Post-Doc Position

ARC COINC: COmputational Issues in Network Calculus

A new Post-doc is available in INRIA within the ARC group COINC.
(http://www-id.imag.fr/Laboratoire/Membres/Gaujal_Bruno/Coinc/coinc.html)

Description of the project

Network Calculus is one of the most promising technique to provide deterministic guarantees in distributed and embedded systems.

The main idea of the theory is to model traffic between the nodes by cumulative *arrival curves*: $A(t)$ is the amount of traffic at a given node up to time t. The service provided at a node is modeled by a cumulative *service curve*: $S(t)$ is the quantity of service available up to time t.

As for the time constraints, they are often seen as constraint functions f and g on A and S respectively, limiting the amount of activity on any interval of time:

$$\forall s,t, \quad A(t) - A(s) \leq f(t-s) \text{ and } S(t) - S(s) \geq g(t-s).$$

The great efficiency of Network Calculus is that it is based on a few basic operators on real functions. The main operations are

1. addition: $h(t) = f(t) + g(t)$,
2. point-wise minimum of functions: $h(t) = \min(f(t), g(t))$,
3. Inf-convolution: $h(t) = \inf_{0 \leq s \leq t}(f(s) + g(t-s))$ (denoted by $h = f \otimes g$),
4. De-convolution: $h(t) = \sup_{\geq 0} f(t+s) - g(s)$ (denoted by $h = f \oslash g$),
5. subadditive closure: $f^*(t) = \lim_{n \to \infty} \min(f(t), f \otimes f(t), \ldots, f \otimes \cdots \ n \text{ times } \cdots \otimes f(t))$.

Thus, designing fast algorithms for those will directly make most computations in Network Calculus not only effective but also efficient. However, even if the operators described above look simple, fast algorithms to implement them are not so easy to design. They depend on data structures as well as which classes of functions are considered.

The primary goal of this post-doctoral work will be to design fast algorithms for different classes of discrete real functions (piecewise affine, ultimately periodic functions, convex/concave functions) using the appropriate data structures.

This research with also include a comprehensible software development effort.

The second goal is to implement the algorithms in a software tool which could be used by the community of real time and embedded systems as well as the network community. Right now, such a software tool does not exist. Up to now, all teams involving Network Calculus in their research have used ad-hoc programs with little concern on the efficiency of the algorithms or on their generality. Up to our knowledge, there are no plans on maintaining the software or in making tools available to the community.

Eventually, this software functionalities will be made compatible with SCILAB, the scientific solver developed by INRIA.

So the post-doc must be both comfortable with algorithmic issues and software design (the preferred programming language will be C or C++).

Location

COINC is a common research project involving university groups and INRIA teams in Grenoble (Mescal) , Nancy (Trio) and Montpellier (Maestro), so the post-doc may choose the join any one of these INRIA teams. However Grenoble is the preferred location.

Contact

Anyone interested should contact

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