InterFLOP

AAPG 2020 PRCE

01/02/2021 – 01/02/2025

Planning

Time	Topic
9h00 - 9h30	Welcome & Coffee
9h30 - 10h00	Presentation & administratives update of the project (David D.)
10h00 - 10h30	User Board presentation (Eric PETIT + Wilfried KIRSCHENMANN)
10h30 - 11h00	COFFEE
11h00 - 11h30	Sparse matrix vector in mixed precision (Théo Mary, LIP6)
11h30 - 13h30	LUNCH
13h30 - 14h30	Nsan integration Demo & Discussion on shadow memory (Mathys Jam, UVSQ Intern)
14h30 - 15h00	ARM Front-End (Yves LHUILLIER, CEA)
15h00 - 15h30	Update on Task 5 (El-Medhi EL-ARAR, UVSQ)
15h30 - 16h00	COFFEE
16h00 - 17h00	Discussion on tasks and deliverables.

Update from the project

- Accord de consortium => Done

- Recruitment of the 2nd Phd student (LIP6) => Done

- Deliverables:
  - 1 Poster at ISC 2021 + 1 publications at ARITH2021

Plan

- Update from the project

- Publications & Diffusion

- InterFLOP descriptions (*geared toward new partici*pants)

Publications & Diffusion

- Publications done for the the project
  - To be inserted at www.interflop.fr
  - & Perform a « Dépôt HAL »

Titre du congrès	ISC-HPC 2021 DIGITAL
Date début congrès	2021-06-24
Ville	Online
Pays	France
Projet(s) ANR	• Plateforme d'analyse pour l'arithmétique flottante [En savoir plus] — INTERFLOP - ANR-20-CE46-0009 — - AAPG2020 - 2020

1- Dépôt des publications scientifiques en libre accès (1/2)

- Le coordinateur ou la coordinatrice et les partenaires s'engagent à déposer les publications scientifiques* (texte intégral) issues du projet de recherche dans une archive ouverte, soit directement dans HAL soit par l'intermédiaire d'une archive institutionnelle locale dans les conditions de l'article 30 de la Loi « Pour une République numérique » (embargo max. 6 mois pour STM et 12 mois pour SHS).

- L'ANR recommande de privilégier la publication dans des revues ou ouvrages nativement en accès ouvert.

- Coût des APC éligibles (hors modèles hybrides).

- En tant que partenaire de la cOAlition S, l'ANR recommande autant que possible la licence CC-BY pour les publications issues des projets qu'elle finance.

*version finale acceptée pour publication

1- Dépôt des publications scientifiques en libre accès (2/2)

- **Lors du dépôt dans HAL, ajouter la métadonnée projet ANR dans la notice de la publication.** Recherche possible par code décision, acronyme, titre.

Projet(s) ANR	Indiquez le ou les projets ANR liés à ce travail

- Pourquoi déposer dans HAL?

  - Plus large diffusion de vos publications en libre accès.
  - Mise en valeur de vos publications scientifiques : moissonnage par différents moteurs de recherche, identifiants pérennes, archivage à long terme.
  - Possibilité de créer un IDhal, un CVhal avec la liste de vos publications.
  - Au sein de l'ANR, bénéfice pour l'auteur : bibliographie des rapports automatiquement renseignée.

INTERFLOP: Initial Consortium

InterFLOP

ANR-20-CE46-0009 (2020-2024)

D. DEFOUR, F. FEVOTTE, S. GRAILLAT, F. JEZEQUEL, W. KIRSCHENMANN, J.-L. LAMOTTE, B. LATHUILIERE, Y. LHUILLIER, P. de OLIVEIRA, E. PETIT, J. SIGNOLES, D. SOHIER, F. VEDRINE.

