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## Research Note: AWS re:Invent 2019

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Amazon's 8th annual re:Invent was held December 2-6, 2019, in Las Vegas. The conference is one of the largest enterprise tech gatherings globally, second only to Salesforce's Dreamforce. This year's re:Invent had 65,000 attendees, which is more than double the 30,000 attendees in 2016.

re:Invent, as a vendor-specific conference, focused on sessions with Amazon executives, technologists, and partners introducing, discussing, and evangelizing AWS products and services. However, in hallway conversations and private meetings, attendees discussed and debated industry trends and challenges in cloud businesses and technologies.

At this year's conference, Wing's research team hosted the Wing Summit: re:Invent, an exclusive, invitation-only dialogue with 40 chief information officers and chief technology officers. In addition, during two days at the conference, we held 20 one-on-one meetings with Fortune 500 executives, principally vice presidents and heads of infrastructure, engineering, cloud, and data.

Our takeaways included:

### **1) Cost economics, though frequently raised, is not the primary driver.**

CIOs in our pre-summit feedback most frequently raised cost economics as a topic. One CIO asked, "are cloud financials what people perceive them to be for production workloads?" Another asked, "is there a crossover point where public cloud becomes more costly than private cloud?" Another questioned, "how should we be thinking about balancing growing opex vs. capex?"

Executives in our meetings emphasized that cost economics are not the primary driver for cloud adoption. For example, a colleague said, "cost savings was a 10-year ago argument that never materialized." Another CIO stated, "enterprises who are new to the cloud have cost questions; those who are mature in the cloud know that the costs are approximately the same."

In his keynote, Andy Jassy emphasized digital transformation as the primary driver for all-in commitment to the cloud. We found a similar perspective in our meetings. One executive stated, "we are moving 50% of our workloads to the cloud over the next few years, not for cost purposes, but for digital transformation." Another executive stated, "the federal government is actively working in the cloud not to save costs but to be able to access services, such as machine learning and facial recognition, that are simply better through the cloud providers."

### **2) Most view multi-cloud as the dominant form moving forward, albeit with a primary and secondary provider(s).**

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Multi-cloud and hybrid-cloud was the second most frequently raised topic in our CIO feedback.

Among the 40 CIOs and CTOs at the Wing summit, we asked: “how many view multi-cloud as the dominant form moving forward?” Approximately 80% responded “Yes,” and approximately 20% responded “No.” One colleague who responded “No” argued that the costs and complexity for teams to learn, support, and operate multiple cloud environments are not worth the benefits. Another colleague who responded “Yes,” representing the majority perspective, argued that multiple cloud environments optimize performance and provide multi-sourcing, as cloud decisions vary by application and workload.

We found that most enterprises pursuing a multi-cloud strategy still have a primary and secondary cloud provider(s). As stated by Andy Jassy in siliconANGLE, multi-cloud workloads are split more like “70/30” or “80/20” or “90/10” rather than “50/50.”

For hybrid-cloud, we found an unclear perspective on the question of whether workloads for a single application should run on-premise and in the cloud. A CIO specifically asked in the feedback, “is anyone running large production workloads for a single application across prem and cloud, and if so what are the biggest reasons and has the complexity been worth it?” No executives responded “Yes,” which is understandable as it is early. One colleague stated, “we are looking at the new hybrid-cloud solution from VMware and we think it is interesting.” Another stated, “we have a hybrid-cloud pilot with a startup, but it is not clear whether it makes sense to scale.”

### **3) Cloud migration remains a major topic, and adoption expectations range from “cloud-native” to “cloud ceilings” to “cloud-last.”**

In our CIO feedback, cloud migration was the third most frequently raised topic. One executive asked, “what is the entry point for migrating to the cloud—instances, containers, or serverless, and why?” Another commented, “how do we increase the chances of success for modernizing legacy applications, processes, and technologies, i.e. ‘changing the engine while in flight?’” Another asked, “how easy is it to onboard and how easy is it to leave, if you decide to?”

