

AWS
VS.
AZURE
VS.
GOOGLE CLOUD

VIRTUAL MACHINE

ELASTIC COMPUTE CLOUD (EC2) IS AMAZON'S FLAGSHIP FOR SCALABLE COMPUTING ON DEMAND, COMPETING WITH GOOGLE'S COMPUTE ENGINE AND AZURE'S VIRTUAL MACHINES AND VIRTUAL MACHINE SCALE SETS.

- AMAZON ELASTIC COMPUTE CLOUD (AMAZON EC2) IS A WEB SERVICE THAT PROVIDES SECURE, RESIZABLE COMPUTE CAPACITY IN THE CLOUD. IT IS DESIGNED TO MAKE WEB-SCALE CLOUD COMPUTING EASIER FOR DEVELOPERS. AMAZON EC2'S SIMPLE WEB SERVICE INTERFACE ALLOWS YOU TO OBTAIN AND CONFIGURE CAPACITY WITH MINIMAL FRICTION. IT PROVIDES YOU WITH COMPLETE CONTROL OF YOUR COMPUTING RESOURCES AND LETS YOU RUN ON AMAZON'S PROVEN COMPUTING ENVIRONMENT. AMAZON EC2 REDUCES THE TIME REQUIRED TO OBTAIN AND BOOT NEW SERVER INSTANCES TO MINUTES, ALLOWING YOU TO QUICKLY SCALE CAPACITY, BOTH UP AND DOWN, AS YOUR COMPUTING REQUIREMENTS CHANGE. AMAZON EC2 CHANGES THE ECONOMICS OF COMPUTING BY ALLOWING YOU TO PAY ONLY FOR CAPACITY THAT YOU ACTUALLY USE. AMAZON EC2 PROVIDES DEVELOPERS THE TOOLS TO BUILD FAILURE RESILIENT APPLICATIONS AND ISOLATE THEM FROM COMMON FAILURE SCENARIOS.
- GOOGLE COMPUTE ENGINE DELIVERS VIRTUAL MACHINES RUNNING IN GOOGLE'S INNOVATIVE DATA CENTERS AND WORLDWIDE FIBER NETWORK. COMPUTE ENGINE'S TOOLING AND WORKFLOW SUPPORT ENABLE SCALING FROM SINGLE INSTANCES TO GLOBAL, LOAD-BALANCED CLOUD COMPUTING. COMPUTE ENGINE'S VMs BOOT QUICKLY, COME WITH PERSISTENT DISK STORAGE, AND DELIVER CONSISTENT PERFORMANCE. VIRTUAL SERVERS ARE AVAILABLE IN MANY CONFIGURATIONS INCLUDING PREDEFINED SIZES OR THE OPTION TO CREATE CUSTOM MACHINE TYPES OPTIMIZED FOR YOUR SPECIFIC NEEDS.

IF YOU WANT TO DEPLOY SOFTWARE CONTAINERS WITH DOCKER, YOU SHOULD LOOK AT AMAZON'S EC2 CONTAINER SERVICE (ECS) AND EC2 CONTAINER REGISTRY (ECR); GOOGLE'S EQUIVALENT ARE CONTAINER ENGINE AND CONTAINER REGISTRY. AZURE'S ALSO ON BOARD WITH DOCKER WITH ITS CONTAINER SERVICE, THOUGH AT THE MOMENT THEY ARE NOT PROVIDING A FACILITY FOR PRIVATE DOCKER REGISTRIES.

VIRTUAL PRIVATE NETWORK (VPN)