1. MOTIVATIONS

"Floating-Point arithmetic is considered an esoteric subject by many people". *D. Goldberg*

The era is becoming increasingly complex as
- **News apps are rising (AI, Drug simulation)**
- **New formats are becoming available (BF16, FP16, FP24, FP128, Unum, Posit, FlexPoint, FPANR…)**
- **New units, new operators and implementations (MatrixUnit, SpecialFunc Unit, Interpolation, Compressor…)**
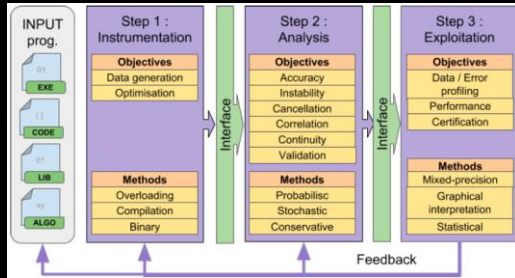
2. OBJECTIVES

Set a common platform integrating major tools of the French Floating-Point community to tackle the FP challenges and recent evolutions of software and hardware. We propose new analyses and combinations of existing ones to address the challenge of providing a quick and precise numerical diagnosis requiring little user expertise. InterFLOP will collect and combine information on numerical instabilities, catastrophic cancellations, unstable tests, build various statistical analyses of program executions at minimal overhead.

3. DESCRIPTION

Task 1: Specification of the platform
Propose an operational workflow. Define the type and the format of the data exchanged between each module to minimize bandwidth and memory usage while maximizing the amount of useful exchanged information. Promote a modular, sustainable and open platform with a common exchange specification between the modules while minimizing the impact on performance.

**Task 2: Front-end and mechanism to collect information**
Enable mixed analysis between the different FP arithmetic. The choice of the arithmetic will come from the availability of different back-ends: floating-point like FP-ANR, Monte-Carlo – MCA, stochastic – CESTAC and Taylor based or affine arithmetic.

Task 3: Models for error estimation and composite analysis
Define and implement composite analyses to illustrate the added value of the software chain. Promote an approach based on (i) an efficient search for instabilities (ii) guarantees of robustness / absence of instabilities on some parts of the code, and (iii) additions of generated code annotations and enabling dynamic changes of the analysis mode.
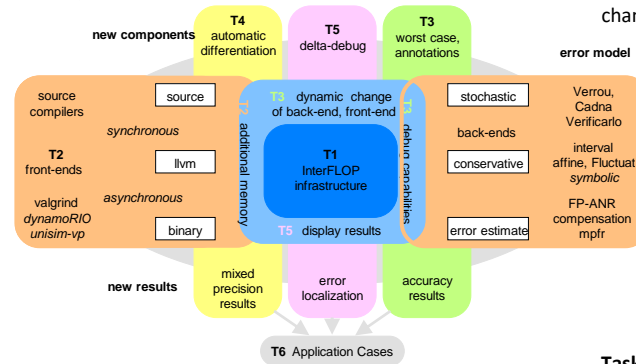
Task 4: Precision auto-tuning and verified computing
Validate the accuracy of numerical results, automatically tune the precision to achieve the desired accuracy for the result and propose new compressed format based.

Task 5: Post-processing and statistical analysis of the results
Tackles the problem of post-processing and analyzing the results of the InterFLOP chain through three axes: statistical analysis, instabilities tracking and visualization.

Task 6: Application Cases
Provide a feedback on the results from the other tasks with regards to their use in industrial applications and propose new analysis methodologies.
Considered applications: Yales2, AVBP, Abinit, Slang, EPX, Code_Aster, Telemac, quantitative analysis.