Cloud adoption is still at the beginning. According to Gartner, cloud is only 5.8% of total IT spending, and 20% of workloads are in the cloud (the 20% estimate feels a bit high to us). According to IDC, almost half of enterprises have not run a production workload in the cloud, and interestingly, the mature cloud adopter seems to have hit a ceiling.

In our conversations, we heard:

- One large media company executive said, “we are now cloud native.”
  - One government executive said, “we are at approximately 50% in the cloud, and we anticipate a ceiling at say 60%.”
  - One banking executive humorously said, “I would describe our bank’s strategy as cloud-last. But, we are working on putting digital experiences in the cloud.”
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Of note, a few colleagues mentioned expectations for a ceiling on cloud adoption. In addition to the government executive above, one retail executive said, “I never want our core store systems to go in the cloud.” However, other executives posited that expectations will change over time. One colleague said, “things that do not make sense now will look differently in three years.” Another said, “the next CIO will just change the executive’s mind.”

#### **4) Another theme was the transformation of the tech organization.**

Another important topic in our CIO feedback was the transformation of the tech organization. One executive said, “the biggest challenge is transforming a traditional tech workforce accustomed to boxes and wires to operate in a world expressed in code.” Another asked, “how are CIOs transforming the shape of their tech organizations as they are creating the digital workforce of the future for their enterprises?”

We found varied approaches in our conversations. Several executives created distinct centers of excellence or specialist teams for modernization capabilities. Others argued that such separated teams were not effective organizationally and were not scalable. One executive referenced that “even if AWS announced no new capabilities, it would take my team five years to catch up to today’s capabilities.”

#### **5) The news at re:Invent was viewed as largely incremental, and executives found different announcements of particular interest.**

re:Invent 2019 included a flurry of AWS announcements. By our count, Amazon had 76 product, feature, and program announcements (see Appendix). AWS now includes 175 services, as compared to 140 a year ago and 100 two years ago. We found a sentiment that this year’s announcements were not as significant as those from prior years, such as SageMaker’s introduction in 2017.

With that said, executives found different announcements of particular interest. For example, several executives commented that their tech teams were excited about the updates to SageMaker, including SageMaker Studio. One said, “my team has been doing internal plumbing work around SageMaker that will no longer be required.” In addition, several executives noted the suite of ML services previewed by Amazon, from transaction fraud and code review to enterprise search and call center transcription.

Specific Amazon announcements mentioned in our meetings included:

- Outposts: AWS hybrid-cloud service, to counter Google Anthos and Azure Arc
  - Local Zones: AWS metro-area service for low-latency (<10ms) applications
  - Kendra: ML-based enterprise content search
  - Contact Lens: ML- and NLP-based transcription and analysis of customer calls for call centers
  - CodeGuru: ML-based code review
  - SageMaker Operators for Kubernetes: containerized ML model training and deployment
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- Elastic Kubernetes Service on Fargate: serverless containerized applications

Amazon also launched Braket, an AWS quantum computing service providing access to Rigetti, D-Wave, and IonQ technology platforms. We found limited-to-no interest in quantum computing among CIOs in our discussions, as the space is at a nascent stage even for enterprise pilots.

Several executives noted the appearance of David Solomon, CEO of Goldman Sachs, in Andy Jassy's keynote (Mr. Solomon also DJ'ed a 15-minute set prior to the session). Goldman is notorious for in-house development, and Goldman's evangelizing of any vendor is notable. Mr. Solomon's presence had two implications: 1) it gave AWS the "financial services nod of approval", as posted by CIO Dive, and 2) it illustrated that cloud is now a strategic, CEO-level decision. As a note, two years ago, Roy Joseph, managing director of technology for Goldman Sachs, appeared in Andy Jassy's keynote. In addition, Marco Argenti, co-chief information officer for Goldman Sachs, previously served as vice president of technology for Amazon.

