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Amazon @ SOSP 2021

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The following **Amazon S3** (Simple Storage Service) paper is appearing at SOSP 2021 on Friday, October 29th at 11:45am - 12:45pm PT:

Using Lightweight Formal Methods to Validate a Key-Value Storage Node in Amazon S3

This paper reports our experience applying lightweight formal methods to validate the correctness of ShardStore, a new key-value storage node implementation for the Amazon S3 cloud object storage service. By "lightweight formal methods" we mean a pragmatic approach to verifying the correctness of a production storage node that is under ongoing feature development by a full-time engineering team. We do not aim to achieve full formal verification, but instead emphasize automation, usability, and the ability to continually ensure correctness as both software and its specification evolve over time. Our approach decomposes correctness into independent properties, each checked by the most appropriate tool, and develops executable reference models as specifications to be checked against the implementation. Our work has prevented 16 issues from reaching production, including subtle crash consistency and concurrency problems, and has been extended by non-formal-methods experts to check new features and properties as ShardStore has evolved.

Global research locations

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Teams that create our next innovations

Amazon S3 (Simple Storage Service) | Seattle, Arlington, Vancouver BC

Amazon S3 is an object storage service that offers industry-leading scalability, data availability, security, and performance. This means customers of all sizes and industries can use it to store and protect any amount of data for a range of use cases, such as data lakes, websites, mobile applications, backup and restore, archive, enterprise applications, IoT devices, and big data analytics. Amazon S3 provides easy-to-use management features so you can organize your data and configure finely-tuned access controls to meet your specific business, organizational, and compliance requirements. Amazon S3 is designed for 99.999999999% of durability, and stores data for millions of applications for companies all around the world.

Alexa Speech | Seattle, Cambridge MA, Sunnyvale CA, Toronto

Alexa Speech is responsible for speech and acoustic event technology for Alexa. Our mission is to enable Alexa to understand and respond to customers in an ultra-natural way, on any endpoint, in any language, under any noise conditions. Some of the systems we work on include those that wake Alexa when customers desire, convert speech to text, identify speakers by voice, detect sounds and vocalizations beyond speech, create the voice of Alexa, and enable local processing on Alexa devices for speed and offline functionality. We also help device developers by providing the wakeword engine they use to determine when their Alexa-enabled should "wake up" and listen to a customer's request, and modules that enable Alexa-enabled devices to execute a subset of Alexa requests without connecting to cloud services. For more info on Alexa Speech visit: amazon.jobs/en/teams/alexa-speech

Alexa AI | Seattle, Sunnyvale CA, Cambridge MA

Amazon's network is a key differentiator for Amazon Cloud Computing and Web Services (AWS), enabling the global operation of thousands of applications across millions of servers worldwide. The AWS Networking team develops and operates the network platform for all of Amazon including our e-commerce products and cloud computing solutions. This platform is industry-leading for its efficiency, throughput and reliability, and it is critical to the success of hundreds of thousands of AWS customers. For more info on Alexa AI visit: amazon.jobs/en/teams/alexa-ai

Alexa Automotive | Seattle, Sunnyvale CA

Alexa Automotive re-imagine how on-the-go experiences embrace voice technology and enable customers to keep their hands on the wheel and eyes on the road. We've enabled customers to remotely warm their car in the morning, find and book parking in a new city, play games while on a family road trip, and even navigate to a precise three-meter square. And we're just getting started – it's always day 1! At Amazon, we believe that voice is the simplest, most natural way to communicate. We recognize that our customers' lives continue past the walls of their home, and we want to make Alexa a natural part of the in-vehicle experience. The auto industry is in the midst of a disruption and voice technology has a significant part to play. We help enable hands-free experiences. We also develop exciting Alexa experiences directly for our customers. Our team builds digital in-cabin voice-enabled experiences for the car through a variety of technologies, building and releasing open source code on GitHub. Our solution supports four core domains: Car Control, Entertainment, Communications and Navigation. For more info on Alexa Automotive visit amazon.jobs/en/teams/alexa-automotive

Amazon Principal Engineering Community

Principal, Senior Principal, and Distinguished Engineers are Amazon's most senior individual technical contributors.