4. EXPECTED RESULTS

- **Common platform available at: https://github.com/interflop**
- **Adapt the granularity level of inspection and type of analyze to the application and user's need**
- **Automatic exploration of precision**
- **Statistical and visual analysis**
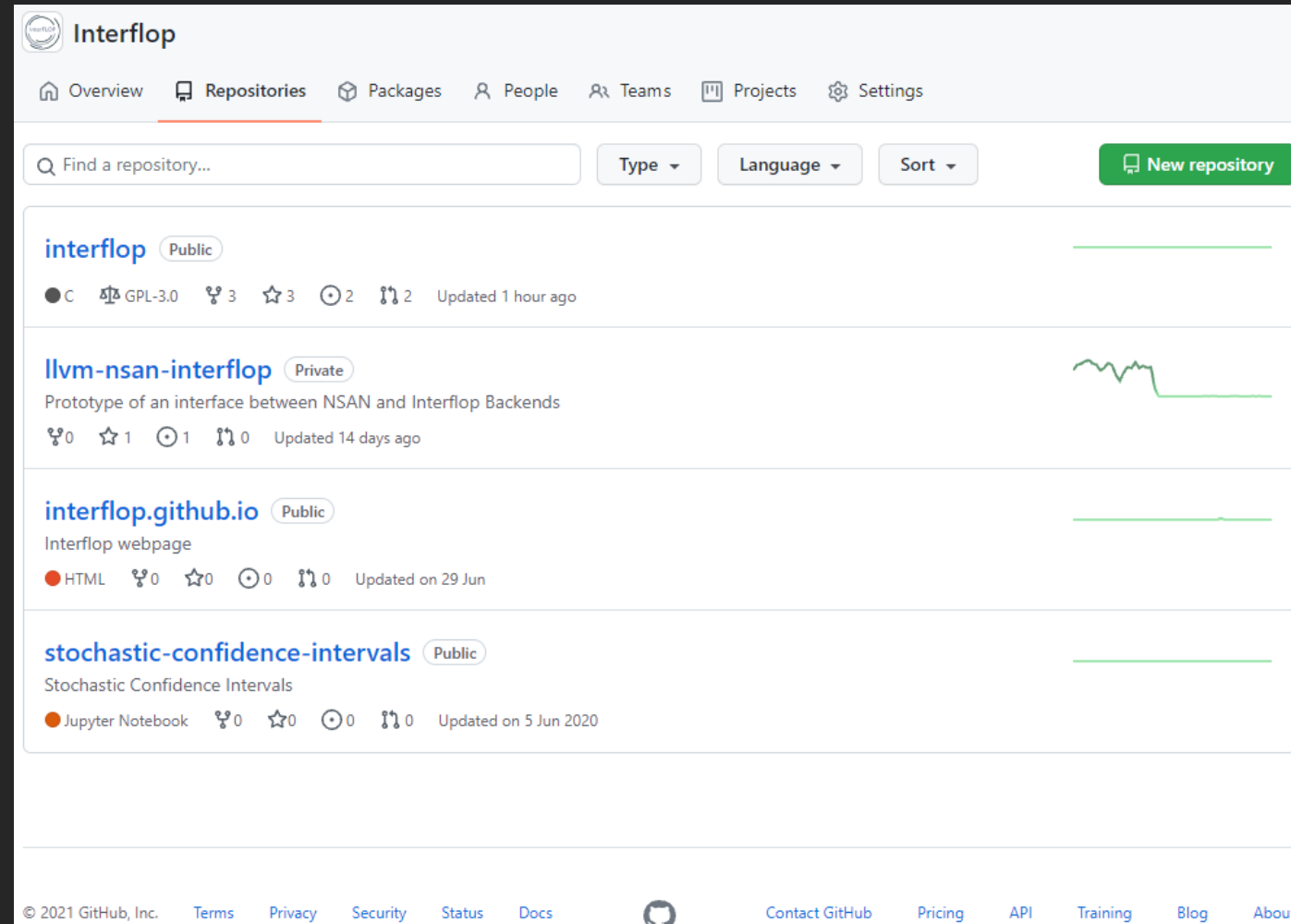- **Validated on real applications**

5. CONSORTIUM

8 Complementary partners which bring their own expertise, tools and methodology in software analysis, compilation, Numerical Simulation, Statistics, Computer arithmetic, Parallelism, Computer architecture to make this project successful.
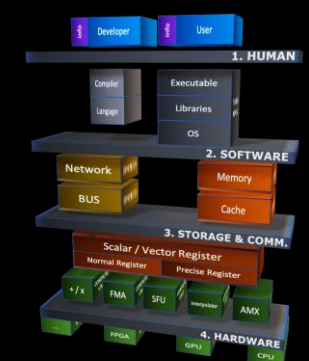
6. CONCLUSION

Takes the problem of numerical bug detection, software verification and validation to a new level, necessary to address issues that will be encountered with larger problems, new architectures, and new representation formats.
Numerical bug detection will be aided and guided through a unique interface at every step of the lifecycle of a software starting from its prototyping, testing, installation and operation.
Industrial and academic users could then evaluate basic compositions and develop customized ones for their own needs. Such composite analyses mixing execution (for speed on large codes), analysis (for precise diagnosis) and auto-tuning (to propose automatic enhancement) will be pioneer in the field and will be enriched with statistical and visual analysis.

InterFLOP as it is now...

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