Andy Jassy also mentioned in his keynote that Microsoft wants a "stranglehold" on the market. Earlier this year, Microsoft changed its licensing policies to limit use of existing software licenses for Windows and SQL Server for cloud migration to Amazon, Google, and Alibaba. CIOs in our conversations agreed with Andy Jassy's sentiment. One said, "Microsoft's change is certainly not customer-friendly." Several humorously said, "Microsoft risks being like Oracle."

Finally, other topics in our discussions included:

- Adoption of Kubernetes by traditional enterprises
- Need for in-depth controls for cloud data services
- Need for application-level compliance solutions for companies in regulated industries

## Conclusion

AWS re:Invent is one of the largest gatherings of enterprise technologists globally. Although the conference is vendor-specific, the attendees include a large ecosystem of customers, partners, entrepreneurs, analysts, and investors. The discussions shape the future of the cloud, which is now driving business transformation and agility rather than simply saving costs. The fundamental trend toward the cloud continues, and key debates remain on hybrid-cloud, migration, talent, and security, among other areas. In our view, cloud is a major opportunity for large scale growth and dynamic, entrepreneurial innovation.

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*Wing Venture Capital is an early stage venture capital firm focused on seed and series A investments in business technology. As disclosure, a list of Wing's portfolio companies is available on Wing's website at [wing.vc/companies](http://wing.vc/companies).*

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## Appendix – re:Invent 2019 Selected Announcements

### AWS Customers

- **Best Western Hotels & Resorts:** announced selection of AWS to automate processes and quickly develop new and more personalized experiences for traveler customers.
- **Cerner:** announced selection of AWS as its preferred cloud, AI, and machine learning provider.
- **Formula One Group:** completed Computational Fluid Dynamics simulation project for racing car aerodynamics, leveraging AWS ParallelCluster and Amazon S3 and achieving 70% reduction in average simulation run time from 60 hours to 18.
- **FOX:** announced multi-year strategic collaboration agreement to use AWS for a new cloud-based media production and delivery platform.
- **Goldman Sachs:** announced selection of AWS for its securities database Marquee Web Services.
- **Klarna:** announced selection of AWS as its preferred cloud provider to enable faster innovation while maintaining regulatory compliance and protecting customer financial data.
- **Seattle Seahawks:** announced integration of AWS machine learning algorithms into various parts of its organization, from player performance to business processes, for the next five years.

### AWS Marketplace

- **Amazon:** announced Discovery API, a new feature that enables sellers and data providers to curate third-party software and data products by integrating the AWS Marketplace catalog into their web properties.
- **Amazon:** announced that registered sellers with a public listing in AWS Marketplace can extend a custom contract through Seller Private Offers, with a simplified fee structure and reduced listing fees starting in 1Q 2020.
- **DataRobot:** announced AWS Marketplace availability of DataRobot, an enterprise machine learning platform that empowers users irrespective of skill level to build prediction models.
- **Digital Guardian:** announced availability of the Digital Guardian Data Protection Platform in AWS Marketplace, enabling customers to gain visibility into system, data and user events on endpoints while identifying, classifying, and securing sensitive information.
- **JFrog:** announced availability of CloudPro X, a subscription package that includes JFrog Artifactory and JFrog Xray solutions, in AWS Marketplace.
- **Netskope:** announced the availability of Netskope Security Cloud in AWS Marketplace.
- **Panzura:** announced support for its Freedom cloud file services and Vizion.ai cloud data management and machine learning analytics service as ISV Solutions on the AWS Marketplace.
- **Polte:** announced availability of its Polte Location API for its Cloud Location over Cellular technology in AWS Marketplace.
- **SentinelOne:** announced availability of SentinelOne's combined EPP and EDR solutions in AWS Marketplace.
- **Talend:** announced availability of Talend Cloud, a data integration platform optimized for AWS, in AWS Marketplace.
- **Veeam:** announced new Veeam Backup for AWS, an Amazon EC2 protection available through AWS Marketplace.

