Service Name

Amazon Braket

Service Overview

Amazon Braket is a fully managed AWS service that provides researchers, scientists, and developers with access to quantum computing technologies. It offers a single point of access to various quantum computers from third-party providers including AQT, IonQ, IQM, Rigetti, and QuEra, along with quantum circuit simulators. The service enables users to explore and design quantum and hybrid algorithms, test algorithms on simulators, and run quantum programs on different types of quantum hardware including superconducting, trapped-ion, and neutral-atom quantum computers. Braket includes development environments with pre-installed Jupyter notebooks, the Amazon Braket SDK, and integration with frameworks like PennyLane for variational quantum algorithms in the current Noisy Intermediate-Scale Quantum (NISQ) era.

Key Use Cases

- Quantum algorithm research and development: Design, test, and optimize quantum algorithms for computational problems beyond classical computer reach
- Hybrid quantum-classical computing: Develop variational quantum algorithms combining classical and quantum resources using PennyLane framework
- Quantum simulation and modeling: Simulate quantum systems and molecular behavior for drug discovery, materials science, and chemical engineering applications
- Optimization problems: Solve complex optimization challenges in financial portfolio management, logistics, and machine learning using quantum computing advantages
- Educational and training purposes: Learn quantum computing fundamentals through managed Jupyter notebooks with pre-built examples and tutorials

Features

- **Multi-Provider Quantum Hardware Access**: On-demand access to quantum computers from AQT, IonQ, IQM, Rigetti, and QuEra with different qubit technologies
- **Quantum Circuit Simulators**: Four simulator options including local simulator, SV1, DM1, and TN1 for testing and validating circuits
- **Braket SDK and Development Tools**: Hardware-agnostic SDK for designing quantum algorithms with support for multiple programming languages and frameworks

- **Hybrid Jobs**: Managed execution environment for quantum-classical hybrid algorithms with embedded simulators
- **Braket Direct**: Dedicated device access through reservations with expert advice and experimental capabilities
- **Jupyter Notebook Environment**: Fully managed notebooks pre-installed with sample algorithms, resources, and developer tools

Value Proposition

Amazon Braket eliminates the traditional barriers to quantum computing by providing cost-effective, on-demand access to multiple quantum hardware providers without upfront commitments or individual provider negotiations. Unlike building quantum computing capabilities in-house, Braket offers a fully managed service that handles underlying infrastructure complexity, including high-performance simulators running on Amazon EC2 clusters:

- The service provides unique advantages through its hardware-agnostic approach, allowing algorithm testing across different quantum technologies with a single line of code change
- Braket's integration with AWS services enables seamless scaling, monitoring, and data management, while the pay-as-you-go pricing model makes quantum computing accessible to organizations of all sizes, from research institutions to enterprises exploring quantum advantages

Service Integration

Amazon Braket integrates deeply with core AWS services for comprehensive quantum computing workflows. Amazon S3 serves as the primary storage for quantum computation results and data management:

- Amazon SageMaker provides the underlying infrastructure for managed Jupyter notebook instances and machine learning integration
- AWS Identity and Access Management (IAM) controls access permissions and security policies for quantum resources
- Amazon CloudWatch monitors Braket resources and provides metrics for quantum tasks
- AWS CloudTrail logs all API calls for audit and compliance purposes
- Amazon EventBridge receives quantum computing events including task state changes and device status updates
- Amazon EC2 powers the high-performance classical computing clusters used for quantum circuit simulation, while AWS Lambda can be used for serverless quantum computing workflows

Onboarding and Offboarding

Customers begin by enabling Amazon Braket in their AWS account and creating a managed Jupyter notebook instance through the AWS Management Console. The service provides pre-installed example notebooks, tutorials, and the Amazon Braket SDK to accelerate learning:

- Users can start with the local quantum simulator for development, progress to on-demand simulators (SV1, DM1, TN1), and then access real quantum hardware when ready
- The getting started process includes building a first Bell state quantum circuit, running it on simulators, and optionally executing on quantum processors
- AWS offers a free tier with one hour of simulation time monthly for the first year
- Educational institutions can apply for AWS research credits, while enterprise customers can leverage the Amazon Quantum Solutions Lab for expert guidance and collaborative development of quantum applications

Getting Started Guide:
https://docs.aws.amazon.com/braket/latest/developerguide/braket-get-started.html

Data Removal

Amazon Braket stores quantum computation results in customer-owned Amazon S3 buckets, giving users full control over their data lifecycle and deletion. When offboarding, customers can delete their S3 buckets and associated data following standard S3 data removal procedures. Notebook instances can be stopped and deleted through the Braket console, removing associated local storage. Users should terminate any running hybrid jobs and delete created IAM roles and policies. CloudWatch logs and CloudTrail records follow their respective retention policies and can be manually deleted if needed.

