

## Imperial College London

IMP

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### Summary

IMP has led WP5 on the CloudButton Toolkit, with a focus on developing new programming abstraction for stateful serverless applications, while ensuring constancy and fault-tolerance and offering tools and facilities for the easy porting of existing legacy applications. IMP has developed Faasm, which is a distributed serverless runtime as part of CloudButton that uses WebAssembly technology to allow existing legacy applications to run in serverless clouds. IMP has contributed further components to Faasm that supports popular data intensive legacy programming models, including OpenMP and MPI. IMP collaborated with Hutton on partial support for its genomics pipeline using Faasm. In addition, it worked with URV to contribute Faasm as a runtime to the Lithops framework.

### Publications

Simon Shillaker, Carlos Segarra, Mayeul Fournial, Peter Pietzuch (Imperial College London)

#### **Granny: Fine-Grained Distribution of Scientific Workloads in the Cloud**

*Under review*

2022

Carlos Segarra, Simon Shillaker, David Goltzsche, Anjo Vahldiek-Oberwagner (Intel Labs), Michael Steiner, Mona Vij, Lluís Vilanova, Rüdiger Kapitza, Peter Pietzuch

#### **T-Less: A Confidential Serverless Runtime with Attestation and Authorisation**

*Under review*

2022

Pedro García-López, Marc Sánchez-Artigas, Simon Shillaker, Peter Pietzuch, David Breitgand, Gil Vernik, Pierre Sutra, Tristan Tarrant, Ana Juan-Ferrer, Gerard París

#### **Trade-Offs and Challenges of Serverless Data Analytics**

Technologies and Applications for Big Data Value

Springer 2022

[link](#)

Simon Shillaker, and Peter Pietzuch

**Faasm: Lightweight Isolation for Efficient Stateful Serverless Computing**

USENIX Annual Technical Conference (USENIX ATC), 2020

Boston, MA, USA

[link](#)

## Open source repositories

Faasm - <https://github.com/faasm/faasm>

Faasm OpenMP/MPI support -- <https://github.com/faasm/faabric>

Faasm Python support -- <https://github.com/faasm/python>

Faasm MPI experiments -- <https://github.com/faasm/experiment-mpi>

Faasm OpenMP experiments -- <https://github.com/faasm/experiment-openmp>

Faasm Confidential Computing support -- <https://github.com/faasm/experiment-sgx>

Faasm Lithops integration -- <https://github.com/faasm/lithops>

## Dissemination activities

October 2021 – Invitation to talk about Faasm/CloudButton at **Microsoft** Research Summit 2021, “The Future of Cloud is Serverless”

October 2021 – Invited talk on CloudButton/Faasm, **Huawei** Strategy & Technology Workshop “Heterogeneous System Software”

April 2021 – Talk on Faasm/WebAssembly for Serverless at 2nd Workshop on Resource Disaggregation and Serverless (**WORDS'21**), co-located with ASPLOS 2021

February 2021 – Collaboration with **University of Edinburgh** (Antonio Barbalace’s team) on using Faasm for near-memory computing clouds

November 2020 – Workshop “Next-Generation Cloud Technologies”, Presentation of CloudButton/Faasm, organised by **Huawei Munich Research Centre**

August 2020 – “Serverless Computing Panel”, Presentation of CloudButton/Faasm, **University of Waterloo**

July 2020 – Discussion with **Intel** team developing WAMR WebAssembly runtime about CloudButton/Faasm/WASM

May 2020 – Presentation of Faasm/CloudButton to **Intel Labs**, Portland, Oregon, USA

April 2020 – Discussion of Faasm application and distributed programming model, **Huawei Canada**

November 2019 – Presentation of Faasm to Michael Berendt, **IBM** Distinguished Engineer/CTO Serverless

## **Exploitation Activities**

IMP has two exploitation paths that it is pursuing:

- (1) IMP has created the successful Faasm open-source project on GitHub. Faasm has attracted substantial interest and independent third-party development, as can be seen by its over 680 stars on GitHub and 50 forks. Faasm enjoys wide visibility in the WebAssembly serverless community, e.g. being mentioned at the Cloud Native 2022 WASM day. The original developer behind Faasm, Simon Shillaker, has joined a European cloud provider to lead their serverless effort and will continue to manage the Faasm open-source community.
- (2) IMP is exploring further commercial exploitation of the Faasm serverless technology. It is currently negotiating follow-on funding with industrial partners that will develop new use cases on top of Faasm. With Intel, IMP has added support for Confidential Computing using Intel SGX to Faasm. In addition, IMP is in discussion with a North American VC Fund (Amplify Partners) about how the Faasm and WebAssembly serverless ecosystems can be supported further.

## **Collaborations**

IMP has collaborated directly with the following partners in the consortium:

- 1) IMP and Pirbright/Hutton Institute have worked on porting the legacy components of the Genomics pipeline to CloudButton using Faasm.
- 2) IMP and URV have worked on the integration of Faasm with Lithops as an execution back-end.
- 3) IMP and IMT have discussed serverless programming models and coordinated on the different proposals for handling stateful functions in CloudButton.