### AWS Partners

- **2nd Watch:** announced achievement of VMware Master Services Competency.
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- **Amazon:** announced AWS Partner Network Global Startup Program, a go-to-market program for eligible global startups.
  - **Amazon:** announced AWS Service Ready Program, a new way for enterprises to identify if a tool or application will integrate with AWS services.
  - **Amazon:** introduced AWS Partner Network Immersion Days program, which provides APN Partners a repeatable model, reusable content, and automated tools for a set of technical workshops.
  - **Amazon:** introduced AWS Retail Competency for retailers looking for highly specialized APN Partners offering retail technology on AWS.
  - **Amazon:** introduced the AWS Public Safety & Disaster Response Competency, allowing public safety and disaster response entities to discover AWS Partner Network Consulting Partners with solutions such as operations, data and analytics, and infrastructure resilience and recovery.
  - **Capgemini:** expanded its strategic initiative with AWS to North America for mass application migrations, cloud-native development, cloud application modernization, AI, machine learning and managed services.
  - **Center for Internet Security:** launched a new Department of Defense STIG compliant CIS Benchmark and Hardened Image for Red Hat Enterprise Linux 7, along with several other new Hardened Images for Microsoft Server 2019.
  - **Cisco:** announced deeper partnership of its networking services with AWS, including integration of Cisco's SD-WAN and AWS Transit Gateway, extension of Cisco's ACI Anywhere to AWS Outposts, and addition of AWS Security Group management to Cisco Defense Orchestrator.
  - **ClearDATA:** released ClearDATA Comply, a new SaaS platform for health care organizations to monitor and manage privacy and compliance obligations and provide remediation.
  - **CloudBolt Software:** announced that it has joined the AWS Partner Network Global Startup Program.
  - **CloudCheckr:** unveiled CloudCheckr Business Partner Program, a worldwide partner enablement program for cloud service and IaaS resellers.
  - **Crayon:** announced achievement of AWS Well-Architected Partner Status.
  - **Datica:** introduced its new Cloud Compliance solution, which is designed to solve the complexities of HIPPA compliance and HITRUST certification on the cloud.
  - **Informatica:** announced new product capabilities and accelerators for AWS solutions, including Amazon Redshift Ready designation, data engineering solutions for Databricks on AWS, latest release of Amazon EMR, and integration with AWS Glue.
  - **InterVision:** announced achievement of Premier Consulting Partner status.
  - **Matillion:** announced Matillion Data Loader, a free SaaS data integration solution to simplify, load, and migrate data.
  - **New Relic:** announced Cloud Adoption Solution updates for AWS, receipt of AWS Retail competency, expansion of AWS managed service provider partnerships to Bespin Global, Blazeclan, and Mission Cloud Services, new integrations to collect data via Amazon CloudWatch, and the New Relic Logs for AWS FireLens.
  - **NTT DATA:** announced agreement to acquire Flux7, an AWS Premier Consulting Partner that provides cloud implementation and migration, automation, and DevOps consulting services.
  - **Rackspace:** extended its Rackspace Service Blocks portfolio to provide professional and managed services for AWS.
  - **Seeq:** announced achievement of AWS Industrial Software Competency status.
  - **Sourced Group:** announced achievement of AWS Financial Services Competency.
  - **stackArmor:** launched stackArmor OpsAlert, a platform for government agencies to monitor cloud costs and compliance with FedRAMP, FISMA and DFARS requirements.
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- **TEKsystems Global Services:** announced acquisition of 1Strategy, a Premier Consulting Partner in the AWS Partner Network.
- **Teradata:** announced achievement of AWS PrivateLink Ready designation.
- **Umbrella Infocare:** announced achievement of AWS Premier Consulting Partner status.
- **Zendesk:** announced a go-to-market solution package based upon an enhanced integration between Amazon Connect and Zendesk Talk Partner Edition.

### Chips

- **Amazon:** introduced Amazon EC2 Inf1 Instances with AWS Inferentia chips, new high-performance machine learning inference chips designed and built by AWS that deliver up to 3x higher throughput and up to 40% lower cost per inference than Amazon EC2 G4 instances.

