



UNIVERSITÀ DI PISA
DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE
Dottorato di Ricerca in Ingegneria dell'Informazione

Doctoral Course

“Network Science”

Prof. Giovanni Neglia

INRIA

MAESTRO Team (Models for performance analysis and control of networks)

Short Abstract: Network science (aka the science of complex networks) has emerged in the last ten years as an inter-disciplinary and yet distinct research field, seeking to discover common principles, algorithms and tools that govern networks as different as the Internet, the web, human social networks, gene regulatory networks, the brain, ecosystems, social organizations, transport networks.

Course Contents in brief:

- What do real networks look like? and why?
 - Small world effect or 6-degrees of separation, clusters, hubs and heavy tails.
- Navigation in complex networks networks
 - How to find paths in large networks with strongly limited memory and/or computation capabilities?
- Contagion in networks
 - How to model virus spreading, file replication in a P2P network or epidemic routing in DTNs? Which topologies are more vulnerable/efficient? How to slow-down or speed-up contagion?
- Consensus
 - How do beliefs form? How can sensors in a large wireless network improve their measurement estimates?

Total # of hours: 20 hours

References:

- [1] Network, Crowds, and Markets, Easley and Kleinberg, Cambridge University Press
 - [2] Dynamical Processes on Complex Networks, Barrat, Barthélemy, Vespignani, Cambridge Press
 - [3] Mean Field Methods for Computer and Communication Systems: A Tutorial, Le Boudec
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CV of the Teacher

His research includes congestion control, P2P networks, epidemic routing in intermittently connected networks, biologically inspired protocols and algorithms, game theory applications to computer networks.

Ongoing Research Activities

- Complex Networks.
- Smart Grids.
- Distributed Gradient Optimization for Epidemic Routing.
- Consensus Protocols.
- Network coding in wireless networks.
- Efficient Network Sampling.

Previous Research Activities

- Routing in Quasi-Deterministic DTNs [CRASQUIDEM project](#).
- A framework for evolutionary epidemic routing.
- Modeling epidemic routing in wireless networks.
- Game theoretical analysis of Bittorrent.
- Measurements on Bittorrent swarms.
- The effect of admission control on data traffic long range dependence.
- TCP performance in DiffServ networks with AQM routers.

His "Pay Few, Influence Most: Online Myopic Network Covering" (with K. Avratchenkov, P. Basu, B. Ribeiro and D. Towsley) got the Best Paper Award at the IEEE Infocom workshop on Network Science for Communication Networks (NetSciCom).

- He was the organizers of the [Winter School on Complex Networks 2014](#) on the SophiaTech campus on January 27-31 2014.

The paper On Optimal Packet Routing in Deterministic DTNs got a best paper award at [IEEE VTC2013-Spring](#). This is a joint work with Xiaolan Zhang, Jim Kurose, Don Towsley and Haixiang Wang.

Room and Schedule

Room: *Aula Riunioni del Dipartimento di Ingegneria dell'Informazione, Via G. Caruso 16, Pisa – Ground Floor*

Schedule:

23/03/2015 09:00-13:00

24/03/2015 09:00-13:00

25/03/2015 09:00-13:00

26/03/2015 09:00-13:00

27/03/2015 09:00-13:00