Backup/Restore and Disaster Recovery

Amazon Braket does not provide traditional backup and disaster recovery capabilities as it primarily serves as a compute service for quantum algorithms rather than a data storage service. Quantum computation results are stored in customer-controlled Amazon S3 buckets, which inherit S3's durability and availability features. Users are responsible for implementing backup strategies for their quantum algorithms, notebooks, and results using standard AWS backup services. The service itself is designed for stateless quantum task execution, where reproducibility comes from re-running quantum circuits rather than restoring previous states.

Backup Capabilities

Amazon Braket does not have native backup capabilities as it functions as a quantum computing execution service rather than a persistent data storage service. The service stores computation results in customer-owned S3 buckets, which support versioning,

cross-region replication, and integration with AWS Backup for comprehensive data protection. Customers must implement their own backup strategies for quantum algorithms, notebook code, and research data using standard AWS backup services and S3 features.

Disaster Recovery

Amazon Braket does not directly integrate with AWS Elastic Disaster Recovery as it provides stateless quantum computing execution rather than persistent infrastructure that requires disaster recovery. The service operates across multiple AWS regions (US East, US West, Europe) providing geographic distribution. Quantum algorithms and code can be replicated across regions, and results stored in S3 benefit from S3's cross-region replication capabilities for disaster recovery scenarios.

Recovery Objectives

Amazon Braket supports recovery objectives through its multi-region availability and stateless execution model. Since quantum computations are reproducible by re-running circuits, Recovery Time Objective (RTO) is primarily limited by quantum hardware queue times and circuit execution duration. Recovery Point Objective (RPO) depends on customer backup strategies for quantum algorithms and result data stored in S3. The service's integration with S3 cross-region replication enables near-zero RPO for critical quantum computation results and algorithms.

Service Constraints

Service Quotas: https://docs.aws.amazon.com/braket/latest/developerguide/braket-quotas.html

FAQ: https://aws.amazon.com/braket/faqs/

Technical Requirements

Service Documentation: https://docs.aws.amazon.com/braket/latest/developerguide/what-is-braket.html

User Guide: https://docs.aws.amazon.com/braket/latest/developerguide/what-is-braket.html

API Reference: https://docs.aws.amazon.com/braket/latest/APIReference/index.html

Pricing Overview

Please see the AWS UK G Cloud 15 Pricing Document accompanying this service in the Digital Marketplace.

Public Pricing: https://aws.amazon.com/braket/pricing/

Cost Optimization

Amazon Braket offers unique cost optimization through its pay-as-you-go model with no upfront commitments and spending limits for quantum processing units (QPUs) to control costs proactively. The service provides a free local simulator and one hour of monthly simulation time in the AWS Free Tier:

- Cost optimization strategies include testing circuits on free simulators before using paid QPUs, leveraging the near real-time cost tracking in the Braket SDK, setting per-device spending limits, and using TN1 simulator with low shot counts for initial testing
- Braket Direct offers reserved device access at hourly rates rather than per-task pricing for high-volume users
- Educational institutions can access AWS research credits, and the service provides cost estimation tools within development notebooks

Savings Considerations

Primary cost savings come from eliminating the need for expensive quantum computing hardware investments and maintenance costs. The shared access model reduces individual organization costs compared to dedicated quantum computer procurement:

- Pay-per-use pricing eliminates capacity planning risks and unused resource costs
- Free simulation capabilities enable algorithm development and testing without hardware costs
- The managed service approach reduces staffing requirements for quantum computing infrastructure expertise
- Integration with AWS services leverages existing cloud investments and skills
- Educational and research programs provide significant cost reductions through credits and grants
- The ability to test across multiple quantum hardware types with minimal switching costs enables optimal price-performance selection for specific applications