Proposal I

Title: ***Architectures for integration of hybrid simulation tools for wireless networks***

Supervisor(s)

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Framework

Complexity of telecommunication networks requires efficient simulation tools for the planning and design phases and wireless networks are no exception.

In fact there are several reason for it to be more important in wireless networks:

- The next generation wireless communication technology will be adaptive and reconfigurable (software-defined radios, smart antennas, programmable networks, …)
- There is substantial 'cross-layer interaction' among the technology solutions at multiple layers of the protocol stack to provision dynamic Quality of Service among the voice, video, and data traffics that must be carried by such networks
- There is limited experience, with large scale deployments and use of such on-the-move communication technology
- Static analysis and planning may not be adequate to achieve the dynamically varying Quality of Service requirements for the diverse applications
- System / Network simulations/emulations can play a critical role in assessing the dynamic impact of net-centricity in the design and operation of such networks

Thus simulation evaluation tool design and system modelling is a challenging task in an effort to provide a trade-off between accurate system modelling, and complexity, which will adversely effect the simulation time. In mono-system optimisation design, effort has been targeted towards providing a framework for optimisation, which entails providing reliable and accurate model of the system deployment scenario and user mobility. Furthermore, significant attention is given to the interfacing methodology between PHY and MAC layer, and MAC and Network layer. Typically, the protocol evaluation platforms are not managed by the same task manager/processor, otherwise computation time would be prohibitive. Thus, interfacing is usually managed by look-up tables that are computed off-line. The traditional problem is how to reflect the physical layer assumptions, implications, and scenarios on the system level, and again on the network layer, when independent simulation platforms with different time granularities are employed. Therefore, current research is targeted towards how to model the interface accurately, keeping processing power low, and reducing the number look-up table elements. However the use of LUT's despite its simplicity is obviously not the most

appropriate solution from the user point of view and of course it would be more appropriate to have an integrated tool, that would invoke the different simulators in an efficient way (e.g using caching) when needed and automatically pass the relevant information.

Objectives:

The proposal for this PhD targets this objective and should specifically contribute to:

Research efficient and scalable architectures to integrate simulators operating at different levels of granularity.

Definition, development and test of the appropriate API's to interface the different simulators according to the lines of the architecture specified.

Proposal II

Title: ***Machine Learning Architectures and Algorithms for Cognitive Radio Networks***

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Framework

Cognitive radio offers the promise of intelligent radios that can learn from and adapt to their environment.

A cognitive radio includes an independent cognitive engine, composed of a knowledge-base, reasoning engine, and a learning engine to implement the so-called cognitive cycle as shown Fig. 1.

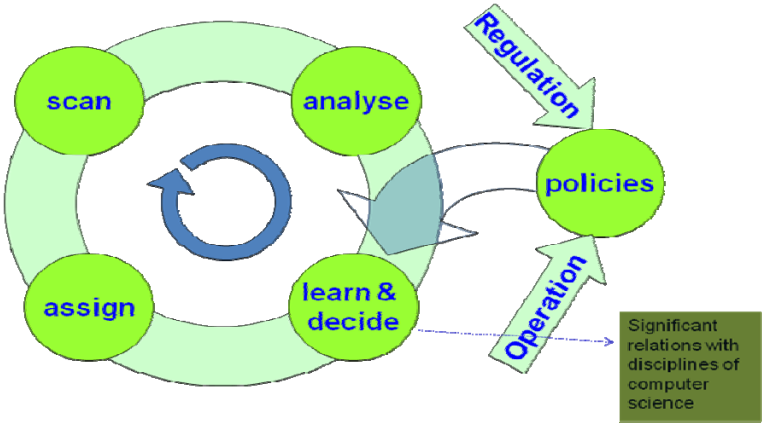

Fig. 1

Several approaches are currently considered in the research community to build the learning machine, some derived from artificial intelligence, while others have proposed biologically inspired solutions where genetic algorithms for the "learning" component of CR's is under investigation namely at Rutgers University and other are considering algorithms based on the results of game theory which are investigated at the University of Virginia.

The algorithms cannot of course decoupled from the architecture, and well-defined API's should dictate the communication between the cognitive engine and the platform..

Objectives

The proposal for this PhD thesis is to:

- Investigate architectures for the learning component of the cognitive radio, including the specifications of the interfaces to the other units.
- Investigate algorithms for resource assignment and database update for the architecture investigated

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