Principles of Computer Science II Cloud Computing

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Lecture 10

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AWS: Elastic Compute Cloud (EC2) Resizable compute resources in the cloud.

AWS EC2 = Elastic Compute Cloud

 Introduce a new server within minimum delay. Scale capacity up very fast. Quickly modify the capabilities of the compute instance. Introduce additional computational, memory and storage

capabilities. Reduce computational, memory and storage capabilities.

Shutdown - or completely remove resources. Scale down very fast.

Pay only for the resources you need.

Minimizes the time to provision a server.

Typical Use Cases

- Development and Testing Environments ► Hosting of Databases
- Hosting of web services Data analytics
- Code repository
- GPU-assisted machine learning
- High performance computing
- Video processing
- Backup and disaster recovery

EC2 Provisioning Options

- On Demand Pay for the compute capacity by the hour. No up-front payment or long-term commitment.
 - Short-term, spiky, or unpredictable workloads. Applications development or testing.
- ► Spot Instances Acquire spare capacity up to 90% off the
 - on-demand price.
 - When start/end times are flexible.
 - Applications that are only feasible at very low compute prices.

 - Urgent computing needs for large amounts of additional
 - capacity.
- Reserved Instances Significant discount (up to 75%)
 - compared to On-Demand instance pricing.
 - For applications that have steady state or predictable usage. Long term (> 1 year) to reduce their total computing costs.

- Dedicated Hosts Physical servers dedicated for use use.



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EC2 Instance Types

Available OS & Software

Operating Systems

Enterprise, Microsoft SQL. . . .

software from well-known vendors

- ► General Purpose balance of compute, memory and
 - networking resources. Compute Optimized – ideal for compute bound applications that benefit from high performance processors.
 - Memory Optimized deliver fast performance for workloads that process large data sets in memory. Accelerated computing – use hardware accelerators, or
 - co-processors, to perform functions, such as floating point number calculations, graphics processing, or data pattern matching, more efficiently than is possible in software running on generic CPUs. Storage optimized – for workloads that require high, sequential
 - read and write access to very large data sets on local storage.

Linux/Unix - Amazon Linux, Debian, Ubuntu, Red Hat,

Databases - PostgreSQL, MySQL, MongoDB, Neo4J, Oracle

► AWS Marketplace – a wide selection of commercial and free

CentOS, SUSE, FreeBSD, Gentoo, Mint, ...

Windows – Server 2019, Server 2016, Server 2012.

EC2 Instance Types & Resources

 CPU – 64-bit Arm, AMD EPYC 7000, Intel Xeon Platinum 8175M. Intel Xeon E5-2676.

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1 192 virtual CPUs = 1 thread = 1 vCPU ► Memory - 1 ... 512 GB.

- ▶ Network up to 100 Gbps. Storage
 - Amazon Elastic Block Store (EBS) easy to use, high performance block storage service.
- 0 ... 60 TB NVMe SSD ensure best IOPS (Input/Output operations per second).
- ▶ Hardware Accelerators
- NVIDIA Tesla V100 GPUs. NVIDIA K80 GPUs. NVIDIA T4 Tensor Core GPUs.
 - AWS Inferentia Chins. Xiliny Virtey IlltraScale+ VIIQP EPGAs



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Pricing Examples

- ▶ General Purpose
 - t2 micro Linux or Windows 2 vCPUs + 4 GB 750 hours free per month \$0.05/h
 - a1 xlarge Linux 4 64-bit ARM vCPUs + 8 GB \$0.1152/h. a1.xlarge Linux - 4 64-bit ARM vCPUs + 8 GB - \$0.1152/h m5.24xlarge Linux – 96 Xeon vCPUs + 337 GB – \$5.136/h
 - m5.24xlarge Windows 96 Xeon vCPUs + 337 GB \$9.552/h Compute Optimized c5.xlarge Linux - 4 Xeon vCPUs + 8 GB - \$0.192/Hour
 - c5.24xlarge Linux 96 Xeon vCPUs + 192 GB \$4.608/Hour
 - ▶ Hardware Accelerators p3.2xlarge Linux - 1 NVIDIA Tesla V100 GPUs + 8 Xeon

 - vCPUs + 61 GB \$3.305 per Hour p3dn.24xlarge Linux - 8 NVIDIA Tesla V100 GPUs + 96 Xeon vCPUs + 768 GB - \$33.711 per Hour

Amazon Elastic Block Store (EBS)

- Easy to use, high performance block storage service. Targeting both throughput and transaction intensive
- workloads Can be used for relational and non-relational databases
 - Enterprise applications.
 - Big data analytics engines.

 - General purpose file systems. Media workflows.
- ▶ Highly availability and durability 99.999%
- Virtually unlimited scale as little as a single GB of storage,
- or scale up to petabytes of data. Secure – encryption of data at-rest, data in-transit, and all
- volume backups.

EBS Volume Types - HDD based

- ► Throughput Optimized HDD (ST1) ideal for frequently accessed, throughput-intensive workloads, Large datasets and large I/O sizes, such as MapReduce, Kafka. log processing, data warehouse, and ETL workloads.
- Low cost HDD volume.
 - Volume Size: 500 GB 16 TB.

 - Max IOPS/Volume: 500 Max Throughput/Volume: 500 MB/s
- Price: \$0.045/GB-month ► Low-cost HDD (SC1) - ideal for less frequently accessed
- workloads with large, cold datasets.
 - Colder data requiring fewer scans per day.
 - Volume Size: 500 GB 16 TB.
 - Max IOPS/Volume: 250 Max Throughput/Volume: 250 MB/s
 - Price: \$0.025/GB-month



EBS Volume Types - SSD based

- ▶ Provisioned IOPS SSD (IO1) high performance SSD volume designed for latency-sensitive transactional workloads. I/O-intensive NoSQL & relational databases.

 - Volume Size: 4 GB 16 TB. Max IOPS/Volume: 64 000
 - Max Throughput/Volume: 1.000 MB/s Price: \$0.125/GB-month + \$0.065/provisioned IOPS
 - ▶ Default EBS volume type (GP2) ideal for suitable for a broad range of transactional workloads.
 - Boot volumes, low-latency interactive apps, dev & test.
 - Volume Size: 1 TB 16 TB.
 - Max IOPS/Volume: 16.000
 - Max Throughput/Volume: 250 MB/s Price: \$0.10/GB-month







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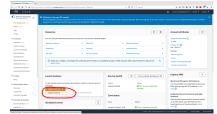


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Open EC2 Service Dashboard



Launch Instance







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Choose Instance Type

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Instance Ready to Launch







List of Instances



Overview of Instance

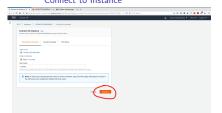




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Command Line Console







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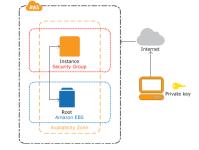
Other Examples

- ► Start, Stop, Terminate instance.
- ► Change Instance Type.
- ► Add Storage Volumes.
- ► Configure Security Groups.



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Connecting to the Instance



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