### Collaboration/Communication

- **Amazon:** announced that Amazon Chime hosts meetings in 14 AWS Regions and 32 Availability Zones, automatically selecting the region that provides a low latency for meeting participants.
- **Amazon:** announced Amazon Kinesis Video Streams support for real-time two-way media streaming with WebRTC, an open-source project that enables real-time communication between web browsers, mobile applications, and connected devices via simple APIs.
- **Slack:** announced Amazon Chime Meetings App for Slack, a feature for Slack users to start and join Amazon Chime online meetings directly from their Slack workspace channels and conversations.

### Compute

- **Amazon:** announced availability of EC2 Image Builder, a service that simplifies the creation, patching, testing, distribution, and sharing of Linux or Windows Server images.
- **Amazon:** announced AWS Compute Optimizer, a machine learning-based recommendation service to ensure optimal use of AWS Compute resources.
- **Amazon:** announced enhancements to the Nitro system, such that C5/C5d/C5n, M5/M5d/M5n/M5dn, R5/R5d/R5n/R5dn, and P3dn instances support 36% higher EBS-optimized instance bandwidth up to 19 Gbps.
- **Amazon:** announced new Amazon EC2 M6g, C6g, and R6g instances powered by AWS Graviton2 Processor, a next-generation that uses 64-bit Arm Neoverse cores, custom silicon designed by AWS, and 7-nanometer manufacturing technology.

### Container

- **Amazon:** announced Amazon ECS Cluster Auto Scaling, which manages scaling policy of ASG through an ECS Capacity Provider.
  - **Amazon:** announced availability of Amazon ECS Capacity Providers, a new way to manage compute capacity for containers that allow the application to define requirements for how it uses the capacity.
  - **Amazon:** announced that Amazon ECS supports Windows group Managed Service Account, a new capability that allows ECS customers to authenticate and authorize Windows containers with network resources using an Active Directory.
  - **Amazon:** introduced Amazon SageMaker Operators for Kubernetes, enabling developers and data scientists using Kubernetes to train, tune, and deploy machine learning models in Amazon SageMaker.
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- **Amazon:** previewed updates to Amazon EKS for Amazon EC2 A1 instances with the latest Kubernetes versions 1.13 and 1.14, global AMI availability, and bug fixes.
- **Check Point:** extended its CloudGuard cloud security platform to support Kubernetes computing services, including Amazon EKS and Amazon ECS, as well as AWS Lambda and related services like AWS Fargate, Amazon API Gateway, Amazon DynamoDB, and Amazon Kinesis.
- **Pegasystems:** expanded its Pega Cloud Choice Guarantee with Kubernetes support so that enterprises can deploy Pega with Kubernetes on AWS, Microsoft Azure, Google Cloud, Pivotal, and Red Hat while removing technical lock-in.

### Edge

- **Amazon:** announced AWS Wavelength, which embeds AWS compute and storage services at the edge of telecommunications providers' 5G networks, in partnership with Verizon, Vodafone, SK Telecom, and KDDI to launch across North America, Europe, Japan, and South Korea in 2020.
- **Amazon:** announced the Los Angeles opening of an AWS Local Zone, placing compute, storage, and other select services closer to users and enabling applications that require single-digit millisecond latencies.
- **ADLINK:** announced an integrated solution that combines Intel Distribution of OpenVINO toolkit, AWS Greengrass, Amazon SageMaker, and ADLINK Edge, for simplified edge AI deployments