- AMAZON VIRTUAL PRIVATE CLOUD (AMAZON VPC) LETS YOU PROVISION A LOGICALLY ISOLATED SECTION OF THE AWS CLOUD WHERE YOU CAN LAUNCH AWS RESOURCES IN A VIRTUAL NETWORK THAT YOU DEFINE. YOU HAVE COMPLETE CONTROL OVER YOUR VIRTUAL NETWORKING ENVIRONMENT, INCLUDING SELECTION OF YOUR OWN IP ADDRESS RANGE, CREATION OF SUBNETS, AND CONFIGURATION OF ROUTE TABLES AND NETWORK GATEWAYS. YOU CAN USE BOTH IPv4 AND IPv6 IN YOUR VPC FOR SECURE AND EASY ACCESS TO RESOURCES AND APPLICATIONS.
- GOOGLE CLOUD PLATFORM (GCP) VPC, YOU CAN PROVISION YOUR GCP RESOURCES, CONNECT THEM TO EACH OTHER, AND ISOLATE THEM FROM ONE ANOTHER IN A VIRTUAL PRIVATE CLOUD (VPC). YOU CAN ALSO DEFINE FINE-GRAINED NETWORKING POLICIES WITHIN GCP, AND BETWEEN GCP AND ON-PREMISES OR OTHER PUBLIC CLOUDS. VPC IS A COMPREHENSIVE SET OF GOOGLE-MANAGED NETWORKING CAPABILITIES, INCLUDING GRANULAR IP ADDRESS RANGE SELECTION, ROUTES, FIREWALLS, VIRTUAL PRIVATE NETWORK (VPN), AND CLOUD ROUTER.
- AZURE VPN GATEWAY CONNECTS YOUR ON-PREMISES NETWORKS TO AZURE THROUGH SITE-TO-SITE VPNs IN A SIMILAR WAY THAT YOU SET UP AND CONNECT TO A REMOTE BRANCH OFFICE. THE CONNECTIVITY IS SECURE AND USES THE INDUSTRY-STANDARD PROTOCOLS INTERNET PROTOCOL SECURITY (IPSEC) AND INTERNET KEY EXCHANGE (IKE). POINT-TO-SITE VPN LETS YOU CONNECT TO YOUR VIRTUAL MACHINES ON AZURE VIRTUAL NETWORKS FROM ANYWHERE, WHETHER YOU ARE ON THE ROAD, WORKING FROM YOUR FAVORITE CAFÉ, MANAGING YOUR DEPLOYMENT, OR DOING A DEMO FOR YOUR CUSTOMERS.

RELATIONAL DATABASE

- AMAZON RELATIONAL DATABASE SERVICE (AMAZON RDS) MAKES IT EASY TO SET UP, OPERATE, AND SCALE A RELATIONAL DATABASE IN THE CLOUD. IT PROVIDES COST-EFFICIENT AND RESIZABLE CAPACITY WHILE AUTOMATING TIME-CONSUMING ADMINISTRATION TASKS SUCH AS HARDWARE PROVISIONING, DATABASE SETUP, PATCHING AND BACKUPS. IT FREES YOU TO FOCUS ON YOUR APPLICATIONS SO YOU CAN GIVE THEM THE FAST PERFORMANCE, HIGH AVAILABILITY, SECURITY AND COMPATIBILITY THEY NEED. AMAZON RDS IS AVAILABLE ON SEVERAL DATABASE INSTANCE TYPES - OPTIMIZED FOR MEMORY, PERFORMANCE OR I/O - AND PROVIDES YOU WITH SIX FAMILIAR DATABASE ENGINES TO CHOOSE FROM, INCLUDING AMAZON AURORA, POSTGRESQL, MYSQL, MARIADB, ORACLE, AND MICROSOFT SQL SERVER. YOU CAN USE THE AWS DATABASE MIGRATION SERVICE TO EASILY MIGRATE OR REPLICATE YOUR EXISTING DATABASES TO AMAZON RDS.
