



Modelling Network Routing Protocols

(Research Internship Offer in Computer Science/Engineering)

Background

Wireless Mesh Networks (WMNs) are a promising technology that is currently being used in a wide range of application areas, including Public Safety, Transportation, Mining, etc. Typically, these networks do not have a central component (router), but each node in the network acts as an independent router, regardless of whether it is connected to another node or not. They allow reconfiguration around broken or blocked paths by “hopping” from node to node until the destination is reached. Unfortunately, the current systems often do not live up to the expectations of end users in terms of performance and reliability, as well as ease of deployment and management.

In cooperation with Macquarie University (Sydney, Australia) and Queensland University (Brisbane, Australia), NICTA explores and develops new adaptive network protocols and mechanisms for Wireless Mesh Networks that can overcome the major performance and reliability limitations of current systems. To support the development of these new protocols, the project also aims at new Formal Methods based techniques, which can provide powerful new tools for the design and evaluation of protocols and can provide critical assurance about protocol correctness and performance. Close collaboration with industry partners ensures the use-inspired nature of the project.

Research Question and Tasks

Classical routing protocol specifications are usually written in plain English. Often this yields ambiguities, inaccuracies or even contradictions. The use of Formal Methods like process algebra avoids these problems and leads to a precise description of protocols. To compare and evaluate different protocols, we aim at a compendium of standard routing protocol specifications in a unified language.

So far we have modelled two of the standard protocols using process algebra, namely the Ad hoc On-Demand Distance Vector (AODV) and the Dynamic MANET On-demand (DYMO) routing protocol. The project’s work should include the formalisation of a second standard protocol, called OSLR (http://en.wikipedia.org/wiki/Optimized_Link_State_Routing_Protocol). After a faithful specification of OSLR has been given, the work could include the verification of basic properties or the comparison with other protocols. An example for a basic property is packet delivery; it guarantees that a packet, which is injected into a network, is finally delivered at the destination (provided the destination can be reached).

The ideal applicant should be interested in applying Formal Methods and logic-based calculi in general; previous knowledge about process algebra is appreciated, but not necessary. Prior knowledge about wireless mesh networks is not needed at all.

General Information

NICTA (National ICT Australia) is Australia’s Information and Communications Technology (ICT) Centre of Excellence. It is an independent company in the business of research, commercialisation and research training. With over 700 people, NICTA is the largest organisation in Australia dedicated to ICT research.

The internship is integrated in *Concurrency and Protocol Verification* (<http://ssrg.nicta.com.au/projects/concurrency/home.pml>). The team behind *Concurrency and Protocol Verification* is a highly motivated group with different backgrounds (e.g., formal methods and network engineers), working at different institutes (UNSW, NICTA, UQ, and Macquarie University), and with different levels of experience (from young researchers to professors). The successful applicant will work in the Software Systems Research Group. He/She will work together with Prof. Rob van Glabbeek and Dr. Peter Höfner.

Sydney is the largest and most populous city in Australia. It is located on Australia's south-east coast of the Tasman Sea. With an approximate population of 4.5 million in the Sydney metropolitan area the city is the largest in Oceania. Sydney also ranks among the top 10 most liveable cities in the world according to Mercer Human Resource Consulting and The Economist.

Unfortunately, NICTA, as the host institute, cannot offer further financial scholarships.

Contact Information

If you have any questions concerning the internship, please do not hesitate to contact us:

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