### General/Other

- **Amazon:** announced HTTP APIs for Amazon API Gateway, enabling enterprises to build RESTful APIs that are up to 71% cheaper than REST APIs also available from API Gateway.
  - **Amazon:** announced that AWS License Manager adds Dedicated Host management capabilities to simplify the Bring Your Own License experience for software licenses, such as Windows and SQL Server, that require a dedicated physical server.
  - **Amazon:** announced that AWS License Manager allows administrators to automate discovery of Bring Your Own License usage across their AWS and on-premises environments.
  - **Amazon:** introduced Amazon Builders' Library, a collection of living articles regarding how Amazon architects, releases, and operates the software underpinning Amazon.com and AWS.
  - **Amazon:** introduced AWS Step Functions Express Workflows, a new type of AWS Step Functions workflow type that orchestrates AWS compute, database, and messaging services at event rates greater than 100,000 events per second.
  - **Amazon:** introduced the Amazon EventBridge Schema Registry, which stores event schema in a shared central location and maps those schemas to code for Java, Python, and Typescript.
  - **Amazon:** launched AWS Data Exchange, a subscription-based data service that gives users access to over 1,000 free and paid licensable data products from over 80 different third-party data providers.
  - **Amazon:** launched the EMP for Windows Server, which includes technology and expert guidance to migrate legacy applications from Windows Server 2003, 2008, and 2008 R2 to newer, supported versions on AWS, without refactoring.
  - **Amazon:** introduced Amplify for iOS and Android, an open source project for building cloud-enabled mobile and web applications with capabilities such as Analytics, AI/ML, API (GraphQL and REST), DataStore, and Storage.
  - **Liquidware and IGEL:** announced that IGEL OS includes support for Liquidware's Stratusphere UX user experience monitoring and diagnostics option.
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- **MongoDB:** announced that MongoDB Atlas will support AWS CloudFormation, EventBridge, and PrivateLink to automate data infrastructure deployments, build event-driven apps, and ensure private connectivity to apps.
- **PagerDuty:** announced PagerDuty for Cloud Operations, a solution to help IT and DevOps teams transform operation practices as they move to the cloud.

### Hybrid Cloud

- **Amazon:** announced 2nd Watch, Cloudreach, Cohesity, Sourced Group, and Veritas as supporters and integration partners for AWS Outposts.
- **Amazon:** announced support of Amazon EMR, Amazon ECS, Amazon EKS, and AWS App Mesh in AWS Outposts, a hybrid cloud service that extends AWS infrastructure and tools to data centers, co-location spaces, or on-premises facilities.
- **Amazon:** announced the general availability of AWS Outposts, a new hybrid-cloud service that extends AWS infrastructure, AWS services, APIs, and tools to virtually customer data centers, co-location spaces, or on-premises facilities.
- **Amazon:** previewed Amazon RDS on Outposts for fully managed Amazon RDS database instances in on-premises environments.
- **Dynatrace:** announced extension of its AI-powered software intelligence platform to support AWS hybrid clouds.
- **VMware:** announced the VMware Cloud on AWS Outposts Beta program and the opening of nominations to select a set of Beta program customers.
- **XM Cyber:** announced that its HaXM breach and attack simulation platform can simulate attacks on AWS and on hybrid cloud environments.

### Internet of Things

- **Amazon:** announced new features and updated pricing for AWS IoT SiteWise, including additional capabilities to collect data from industrial equipment, add context to the data using asset models, use the data in custom applications, view the data in near real-time through a web application, and be charged for data ingest and egress based on number of messages.

### ML Services

- **Amazon:** expanded DeepRacer with the launch of multi-car racing and object avoidance capabilities in the AWS DeepRacer console.
  - **Amazon:** previewed Contact Lens for Amazon Connect, a set of integrated machine learning analytics capabilities for contact centers to understand the sentiment, trends, and compliance of customer conversations to improve customer experience and identify customer feedback.
  - **Amazon:** announced Amazon CodeGuru, a machine learning service for development teams to automate code reviews, identify the most expensive lines of code in applications, and receive correction and improvement recommendations.
  - **Amazon:** announced Amazon Kendra, an enterprise search service based on machine learning to provide search accuracy from content within manuals, research reports, FAQs, HR documentation, and customer service guides.
  - **Amazon:** announced the availability of Amazon Transcribe Medical, a new, HIPPA-eligible speech recognition capability that transcribes physicians' dictations and conversations with patients into text.
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- **Amazon:** introduced AWS DeepComposer, the first machine learning-enabled keyboard for developers to create a melody that will transform into an original song in seconds.
- **Amazon:** previewed Amazon Fraud Detector, a service to identify potentially fraudulent online activities such as online payment fraud and the creation of fake accounts.