Amazon's Principal Engineer Community sets the standard for engineering excellence at Amazon. The community comprises Principal, Senior Principal, and Distinguished Engineers who are responsible for driving Amazon's overall technical architecture. Principal Engineers at Amazon are pragmatic visionaries. They make a lasting impact that echoes through the technology, the product, and the company. They work on Amazon's hardest problems, building high quality, architecturally sound systems that are aligned with our business needs. They remain hands-on and lead by example. By being close to the details, they earn the respect needed to be effective technical leaders. Principal Engineers bring clarity to complexity and demonstrate smart ways to simplify.
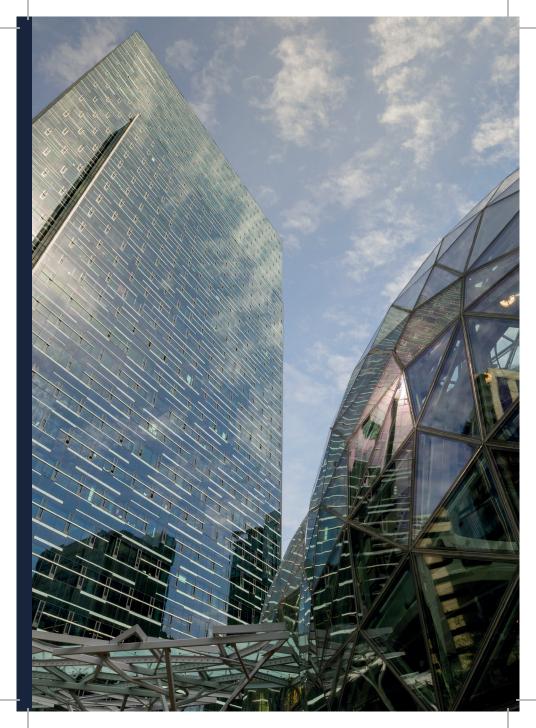
Career

If you are interested in pursuing a senior individual contributor role at Amazon, please contact the Senior Technical Talent Recruiting team at **principal-engineer-hiring@amazon.com**

Amazon Principal Engineer Speaker Series

Stay up to date with what the Amazon Principal Engineering Community is up to:

amazon.jobs/principal-engineer-hiring
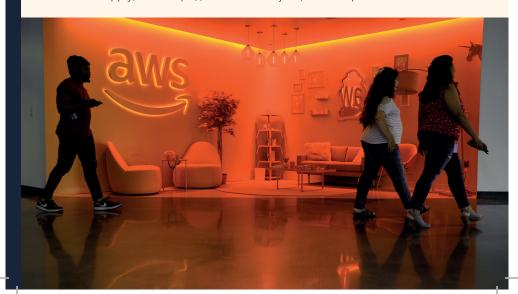
youtube.com/watch?v=H9a2VbeiY8E&list

Academic collaborations

Student Programs

At Amazon, we hire PhD and Masters interns throughout the year across a wide variety of teams, locations and domains. The projects will depend on your area of research and interest as well as the team in which you are placed. Relevant areas of research include:

- Machine learning
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- Statistics
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To apply, visit: https://www.amazon.jobs/internships-for-students

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AWS cloud credits for Research Program supports researchers who seek to:

- Build cloud-hosted publicly available science-as-a-service applications, software, or tools to facilitate their future research and the research of their community
- Perform proof of concept or benchmark tests evaluating the efficacy of moving research workloads or open data sets to the cloud
- Train a broader community on the usage of cloud for research workloads via workshops or tutorials

If you are ambitious and unafraid to do things differently then apply online at aws.amazon.com/research-credits.

Amazon Research Awards

The Amazon Research Awards (ARA) program funds projects conducted primarily by PhD students or post docs, under the supervision of faculty member or academic institution awarded funds of up to $80,000.
You can learn more at ara.amazon-ml.com.

Areas of research include:

- Computer vision
- Fairness in artificial intelligence
- Knowledge management and data quality
- Machine learning algorithms and theory
- Natural language processing
- Online advertising
- Operations research and optimization
- Personalization
- Robotics
- Search and information retrieval
- Security, privacy and abuse prevention

Events

Every year we organize a variety of AI and ML events such as re:MARS, MARS, re:Invent and Amazon Research Days.

Alexa Prize

The Alexa Prize is an annual competition for ambitious university students that is dedicated to accelerating the field of conversational AI.
To learn more visit: alexaprize.com.

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