Mission confiée
Initial work on the Vélus compiler treated the basic features of Lustre: simple equations, initialized delays, and function instantiations. Recent PhD work has extended the semantic model and compilation passes with the modular reset construct from the Scale language. This PhD would focus on progressively adding state machines. Please see the Vélus website for other scientific references.

The first challenge is to adapt existing state machine semantic models for use within an interactive theorem prover. The definitions must be consistent with intuitions about the construct, suitable for verifying compilation passes, and amenable to program verification. State machines are compiled by rewriting them into a smaller subset of the language. The second challenge is to implement rewrite rules as a functional program in Coq and to prove that it preserves the semantics of source programs.

The PhD student will work closely with other team members to develop semantic models, compilation passes, and correctness proofs for the state machine construct from the Sacle language. This PhD would focus on progressively adding state machines. Please see the Vélus website for other scientific references.

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Principal activities
1. Master relevant background knowledge on synchronous language semantics and compilation, and interactive theorem proving by reading books and research articles.
2. Develop a plan of action based on successively treating the various state machine features described in the literature.
3. Extend the existing Vélus compiler with required constructs and define semantic models for them in the Coq ITP.
4. Implement compilation algorithms in Coq and develop proofs of semantic preservation.
5. Document the results in scientific articles and collaborate with other researchers. At the end of a successful PhD, the candidate will be well prepared to continue a research career or contribute to cutting edge developments in industry.

Additional activities:
1. Participate in workshops and team activities.
2. (Optional) Contribute to teaching by supervising lab and tutorial sessions.

Competences
Languages: French or English.

Advantages
- Subsidized meals
- Partial reimbursement of public transport costs
- Leave: 7 weeks of annual leave + 10 extra days off due to RTT (statutory reduction in working hours) + possibility of exceptional leave (sick children, moving home, etc.)
- Possibility of teleworking (after 6 months of employment) and flexible organization of working hours
- Professional equipment available (videoconferencing, loan of computer equipment, etc.)
- Social, cultural and sports events and activities
- Access to vocational training

Informations générales
- Thème/Domaine: Preuves et vérification
- Ville: Paris
- Date de prise de fonction souhaitée: 2020-01-01
- Durée de contrat: 3 ans
- Date limite pour postuler: 2019-10-31

Contacts
- Équipe Inria: PARKAS
- Directeur de thèse: Bourke Timothy / Timothy.Bourke@inria.fr

A propos d’Inria
Inria, l’institut national de recherche dédié aux sciences du numérique, promeut l’excellence scientifique et le transfert pour avoir le plus grand impact. Il emploie 2400 personnes. Ses 200 équipes-agiles, en général communes avec des partenaires académiques, impliquent plus de 3000 scientifiques pour relever les défis des sciences informatiques et mathématiques, souvent à l’interface d’autres disciplines. Inria travaille avec de nombreuses entreprises et a accompagné la création de plus de 160 start-up. L’institut t’offre ainsi de répondre aux enjeux de la transformation numérique de la science, de la société et de l’économie.

L’essentiel pour réussir
You are passionate (but not fanatic!) about functional languages and interactive proof assistants. You are not (just) interested in the theory of logic, but really motivated to apply it to real-world problems. Tenacity and a taste for simplicity are essential character traits for this work.

Ideally, you have had some exposure to interactive theorem proving in your undergraduate or masters programs—just to be sure that the subject suits you.

A curiosity to master new topics, an openness to criticism, a willingness to learn and improve, and a critical mind are essential.

Knowledge of Lustre, Sacle, or Model-Based Development is optional.

Any PhD involves focusing on a narrow topic for three (long!) years. Additionally, developing large projects in interactive theorem provers requires a particular kind of tenacity and stamina.

It would be possible to undertake a five month (M2) internship in the team before beginning the PhD (or deciding not to).

Consignes pour postuler
Sécurité défense:
Ce poste est susceptible d’être affecté dans une zone à régime restrictif (ZRR), c’est-à-dire définie dans le décret n°2011-1425 relatif à la protection du potentiel scientifique et technique de la nation (PPST). L’autorisation d’accès à une zone est délivrée par le chef d’établissement, après avis ministériel favorable, tel que défini dans l’arrêté du 03 juillet 2012, relatif à la PPST. Un avis ministériel défavorable pour un poste affecté dans une ZRR aurait pour conséquence l’annulation du recrutement.

Politique de recrutement:
Dans le cadre de sa politique diversité, tous les postes Inria sont accessibles aux personnes en situation de handicap.
Attention: Les candidatures doivent être déposées en ligne sur le site Inria. Le traitement des candidatures adressées par d'autres canaux n’est pas garanti.