Offre n°2025-08587

A study to provide a set of guidelines for calculation and cost-efficient of numerical algorithms in the cloud with security concern.

Le descriptif de l'offre ci-dessous est en Anglais

Niveau de diplôme exigé : Bac + 4 ou équivalent

Fonction : Ingénieur scientifique contractuel

Corps d'accueil : Ingénieur d'Etudes / Ingénieur de Recherche (IE/IR)

Niveau d'expérience souhaité : Jeune diplômé

A propos du centre ou de la direction fonctionnelle

The Inria research centre in Lyon is the 9th Inria research centre, formally created in January 2022. It brings together approximately 320 people in 19 research teams and research support services.

Its staff are distributed in Villeurbanne, Lyon Gerland, and Saint-Etienne.

The Lyon centre is active in the fields of software, distributed and high-performance computing, embedded systems, quantum computing and privacy in the digital world, but also in digital health and computational biology.

Contexte et atouts du poste

If only integers are manipulated, portability of numerical software is not a big deal. When floating-point arithmetic is used, the situation is quite different. Although the IEEE 754 Standard for Floating-Point arithmetic [1] has greatly improved a situation that was disastrous before the 90's (see [2]), there are still some problems that cannot be ignored, especially when writing soft- ware for critical applications. Some horror stories (along with recommendations) can be found in [3] by Monniaux, and in Chapter 6 of [4].

Now Cloud infrastructure are common, nevertheless the problems have been propagated (even amplified) to this kind of architecture as a Service.

Many application take benefit of arithmetic libraries. In this study we plan to focus on a specific application. Through this use case we will be faced on a real application and we will provide a real experiments to validate the numerical behavior and the Cloud optimization.

The selected application from Bosch is a large, real-time capable, computation-intensive and optimization-based predictive "eco-driving" application. The goal of this software-function is to save energy, and this is reached, knowing the information of the road ahead, by anticipating the speed profile that minimizes as much as possible braking and acceleration. At the same time, this way of driving has another benefit : it reduces vehicle wear and tear (fewer breakdowns etc.) which again saves money. Relying on vision, human drivers scan relevant features of the road ahead and with or without the help of maps and other ADAS systems are able to anticipate but due to a fuzzy internal representation of the car dynamic not to optimize very well the speed profile.

That is the motivation for optimal predictive eco driving-functions. The main idea is to online plan the speed trajectory that minimizes a metric which takes into account energy consumption, travel time and driver comfort over a certain distance or time horizon, while respecting look- ahead information of the road, vehicular traffic etc. . The car and its components (battery, electric machine) dynamics and restrictions are represented with a mathematical model. As the car is moving and the horizon is related to the actual position, the optimal speed trajectory is always re-calculated. A first version of this function has been implemented for an embedded device, but now an extended version shall be implemented using the compute capablilities of the cloud

[1] IEEE. *IEEE Standard for Floating-Point Arithmetic (IEEE Std 754-2019)* . July 2019.

[2] W. Kahan. Why do we need a floating-point standard ? Technical report, Computer Science, UC Berkeley, 1981. Available at http://www.cs.berkeley.edu/~wkahan/ieee754status/why-ieee. pdf.

[3] D.Monniaux.Thepitfallsofverifyingfloating-pointcomputations.*ACMTOPLAS*,30(3):1–41, 2008. A preliminary version is available at http://hal.archives-ouvertes.fr/hal-00128124.

[4] Jean-Michel Muller, Nicolas Brunie, Florent de Dinechin, Claude-Pierre Jeannerod, Mioara Joldes, Vincent Lefèvre, Guillaume Melquiond, Nathalie Revol, and Serge Torres. *Handbook of Floating-Point Arithmetic, 2nd edition* . Birkhäuser Boston, 2018. ACM G.1.0 ; G.1.2 ; G.4 ; B.2.0 ; B.2.4 ; F.2.1., ISBN 978-3-319-76525-9.

