Key aspects

addressed in this talk are the issues of how to avoid congestion of the radio channel and of how to evaluate the impact of mobile-to-mobile and mobile-to-infrastructure communications on the efficiency of data services. We will also present the results of field operational tests, and highlight open problems and future challenges.

"Technologies for Communications Between Moving Objects"

Prof. Yevgeni Kucheryavy, Tampere University of Technology, Finland

Abstract: The lecture on wireless networking for moving objects is targeted at understanding of a big picture on the existing and future (2 – 5 years) applications, services, frameworks, e.g. Internet of Things, and correspondent technology enablers. It will reveal existing and upcoming algorithms and protocols for different wireless technologies standardized by IEEE 802.11 committee e.g. n, p, e, s, ad, ac, etc; by 3GPP, e.g. UMTS, HSPA, HSPA+, LTE, LTE-A; ZigBee; 6LoWPAN. Being standardized and developed solutions on network architecture such as femtocell, CoMP (coordinated multipoint), relaying, etc. will be addressed and analyzed. Energy efficiency issues will also be addressed and investigated.