2021-03490 - Engineer Grenoble Alpes University: High Performance Computing Research Engineer for Elastic Ensemble Runs and Large Scale Data Processing

Type de contrat : CDI
Niveau de diplôme exigé : Bac + 5 ou équivalent
Fonction : Ingénieur scientifique contractuel
Niveau d’expérience souhaité : De 3 à 5 ans

A propos du centre ou de la direction fonctionnelle
The candidate will be employed by UGA - Univ. Grenoble Alpes (https://www.univ-grenoble-alpes.fr) as an engineer in the DataMove team that is part of both Inria and UGA. DataMove research lab is located on UGA campus very near Grenoble.

Contexte et atouts du poste
The employer will be Grenoble University Alpes.

The candidate will join the DataMove INRIA team located on the campus of the Univ. Grenoble Alpes near Grenoble. The DataMove team is a friendly and stimulating group with a strong international visibility, gathering Professors, Researchers, PhD and Master students all pursuing research on High Performance Computing.

This work is part of a joint collaboration with international industrial and academic partners. This work experience will bring you skills related to high performance computing, statistics and deep learning that are in high demand.

Hiring date is flexible. We expect to hire the candidate in June 2021, but we have the possibility to start the contract sooner if we find a good candidate or even later to accommodate some specific situations (titulation for instance).

The city of Grenoble is surrounded by the Alps mountains, offering a high quality of life and where you can experience any kind of mountain related activities and more.

Principales activités
Numerical simulations are today commonly used for modeling complex phenomena or systems in different fields such as physics, chemistry, biology or industrial engineering. Some of these numerical simulations require supercomputers to run high-resolution models. In general, a numerical simulation needs a set of input parameters in order to produce the simulation outputs. The input parameters and the often complex internal model produce outputs that can be very large. Analyzing these outputs, tuning the input parameters, or adjusting the internal simulation state based on observation data provided by scientific instruments is still very challenging.

Ensemble runs consist in running many times the same simulation with different parameter sets to get a steady analysis of the simulation behavior in the parameter space. The simulation can be a high resolution large scale parallel code or a smaller scale lightweight version called meta-model or surrogate model. This is a process commonly used for Uncertainty Quantifications, Sensibility Analysis, Data Assimilation, Deep Learning based Surrogate Training. This may require to run from thousands to millions of the same simulation, making it an extremely compute-intensive process that will fully benefit of Exascale machines.

Existing approaches to handle large ensemble runs show a limited scalability. They either rely on intermediate files where each simulation run writes outputs to file that are next processed for result analysis. This makes for a flexible process, but writing these data to the file system and reading them back for the analysis step is a strong performance bottleneck at scale. The alternative approach consists in aggregating all simulation runs into the same large monolithic MPI job. Results are processed as soon as available avoiding intermediate files. However, by not taking benefit of the loose synchronization needs between the different runs, this over-constrains the execution regarding compute resource allocation, application flexibility or fault tolerance. To overcome these limitations we recently proposed a new framework, Melissa, relying on an elastic architecture. Simulations are submitted to the machine batch scheduler independently. Once these jobs start they dynamically connect to a parallel data processing parallel server. This server gets the data from the running simulation that are processed in parallel on-line as soon as available, thus avoiding intermediate files. The computed partial results can be retro-fed to the simulation (needed for data assimilation for instance). They can also be used to support an adaptive sampling process where the set of parameters for the next simulation runs are defined according to these partial results. Such framework enables to fully take benefit of the loose synchronization capabilities between simulation runs: simulations are submitted and allocated independently enabling to better use the machine resources and to support efficient fault tolerance mechanisms.

Melissa framework has been developed for sensitivity analysis where the server gets the data from the simulation to compute statistics without influencing directly the execution of the simulation. Our team is today investigating other ensemble runs based computations where Melissa can bring an original solution. This includes computing surrogate models (reduce models) using deep learning, data assimilation (steering the simulation execution with data obtained from other scientific instruments) for instance.

The engineer work will work on the Melissa development and side activities, mainly:

1. Melissa framework consolidation and extension. One objective is to make it more generic to support a larger variety of ensemble run based computations. Working in close direction wit the team master and PhD Students as well as external collaborators.
2. Preparing, developing, running and analyzing large scale Melissa enabled applications. The engineer

Informations générales
- Thème/Domaine : Calcul distribué et à haute performance
- Ville : Montbonnot
- Centre Inria : CRI Grenoble - Rhône-Alpes
- Date de prise de fonction souhaitée : 2021-06-01
- Durée de contrat : 2 ans
- Date limite pour postuler : 2021-08-31

Contacts
- Equipe Inria : DATAMOVE
- Recruteur : Raffin Bruno / bruno.raffin@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 200 équipes-projets agiles, en général communes avec des partenaires académiques, impliquent plus de 3500 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 180 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.

Consignes pour postuler
Depending on the evolution of the health crisis linked to the Covid 19, it will be possible to work remotely.

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.

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.
will have access to a panel of word-class supercomputers like Jean-Zay at Idris or Juwels at Julich, as well as smaller ones for prototyping.

Through this work the engineer will consolidate her/his expertise in high performance computing, high performance data analysis and gain knowledge on deep learning, reinforcement learning, data assimilation. She/he will integrate a dynamics research team, be involved in research activities including preparation of scientific publications. She/he will have the opportunity to interact with other research teams as well as industrial partners involved with Melissa (EDF R&D for instance), and as such may have to make some short travels in France and abroad.

**References :**
- Melissa for sensibility analysis: [https://hal.inria.fr/hal-01607479v1](https://hal.inria.fr/hal-01607479v1) and [https://melissa-sa.github.io/](https://melissa-sa.github.io/)
- Melissa for data assimilation: [https://hal.archives-ouvertes.fr/LIG/hal-03017033v2](https://hal.archives-ouvertes.fr/LIG/hal-03017033v2)

**Compétences**

We welcome candidates with a master in computer science, experience in high performance computing and scientific computing, and ideally knowledge related to sensitivity analysis, data assimilation or deep learning. No previous work experience required as long as you are motivated and ready to train yourself to complement your skills. Income will be adjusted to your experience.

Expected technical skills include Linux expertise, C/C++ and Python programming, parallel programming experience, a good mastering of development processes including git, continuous integration, containers, etc.

Work will be split in between software development, experiments on large scale supercomputers, explorative research.

Candidates should be motivated by research work, and with good abilities for team work, oral and written communication skills. A good level of English is thus required. French is not mandatory and INRIA will provide French classes if needed.

To apply submit you CV, references, recent marks, and if available your last Internship/Master Thesis manuscript. With your application provide any element (github account, etc.) that could help us assess your skills beyond your academic record, as well as a few references to persons we can contact to get some feedback on your qualities.

**Avantages**

- Subsidized meals
- Partial reimbursement of public transport costs
- Leave: 45 days/ year
- Social, cultural and sports events and activities (CAESUS)
- Access to vocational training
- Social security coverage

As UGA employee

**Rémunération**

Income will depend on the candidate work experience and titles.

For instance a candidate with 3 years of experience and an Engineering title or PhD can reach 2800 euros/month gross income.