Cloud Databases: The True Cost

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QUICK POLL

Is there a certain cloud you are most interested in?

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Deep Apples-to-Apples Evaluation - DBaaS

- Amazon Web Services
  - RDS Postgres
  - Aurora Postgres Compatible
  - EDB Big Animal
- Azure
  - Flexible Server
  - EDB Big Animal

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What we will discuss today

- YOU DO **NOT** WANT:
  - The fastest at all cost
  - The cheapest and slow
- YOU DO WANT:
  - the lowest cost per work element - $/transaction
  - linear scalability in $/transaction
    - Concurrency
    - Workload
    - Database size
- HOW WE DO THAT?:
  - Take a scientific method approach of minimal variables :: maximum constants
  - Industry-accepted workload
  - Workload size consistency
  - Component consistency
- BONUS: We will run a live side-by-side race

How to measure?

The history of database benchmarking

- General workloads
  - Transactional
  - Analytical
- Vendor-specific workloads
  - Database-specific - pgbench
  - Vendor-specific – SAP SD
- More fit-for-purpose
  - Load testing
  - Performance testing
  - IO performance
- Historically benchmarks were focused on **performance NOT economics**

TPC®

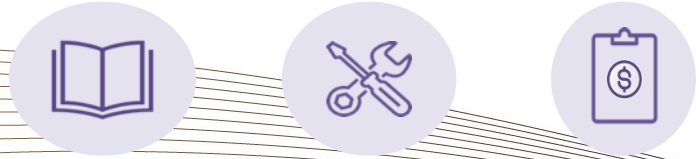
$$

EDB™

The effort EDB undertook

- Evaluate the optimal mix of CPU, RAM, storage and network AND comparable DBaaS
- Use a defensible, standards-based workload that clients can also utilize in their own environment
- Capture business and technical results
- Review the technical and economic result

HammerDB TPC®



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IT: No longer a ‘tailored suit’

Up to now:

‘Educated guesses’ and ‘release note analysis’ to understand sizing and cost.

The cloud allows a more elastic ‘t-shirt’ sizing

Name	Hector	Joe	Dan	Marcus
Height	5’ 4”	5’ 7”	5’ 10”	6’ 1”
Weight	125 lbs	160 lbs	170 lbs	225 lbs
Chest	33	33	35	42
Waist	32	32	36	38

