# SI2-SSE: Abaco -Flexible, scalable, and usable Functions-as-a-service via the Actor Model

useabaco.cloud

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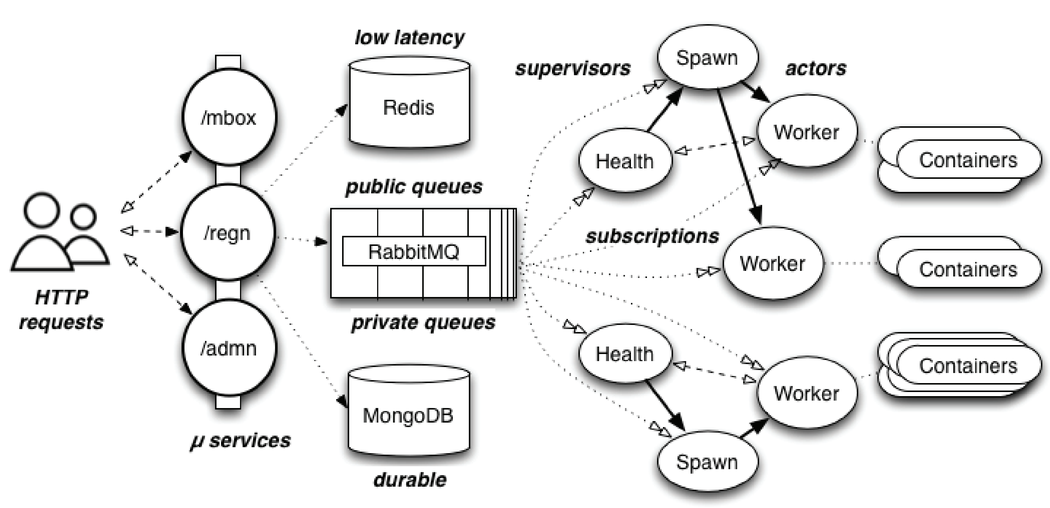
## OVERVIEW

Abaco is a RESTful API and distributed computing platform enabling rapid development and massive scalability of computational components across teams of developers working with heterogeneous physical compute resources. The Abaco API combines technologies and techniques from cloud computing, including Linux Containers and the "functions-as-a-service" paradigm with the Actor model for concurrent computation. Abaco allows for small, lightweight programs to be run on virtually any physical resource.

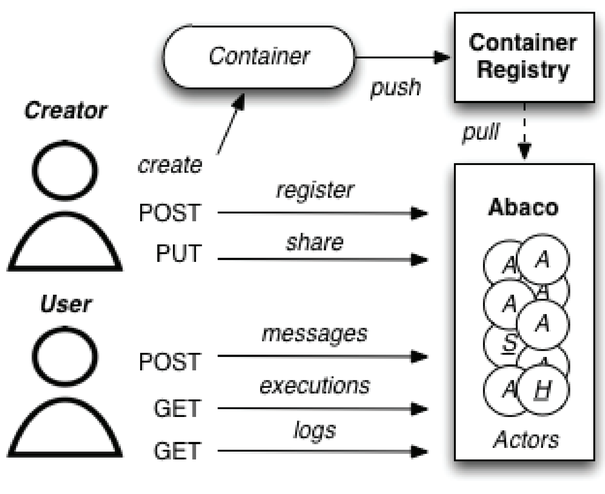
This project will harden and extend existing capabilities to improve robustness and performance. It will also extend Abaco's ability to implement data capabilities, such as data federation and discoverability. Abaco programs can be used, for example, to build federated datasets consisting of separate datasets from all over the internet. By reducing the barriers to developing and using such services, this project will boost the productivity of scientists and engineers working on the problems of today, and better prepare them to tackle the new problems of tomorrow. Abaco has broad applicability across science domains, from biology to engineering to environmental studies. Further, the Abaco team will conduct substantial training and support activities aimed at empowering researchers to benefit from this approach.

## THE ABACO ARCHITECTURE




*Abaco employs an architecture inspired by the Actor model, with independent agents organized into a supervisor hierarchy. Messages are passed between agents through channels brokered by RabbitMQ, while Redis and MongoDB provide persistence. Actors execute functions within containers in response to messages.*

## USING ABACO




*Abaco usage workflow: Creators build functions deployed in containers, send them to a public registry, then create and share actors via web service calls. Users execute functions by making web service calls that send a message to a specific actor.*

**Acknowledgement**

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## PRIMARY CAPABILITIES & INITIAL ADOPTIONS

### Reactors for Event-driven Programming

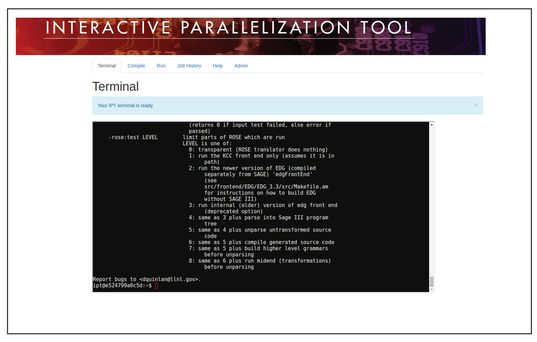
Reactors are actors designed to respond to events. Abaco provides specific functionality and tooling to aid the development of reactors.

#### Early Adopters

***ETL in the Synergistic Discovery and Design Environment*** *- Investigators working on grand challenge problems in Synethic Biology have built a complex ETL pipeline on top of Abaco reactors to process raw experimental data generated from geo distributed laboratories in real time.*

***IPT on the Web*** *- Web developers of the IPT on the Web gateway used Abaco to manage interactive web-terminals running on an elastic cloud.*

***Auto-creation of Singularity images from Biocontainers*** *- A TACC undergradute RA wrote an Abaco reactor to generate a Singularity image every time a new Biocontainers Docker image was created.*



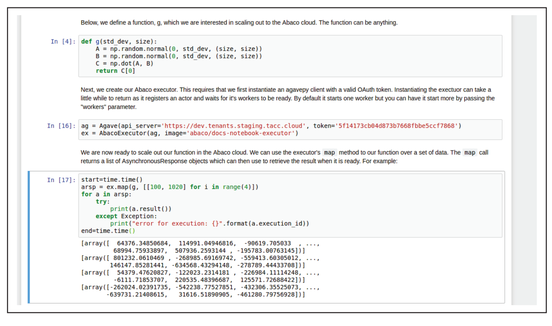

### Asynchronous Executors for Pleasantly Parallel Work-loads

Abaco Asynchronous executors provide high-level tooling for asynchronously executing functions on the Abaco cluster from directly within a running application.

#### Early Adopters

***Exploratory Runs of Opensees from Jupyter Notebooks*** *- Researchers at the University of California, Berkeley who need a way to launch a number of short, exploratory runs of the Opensees application for earthquake modeling are using Abaco executors from within a hosted Jupyter notebook environment.*

***Web Scraping Food Product Ingredients Data for Mobile App*** *- Undergraduate students working with Ritu Arora are building a mobile app that can scan a food product's barcode and make allergy warnings based on the ingredients. The web scraping functions that build the ingredients database can be scaled out on Abaco's compute cluster.*




### Data Adapters for Rationalized Interfaces to Heterogeneous Data Sources

Coming Soon! Abaco will develop a data adapters capability to enable users to create high-quality API access to data from disparate external sources such as files, databases, HTML tables and third-party APIs. Writing adapters will be easy, perhaps as short as a single function with a few lines of code.