- CLOUD SQL IS A FULLY-MANAGED DATABASE SERVICE THAT MAKES IT EASY TO SET UP, MAINTAIN, MANAGE, AND ADMINISTER YOUR RELATIONAL POSTGRESQL BETA AND MYSQL DATABASES IN THE CLOUD. CLOUD SQL OFFERS HIGH PERFORMANCE, SCALABILITY, AND CONVENIENCE. HOSTED ON GOOGLE CLOUD PLATFORM, CLOUD SQL PROVIDES A DATABASE INFRASTRUCTURE FOR APPLICATIONS RUNNING ANYWHERE. CLOUD SQL DELIVERS HIGH PERFORMANCE AND SCALABILITY WITH UP TO 10TB OF STORAGE CAPACITY, 40,000 IOPS, AND 416GB OF RAM PER INSTANCE. EASILY CONFIGURE REPLICATION AND BACKUPS TO PROTECT YOUR DATA. GO FURTHER BY ENABLING AUTOMATIC FAILOVER TO MAKE YOUR DATABASE HIGHLY AVAILABLE (HA). YOUR DATA IS AUTOMATICALLY ENCRYPTED AND CLOUD SQL IS SSAE 16, ISO 27001, PCI DSS v3.0, AND HIPAA COMPLIANT.
- AZURE SQL DATABASE IS A RELATIONAL DATABASE-AS-A SERVICE USING THE MICROSOFT SQL SERVER ENGINE. SQL DATABASE IS A HIGH-PERFORMANCE, RELIABLE, AND SECURE DATABASE YOU CAN USE TO BUILD DATA-DRIVEN APPLICATIONS AND WEBSITES IN THE PROGRAMMING LANGUAGE OF YOUR CHOICE, WITHOUT NEEDING TO MANAGE INFRASTRUCTURE. SQL DATABASE USES BUILT-IN INTELLIGENCE THAT LEARNS YOUR UNIQUE DATABASE PATTERNS AND AUTOMATICALLY TUNES THE DATABASE FOR IMPROVED PERFORMANCE AND PROTECTION. THREAT DETECTION MONITORS YOUR DATABASE AROUND-THE-CLOCK AND DETECTS POTENTIAL MALICIOUS ACTIVITIES, ALERTING YOU UPON DETECTION SO YOU CAN INTERVENE RIGHT AWAY.
- SQL SERVER STRETCH DATABASE LETS YOU DYNAMICALLY STRETCH WARM AND COLD TRANSACTIONAL DATA FROM MICROSOFT SQL SERVER 2016 TO MICROSOFT AZURE. UNLIKE TYPICAL COLD DATA STORAGE, YOUR DATA IS ALWAYS AT HAND. WITH STRETCH DATABASE, YOU CAN PROVIDE LONGER DATA RETENTION TIMES WITHOUT BREAKING THE BANK. RATHER THAN SCALING EXPENSIVE, ON-PREMISES STORAGE, STRETCH DATA TO THE CLOUD—AZURE STORAGE CAN BE UP TO 40 PERCENT LESS EXPENSIVE THAN ADDING MORE ENTERPRISE STORAGE.