### ML Technologies

- **Amazon:** announced Amazon Augmented AI (Amazon A2I), a built-in human review service for machine learning applications such as content moderation and document text extraction.
- **Amazon:** announced Amazon SageMaker Experiments, a new capability that organizes, tracks, and compares machine learning training experiments on Amazon SageMaker.
- **Amazon:** announced availability of new AWS Deep Learning AMIs with updated framework support on Ubuntu 18.04, Ubuntu 16.04, Amazon Linux 2, and Amazon Linux with TensorFlow 1.15, Tensorflow 2.0, PyTorch 1.3.1, MXNet 1.6.0-rc0.
- **Amazon:** announced DJL, an open source library to train, test, deploy, and develop deep learning models in Java with user-friendly APIs.
- **Amazon:** introduced Amazon SageMaker Autopilot, a feature that enables Amazon SageMaker to use tabular data and specified target columns to automatically train and tune machine learning models.
- **Amazon:** introduced Amazon SageMaker Debugger, a capability that provides insights into the training process of machine learning models by automating the capture and analysis of data from training runs at real time.
- **Amazon:** introduced Amazon SageMaker Model Monitor, a new capability that continuously monitors machine learning models in production, detecting deviations such as data drift and providing alerts for enterprises to take remedial actions.
- **Amazon:** introduced Amazon SageMaker Notebook Experience, which allows developers to create and share machine learning notebooks easily.
- **Amazon:** introduced Amazon SageMaker Processing, a new capability for running pre- or post-processing and model evaluation workloads.
- **Amazon:** introduced Amazon SageMaker Studio, an integrated development environment for building, training, debugging, deploying and monitoring machine learning models from experimentation to production.
- **Amazon:** introduced Amazon SageMaker Support for Deep Graph Library, which removes the burden of packaging software dependencies, building infrastructure, and finding validated models, enabling GNNs to be tested and implemented in hours instead of weeks and months.
- **Amazon:** launched Amazon Rekognition Custom Labels, a new feature to enable enterprises to build custom machine learning-based image analysis capabilities for unique objects and scenes relevant to business needs.

### Networking/Routing

- **Amazon:** announced Amazon VPC Ingress Routing, which enables enterprises to insert virtual appliances in the forwarding path of VPC traffic.
  - **Amazon:** announced AWS Transit Gateway support for routing IP multicast traffic between attached Amazon Virtual Private Cloud connections and for the ability to establish peering connections between Transit Gateways in different AWS Regions.
  - **Amazon:** announced AWS Transit Gateway, a network manager that centrally manages and monitors global AWS and on-premise networks.
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### Quantum Computing

- **Amazon:** introduced Amazon Brackets, a service for scientists, researchers, and developers to build, test, and run quantum computing algorithms based on quantum computers from D-Wave, IonQ, and Rigetti.

