Cloud Engineer Job Position Overview

B612 Foundation's Asteroid Institute is looking for a lead software engineer who will help build the first open, extensible, cloud-based solar system mapping platform. This is an opportunity for someone interested in the development of space to create a cloud-based software system for large-scale numerical analyses of orbits and trajectories in space.

The work entails building and improving on a scalable software platform that researchers and eventually other users will use to map the dynamics of the solar system. The Asteroid Discovery, Analysis and Mapping (ADAM) platform is used to model and analyze asteroid orbits and to study candidate space missions including commercial, scientific and deflection missions. Researchers will use ADAM to map and understand the solar system: discover new asteroids from data collected by the largest telescopes in the world, run orbit calculations at large scale, and assess the probabilities that some of these discoveries are potentially hazardous to Earth..

Key elements of ADAM are correctness, robustness, and scalability. Since tens of thousands of calculations may be run at a time, there are challenges in how jobs are scaled out, how progress is monitored, and how the results are combined to form meaningful information. The ideal candidate will help us build the scalable systems to carry out these calculations, make the data useful and accessible, and allow users to interface with the system via an API.

The candidate will work closely with scientists and software and mission planning experts at the B612 Asteroid Institute and the Data Intensive Research in Astrophysics and Cosmology (DIRAC) at the University of Washington.

THE BACKGROUND OF ADAM – CHARTING THE HIGH FRONTIER OF SPACE

What does the mapping of space mean and why is it important? The crucial element for mapping objects in space, as opposed to the traditional requirements of mapping the surface of a planet like Earth, is that we must take into account that celestial bodies in space are continuously moving in three dimensions. Like floating islands in an ever-changing archipelago on a sea, the celestial bodies in our solar system circulate around the Sun, obeying the laws of celestial mechanics. On solar-system-length scales, this additional element of mapping trajectories in space is the most critical, as the most important aspect of identifying and navigating to celestial bodies is knowing where the body is going to be when you get there. The fundamental base layer on which a solar system map will be built is this location and trajectory information.

One can think of this solar system space map as a four-dimensional (three spatial dimensions plus time) rendering of locations and velocities of the millions of celestial bodies in our solar system. The time dimension can be specified so that these locations and velocities are depicted either at the present, times in the past, or most importantly, at times in the future. The predictive nature of the space map (aka ADAM) is possible because we understand the laws of celestial mechanics under which trajectories of bodies in space move under the influence of gravity (with some small contribution from other non-gravitational effects). The more accurately we know the current orbital state of a body, the further we can accurately project where it will be located in the future. At present, for well-tracked solar system bodies, we can reliably predict their motion about a century into the future. Having this predictive ability is crucial because space missions generally take months to years to reach their destinations, and planning begins years prior to launch. That means we must target not where our destination is now, but where it will be at the time we arrive, perhaps years in the future. You can learn more about our vision for the space map engine is here.

The ADAM infrastructure is built on the Google Cloud Platform, with the backends written in a combination of Python and Java and the client-side software written in Python (and open source).

Many of the astrodynamics algorithms underlying the ADAM platform were originally developed for use on single core computers and designed to be run by subject matter experts. These algorithms were not intended to scale up to the potential offered by modern cloud computing platforms, nor were they designed to run automatically and transparently in the background. Current challenges for ADAM include adapting such algorithms to cloud environments, deploying robust and scalable asteroid discovery services, scaling up the processing system to handle more data, making the API easier to use, and rearchitecting parts of the backend services (e.g. for better developer productivity).

ROLE DESCRIPTION

• Work with the Product Manager to understand the goals and requirements for ADAM

• Provide the technical leadership and vision for ADAM software architecture and development.