NoSQL DATABASE

- AMAZON DYNAMODB IS A FAST AND FLEXIBLE NoSQL DATABASE SERVICE FOR ALL APPLICATIONS THAT NEED CONSISTENT, SINGLE-DIGIT MILLISECOND LATENCY AT ANY SCALE. IT IS A FULLY MANAGED CLOUD DATABASE AND SUPPORTS BOTH DOCUMENT AND KEY-VALUE STORE MODELS. ITS FLEXIBLE DATA MODEL, RELIABLE PERFORMANCE, AND AUTOMATIC SCALING OF THROUGHPUT CAPACITY, MAKES IT A GREAT FIT FOR MOBILE, WEB, GAMING, AD TECH, IoT, AND MANY OTHER APPLICATIONS. AMAZON DYNAMODB ACCELERATOR (DAX) IS A FULLY MANAGED, HIGHLY AVAILABLE, IN-MEMORY CACHE THAT CAN REDUCE AMAZON DYNAMODB RESPONSE TIMES FROM MILLISECONDS TO MICROSECONDS, EVEN AT MILLIONS OF REQUESTS PER SECOND.
- CLOUD BIGTABLE IS GOOGLE's NoSQL BIG DATA DATABASE SERVICE. IT'S THE SAME DATABASE THAT POWERS MANY CORE GOOGLE SERVICES, INCLUDING SEARCH, ANALYTICS, MAPS, AND GMAIL. BIGTABLE IS DESIGNED TO HANDLE MASSIVE WORKLOADS AT CONSISTENT LOW LATENCY AND HIGH THROUGHPUT, SO IT'S A GREAT CHOICE FOR BOTH OPERATIONAL AND ANALYTICAL APPLICATIONS, INCLUDING IoT, USER ANALYTICS, AND FINANCIAL DATA ANALYSIS. BIGTABLE OFFERS LOW LATENCY AND HIGH THROUGHPUT AT ANY SCALE OR APPLICATION TYPE. YOU CAN USE BIGTABLE AS THE STORAGE ENGINE FOR LARGE-SCALE, LOW-LATENCY APPLICATIONS AS WELL AS THROUGHPUT-INTENSIVE DATA PROCESSING AND ANALYTICS. BIGTABLE PROVISIONS AND SCALES TO HUNDREDS OF PETABYTES AUTOMATICALLY, AND CAN SMOOTHLY HANDLE MILLIONS OF OPERATIONS PER SECOND. CHANGES TO THE DEPLOYMENT CONFIGURATION ARE IMMEDIATE, SO THERE IS NO DOWNTIME DURING RECONFIGURATION.
- CLOUD DATASTORE IS A HIGHLY-SCALABLE NoSQL DATABASE FOR YOUR APPLICATIONS. CLOUD DATASTORE AUTOMATICALLY HANDLES SHARDING AND REPLICATION, PROVIDING YOU WITH A HIGHLY AVAILABLE AND DURABLE DATABASE THAT SCALES AUTOMATICALLY TO HANDLE YOUR APPLICATIONS' LOAD. CLOUD DATASTORE PROVIDES A MYRIAD OF CAPABILITIES SUCH AS ACID TRANSACTIONS, SQL-LIKE QUERIES, INDEXES AND MUCH MORE.
- AZURE COSMOS DB WAS BUILT FROM THE GROUND UP WITH GLOBAL DISTRIBUTION AND HORIZONTAL SCALE AT ITS CORE. IT OFFERS TURNKEY GLOBAL DISTRIBUTION ACROSS ANY NUMBER OF AZURE REGIONS BY TRANSPARENTLY SCALING AND REPLICATING YOUR DATA WHEREVER YOUR USERS ARE. ELASTICALLY SCALE THROUGHPUT AND STORAGE WORLDWIDE, AND PAY ONLY FOR WHAT YOU NEED. AZURE COSMOS DB PROVIDES NATIVE SUPPORT FOR NoSQL CHOICES, OFFERS MULTIPLE WELL-DEFINED CONSISTENCY MODELS, GUARANTEES SINGLE-DIGIT-MILLISECOND LATENCIES AT THE 99TH PERCENTILE, AND GUARANTEES HIGH AVAILABILITY WITH MULTI-HOMING CAPABILITIES AND LOW LATENCIES ANYWHERE IN THE WORLD— ALL BACKED BY INDUSTRY-LEADING, COMPREHENSIVE SERVICE LEVEL AGREEMENTS (SLAs).