### Security

- **Alert Logic:** announced integration with AWS IAM Access Analyzer.
- **Amazon:** announced availability of Accelerated Site-to-Site VPN, which uses AWS Global Accelerator to improve the performance of VPN connections by routing traffic through the AWS Global Network and AWS edge locations.
- **Amazon:** announced integration of AWS Security Hub with AWS Identity and Access Management Access Analyzer, a feature that enables security teams and administrators to check that policies provide only the intended access to resources.
- **Amazon:** introduced Access Analyzer for Amazon S3, a new feature that monitors access policies, ensuring that the policies provide only the intended access to S3 resources.
- **Amazon:** introduced AWS Identity and Access Management Access Analyzer, a feature for security teams and administrators to check that their policies provide only the intended access to resources.
- **Amazon:** previewed Amazon Detective, a new service that automatically collects log data from AWS resources and uses machine learning, statistical analysis, and graph theory to build a linked data set to easily conduct security investigations.
- **Barracuda:** announced integration of Barracuda Cloud Security Guardian with Amazon Detective for enterprise insights into threats or violations.
- **CloudKnox Security:** announced integration of the CloudKnox Security Platform with AWS IAM Access Analyzer, a new capability from AWS that analyzes resource policies to help administrators and security teams protect their resources from unintended access.
- **Druva:** announced new protection capabilities for AWS workflows, including Amazon S3 backup and archival and global data management policies.
- **ExtraHop:** announced a new integration with AWS that automates quarantining of compromised Amazon EC2 instances and accelerates forensic investigation with continuous packet capture.
- **ForgeRock:** announced support AWS Session Tags, enabling partners and customers to securely pass identity attributes from their ForgeRock Directory or other directory servers into AWS.
- **Fortinet:** announced the integration of FortiGate-VM with AWS CloudFormation third-party resource provider framework and support of Amazon VPC Ingress Routing enhancements by Fortinet's cloud security offerings.
- **McAfee:** announced integration of its MVISION Cloud for AWS with Amazon Detective for incident detection and remediation.
- **OneLogin:** announced support for Session Tags, enabling enterprises to achieve Attribute Based Access Control for secure authentication and authorization to multiple AWS accounts.
- **Threat Stack:** announced support for AWS Fargate in its Threat Stack Cloud Security Platform.

### Serverless

- **Amazon:** announced AWS Fargate support of Fargate Spot, a new deployment option to run fault-tolerant applications orchestrated by Amazon ECS with up to 70% discount compared to Fargate prices.
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- **Amazon:** announced Provisioned Concurrency, a feature that provides greater control over performance of serverless applications.
- **Amazon:** announced that Amazon Elastic Kubernetes Service can run Kubernetes pods on AWS Fargate, the serverless compute engine built for containers.
- **Instana:** announced Node.js functions for AWS Lambda, with zero code modification, automated native serverless tracing, and performance metrics capabilities.

### Storage

- **Amazon:** announced Amazon Redshift data lake export for Apache Parquet, an open columnar storage format for analytics that is up to 2x faster to unload and consumes up to 6x less storage in Amazon S3, when compared to text formats.
  - **Amazon:** announced Amplify DataStore, a queryable, on-device data store for web, IoT, and mobile developers using iOS, Android, and React Native.
  - **Amazon:** announced that Amazon Neptune offers a workbench, an in-console experience to query Neptune graph databases with Jupyter notebooks.
  - **Amazon:** introduced Amazon S3 Access Points, a new feature that simplifies managing data access at scale for shared data sets on Amazon S3.
  - **Amazon:** introduced general availability of Redshift RA3 nodes with managed storage enabling independent compute and storage scaling.
  - **Amazon:** launched EBS direct APIs that provide read access to EBS snapshot data, enabling backup providers to achieve faster backups of EBS volumes at lower costs.
  - **Amazon:** previewed Amazon Managed Apache Cassandra Service, a database service to run Cassandra workloads in the AWS Cloud using the same Cassandra application code, Apache 2.0-licensed drivers, and tools that are currently used.
  - **Amazon:** previewed Amazon RDS Proxy, a database proxy for Amazon RDS that sits between application and database to pool and share established database connections, improving database efficiency and application scalability.
  - **Amazon:** previewed Amazon Redshift Federated Query feature, which allows enterprises to query and analyze data across operational databases, data warehouses, and data lakes.
  - **Amazon:** previewed UltraWarm for Amazon Elasticsearch Service, a performance-optimized warm storage tier to store and analyze data using Elasticsearch and Kibana while reducing cost per GB by up to 90% over existing Amazon Elasticsearch Service hot storage options.
  - **Zerto:** announced support for AWS Storage File Gateway for cloud backup and long-term retention storage in the cloud.
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