• Contribute directly to the codebase

• Coordinate feature development with a distributed team of employees and volunteers (e.g. prototyping, design, code review)

• Propose and implement architectural extensions of the system, such as support of new types of analyses and external tool integrations

• Organize feature releases, package software for ease of use by other team members and wider community

• Participate in regular video meetings & collaboration with a team of developers and subject matter experts (Astronomers, Astrodynamicists, Engineers, Astronauts)

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QUALIFICATIONS

• 5 or more years experience that includes managing an engineering or software team

• Ability to speak and write effectively in English, including preparation of technical reports

• Experience with Cloud architectures (e.g. Google Cloud, AWS, Azure)
  – General understanding of cloud offerings (ideally GCP) and scalable architectures
  – Understanding of storage and compute options and tradeoffs, e.g. blob storage vs relational databases vs no-SQL databases
  – Understanding of tiered architectures and load balancing
  – Understanding of failure management in a distributed system

• Experience using and setting up software development infrastructure
  – Source control (e.g. Github)
  – Continuous integration systems
  – Software deployment and release management
  – Documentation for users and developers

• Experience with Python (required)
  – Ability to write server-side code
  – Understanding of logging, profiling, and performance optimization
  – Ability to establish good coding practices and lead external contributors in developing client code and server libraries

• Experience working in and leading distributed teams of paid and volunteer developers
  – Coordinating feature dependencies and release schedules

• Improving code, providing feedback and guidance to other developers & volunteers

• Independent worker and able to collaborate with other remote workers & volunteers

• Independent problem solver; able to investigate and use new technologies unassisted

• Other activities to help demonstrate how open-source scientific software, data digitization and new collaborative approaches (e.g. hackathon, data challenges) contribute to successful interdisciplinary research.

The employment conditions for this position follow the legal regulations in California. The company is an equal opportunity employer and in particular, strives to increase the percentage of women and minorities in leading positions. Therefore, qualified women and minority researchers are particularly encouraged to apply.

This position is virtual/distributed. Ideally, the candidate would reside near San Francisco, Seattle, or Maryland but it is NOT a requirement.

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HOW TO APPLY

Candidates with the appropriate qualifications are invited to submit their applications including:

- LinkedIn Page
- Github Page
- Curriculum vitae (ideally but not required)
- Lists of publications, patents and any past research funding (if any)
- A short personal statement: tell us why you'd be enthusiastic and energized to work on a platform like ADAM, and what you feel you'd bring to the team.

Please submit your materials and cover letter ensuring you address the selection criteria in the position description when you submit your materials.

This position will work closely with Asteroid Institute researchers and staff members. B612 Foundation is coordinating the search process.

Application Deadline: Applications accepted on a rolling basis

Current Status of Position: Accepting Applicants

Please submit your complete application via email to both danica.remy@b612foundation.org and jobs@b612foundation.org. If you are in academia or intend to pursue an academic path, the title can be adjusted (Fellowship for example) and independent academic research activities can be pursued that are generally aligned while developing ADAM. No phone calls, please.

ABOUT B612 & ASTEROID INSTITUTE

B612 Foundation is the world's leading non-profit organization dedicated to protecting Earth from asteroid impacts. The organization's work is divided into two areas: public education and advocacy, and the development of new scientific and technological projects within the Asteroid Institute. The foundation is entirely funded by private donations. Founded in 2002, by visionary astronauts Dr. Edward T. Lu, and Russell (Rusty) Schweickart, Apollo 9. Collaborators include: Caltech, Jet Propulsion Lab (JPL), Southwest Research Institute (SwRI), Analytical Graphics Inc (AGI), Google Cloud, and Data Intensive Research in Astrophysics and Cosmology Center (DIRAC) at the University of Washington.

The **Asteroid Institute** is a program of B612 and is designed to be the international center of excellence for scientific collaboration on the discovery and deflection of asteroids as well as an incubator for new technologies. Current major projects within the Institute include: postdoctoral research fellowships; ADAM, an open source cloud-based platform for asteroid discovery, analysis and mapping(ADAM) ; and the use of synthetic tracking as a means of increasing the rate of asteroid discovery. A key focus is the creation of a dynamic map of the inner solar system. The map will be a critical resource for planetary defense, while contributing to our understanding of the origins of our Solar System and future space exploration.

The work of the Asteroid Institute is made possible through the support of a community of donors around the world including Tito's Handmade Vodka, the William K. Bowes, Jr. Foundation and three anonymous donors in addition to donors from 46 countries.