DOMAIN NAME SYSTEM (DNS)

AMAZON'S ROUTE 53, GOOGLE DNS OR AZURE DNS.

- **AMAZON ROUTE 53 (ROUTE 53)** IS A SCALABLE AND HIGHLY AVAILABLE DOMAIN NAME SYSTEM (DNS). IT IS PART OF AMAZON.COM'S CLOUD COMPUTING PLATFORM, AMAZON WEB SERVICES (AWS). THE NAME IS A REFERENCE TO TCP OR UDP PORT 53, WHERE DNS SERVER REQUESTS ARE ADDRESSED. IN ADDITION TO BEING ABLE TO ROUTE USERS TO VARIOUS AWS SERVICES, INCLUDING EC2 INSTANCES, ROUTE 53 ALSO ENABLES AWS CUSTOMERS TO ROUTE USERS TO NON-AWS INFRASTRUCTURE. ROUTE 53'S SERVERS ARE DISTRIBUTED THROUGHOUT THE WORLD. AMAZON ROUTE 53 SUPPORTS FULL, END-TO-END DNS RESOLUTION OVER IPv6. RECURSIVE DNS RESOLVERS ON IPv6 NETWORKS CAN USE EITHER IPv4 OR IPv6 TRANSPORT TO SEND DNS QUERIES TO AMAZON ROUTE 53. CUSTOMERS CREATE "HOSTED ZONES" THAT ACT AS A CONTAINER FOR FOUR NAME SERVERS. THE NAME SERVERS ARE SPREAD ACROSS FOUR DIFFERENT TLDs. CUSTOMERS ARE ABLE TO ADD, DELETE, AND CHANGE ANY DNS RECORDS IN THEIR HOSTED ZONES. AMAZON ALSO OFFERS DOMAIN REGISTRATION SERVICES TO AWS CUSTOMERS THROUGH ROUTE 53. AMAZON PROVIDES AN SLA OF THE SERVICE ALWAYS BEING AVAILABLE AT ALL TIMES (100% AVAILABLE). ONE OF THE KEY FEATURES OF ROUTE 53 IS PROGRAMMATIC ACCESS TO THE SERVICE THAT ALLOWS CUSTOMERS TO MODIFY DNS RECORDS VIA WEB SERVICE CALLS. COMBINED WITH OTHER FEATURES IN AWS, THIS ALLOWS A DEVELOPER TO PROGRAMMATICALLY BRING UP A MACHINE AND POINT TO COMPONENTS THAT HAVE BEEN CREATED VIA OTHER SERVICE CALLS SUCH AS THOSE TO CREATE NEW S3 BUCKETS OR EC2 INSTANCES.
- **GOOGLE PUBLIC DNS** IS A FREE ALTERNATIVE DOMAIN NAME SYSTEM (DNS) SERVICE THAT IS OFFERED TO INTERNET USERS AROUND THE WORLD. THE PUBLIC DNS SERVICE AND SERVERS THAT ARE OFFERED ARE MAINTAINED AND OWNED BY GOOGLE. IT FUNCTIONS AS A RECURSIVE NAME SERVER PROVIDING DOMAIN NAME RESOLUTION FOR ANY HOST ON THE INTERNET. THE SERVICE WAS ANNOUNCED ON 3 DECEMBER 2009, IN AN EFFORT DESCRIBED AS "MAKING THE WEB FASTER AND MORE SECURE". AS OF 2014, GOOGLE PUBLIC DNS IS THE LARGEST PUBLIC DNS SERVICE IN THE WORLD, HANDLING 400 BILLION REQUESTS PER DAY
- DNS DOMAINS IN AZURE DNS ARE HOSTED ON AZURE'S GLOBAL NETWORK OF DNS NAME SERVERS. **AZURE DNS** USES ANYCAST NETWORKING SO THAT EACH DNS QUERY IS ANSWERED BY THE CLOSEST AVAILABLE DNS SERVER. THIS PROVIDES BOTH FAST PERFORMANCE AND HIGH AVAILABILITY FOR YOUR DOMAIN. THE AZURE DNS SERVICE CAN BE USED TO MANAGE DNS RECORDS FOR YOUR AZURE SERVICES AND CAN BE USED TO PROVIDE DNS FOR YOUR EXTERNAL RESOURCES AS WELL. AZURE DNS IS INTEGRATED IN THE AZURE PORTAL AND USES THE SAME CREDENTIALS, BILLING, AND SUPPORT CONTRACT AS YOUR OTHER AZURE SERVICES. THE AZURE DNS SERVICE IS BASED ON AZURE RESOURCE MANAGER. AS SUCH, IT BENEFITS FROM RESOURCE MANAGER FEATURES SUCH AS ROLE-BASED ACCESS CONTROL, AUDIT LOGS, AND RESOURCE LOCKING. YOUR DOMAINS AND RECORDS CAN BE MANAGED VIA THE AZURE PORTAL, AZURE POWERSHELL CMDLETS, AND THE CROSS-PLATFORM AZURE CLI. APPLICATIONS REQUIRING AUTOMATIC DNS MANAGEMENT CAN INTEGRATE WITH THE SERVICE VIA THE REST API AND SDKs.

DEPLOYMENT TOOLS

- AWS CloudFormation allows you to model your entire infrastructure in a text file. This template becomes the single source of truth for your infrastructure. This helps you to standardize infrastructure components used across your organization, enabling configuration compliance and faster troubleshooting. AWS CloudFormation provisions your resources in a safe, repeatable manner, allowing you to build and rebuild your infrastructure and applications, without having to perform manual actions or write custom scripts. CloudFormation takes care of determining the right operations to perform when managing your stack, and rolls back changes automatically if errors are detected. Codifying your infrastructure allows you to treat your infrastructure as just code. You can author it with any code editor, check it into a version control system, and review the files with team members before deploying into production.
- Google Cloud Deployment Manager allows you to specify all the resources needed for your application in a declarative format using YAML. You can also use Python or Jinja2 templates to parameterize the configuration and allow reuse of common deployment paradigms such as a load balanced, auto-scaled instance group. By creating configuration files which define the resources, the process of creating those resources can be repeated over and over with consistent results. Templates allow the use of building blocks to create abstractions or sets of resources that are typically deployed together (e.g. an instance template, instance group and autoscaler). These templates can be parameterized to allow them to be used over and over by changing input values to define what image to deploy, the zone in which to deploy or how many virtual machines to deploy.
- The Azure Resource Manager enables you to create reusable deployment templates that declaratively describe the resources that make up your application such as an Azure Website and a SQL Azure database. This simplifies the process of creating complex environments for development, testing and production in a repeatable manner. It also provides a unified way to manage and monitor the resources that make up an application from the Azure Preview Portal. You are able to create an application using the Azure Gallery Templates and define and manage your Azure resources using JSON templates. This makes it easier for you to quickly setup the environment you need to Dev/Test your application in Azure. The two key features are the Visual Studio integration with the Azure Gallery and the ability to create and edit Azure Resource Manager deployment templates.