Mission confiée

This work is part of a collaboration between Bosch and the Inria Aric and Avalon teams.

The work will be under the supervision of Christian Bertsch (Bosch Research), Eddy Caron (Avalon Team. Professor University Lyon1), Nicolas Louvet (Aric Team. Associate professor at University Lyon1). The localization of this position will be at LIP Laboratory, ENS de Lyon.

Principales activités

Before a most generic study we want to explore differents problems with a specific application, the "eco-driving" function described above. This application uses different numerical libraries. Based on a previous internal study have shown a different numerical behavior according to the hardware and to the cloud environment.

The first step will be to evaluate the numerical properties of the application deployed in a Cloud environment. In addition we want to evaluate and forecast the Cloud cost. Based on this, the setup in the Cloud shall be optimized. Tune and scale the deployment on different Cloud providers to deal with the portability and find the best fit accross different Cloud Service Providers and by the way taking into account different underlying hardware. As we have seen these choice must be considered as a point of view of numerical stability and in term of performances.

Beyond the IaaS (Infrastructure as a Service) consideration we want to investigate different configuration possibilities and usage of Bosch-internal and external numerical libraries (e.g. for elementary functions).

We expect that this study will provide a set of generic guidelines for calculation and cost-efficient of numerical algorithms in the cloud.

Moreover a specific focus on security aspect around the platform deployment on Cloud will be a main topic of the work.

Compétences

The following compepencies will be apprciated

— Strong background in computer science

— Knowledge in cloud technologies / large computing infrastutures / distributed systems / Cybersecurity

— Numerical properties of floating point representations and calculations

— Numerical mathematics

Avantages

- 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 (90 days / year) and flexible organization of working hours
- Social, cultural and sports events and activities
- Access to vocational training
- Social security coverage under conditions

Rémunération

From 2692 € (depending on experience and qualifications)

Informations générales

- **Thème/Domaine** : Systèmes distribués et intergiciels
  Infrastructure (TIC) (BAP E)
- **Ville** : lyon
- **Centre Inria** : Centre Inria de Lyon
- **Date de prise de fonction souhaitée** : 2025-03-01
- **Durée de contrat** : 4 mois
- **Date limite pour postuler** : 2025-02-07

Contacts

- **Équipe Inria** : AVALON
- **Recruteur** :
  Caron Eddy / eddy.caron@inria.fr

A propos d'Inria

Inria est l'institut national de recherche dédié aux sciences et technologies du numérique. Il emploie 2600 personnes. Ses 215 équipes-projets agiles, en général communes avec des partenaires académiques, impliquent plus de 3900 scientifiques pour relever les défis du numérique, souvent à l'interface d'autres disciplines. L'institut fait appel à de nombreux talents dans plus d'une quarantaine de métiers différents. 900 personnels d'appui à la recherche et à l'innovation contribuent à faire émerger et grandir des projets scientifiques ou entrepreneuriaux qui impactent le monde. Inria travaille avec de nombreuses entreprises et a accompagné la création de plus de 200 start-up. L'institut s'efforce ainsi de répondre aux enjeux de la transformation numérique de la science, de la société et de l'économie.

L'essentiel pour réussir

- Cloud skills.
- Tenacity
- Thoroughness
- An interest in research

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.

Consignes pour postuler

Applications must be submitted online via the Inria website. Processing of applications submitted via other channels is not guaranteed.

Defence security:

This position is likely to be assigned to a restricted area (ZRR), as defined in decree no. 2011-1425 relating to the protection of the nation's scientific and technical potential (PPST). Authorisation to access a zone is issued by the head of the establishment, following a favourable ministerial opinion, as defined in the decree of 03 July 2012 relating to the PPST. An unfavourable ministerial opinion for a post assigned to a ZRR would result in the recruitment being cancelled.

Sécurité défense :
Ce poste est susceptible d'être affecté dans une zone à régime restrictif (ZRR), telle que 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.