Model Checking Tool Suite for Protocol Development

(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

The techniques used for modelling, analysing and verifying routing protocols for WMNs are based on a simple programming language, which offers expressions for (arbitrary) data structures and basic primitives for WMNs, such as broadcast and unicast. The intention is to use this language right from the beginning when designing protocols; but this can only be achieved if tools support the development.

During Rise 2012 and 2013 a translator from the specification language to the input language of the model checker Uppaal has been developed. During Rise 2013 a text-editor front-end for the specification language has been developed as well. The first task of the project is the combination of the two projects; by this a tool suite is created which can be used to design new protocols and which immediately offers model checking support. The second aim is to extend the tool suite by a set of standard tests which can be used to automatically analyse protocols during development and to offer on-the-fly feedback to the user.

The ideal applicant should have experience in programming, preferable using Java; knowledge about model checking and mesh networks is not required and will be explained when needed.

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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