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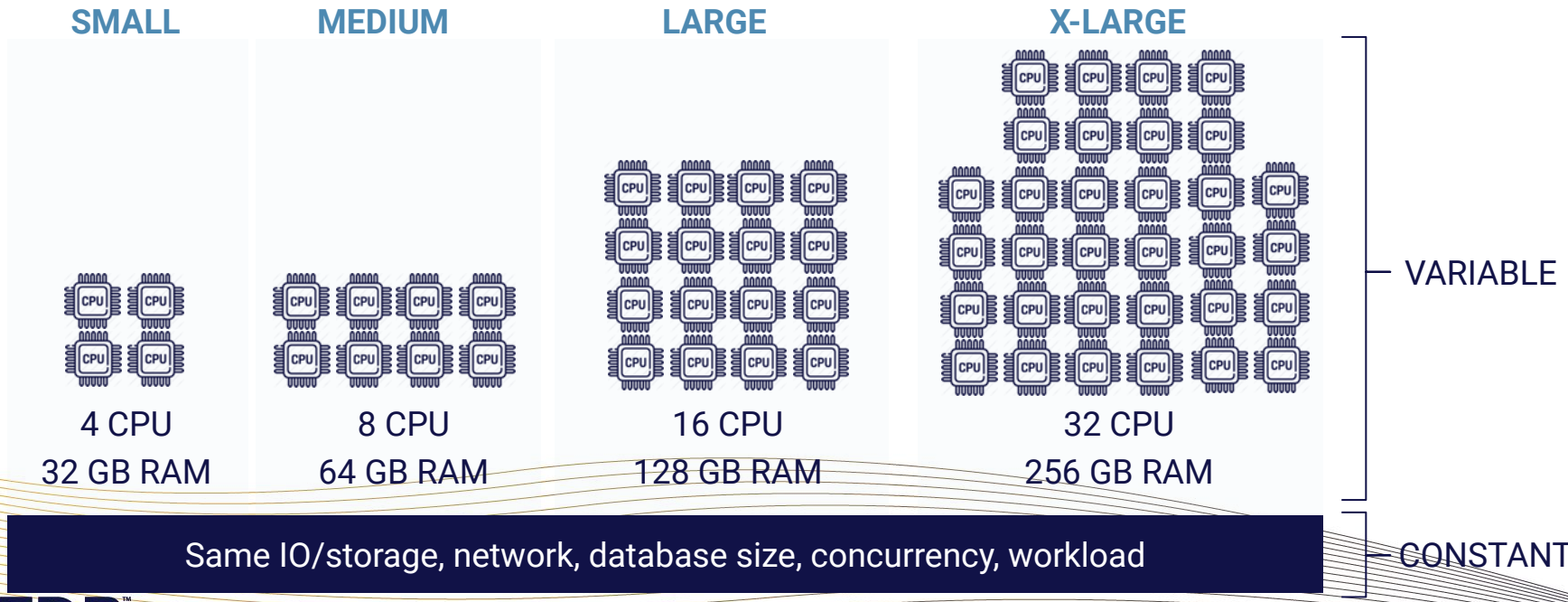
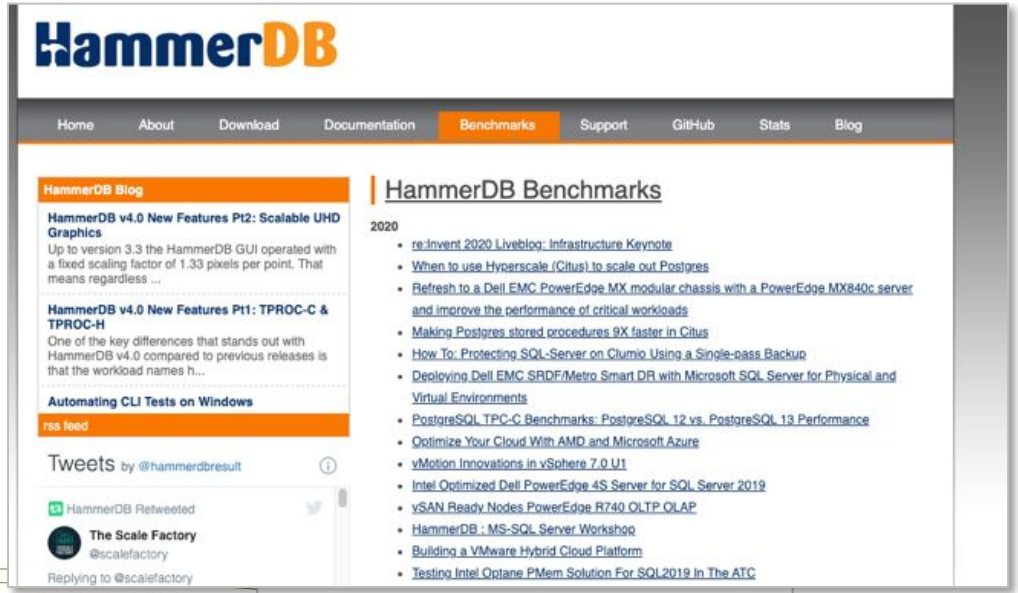
Think of cloud provisioning as ‘t-shirt’ sizes



Workload constant - **HammerDB**

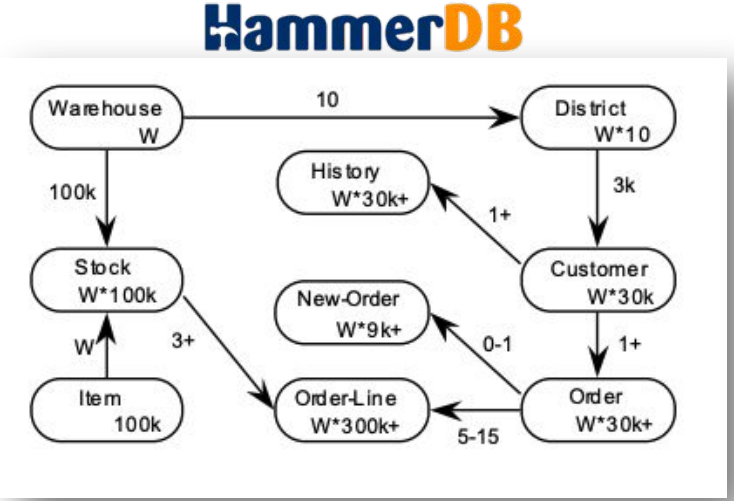
- HammerDB is open-source – evolving, community and free
- Standards based
  - TPC-C for transactional
  - TPC-H for analytical
- Works with all major databases – Oracle, SQLServer, DB2, MySQL, MariaDB, Postgres



www.hammerdb.com

Quick Anatomy of HammerDB

- Order Processing Use-case
- Typical Transactional use case
  - Simple SQL
  - Large in volume
- Two primary ‘knobs’ to size the effort
  - Warehouses – database size
  - User Concurrency
- **Resulting measure:** Transactions-per-minute (TPM)



Action Type	Mix
SELECT	75%
INSERT	8%
UPDATES	16%
DELETE	1%

Let’s kick off the RACE

CONSTANT #1: Workload

To measure and compare, we need maximum ‘constants’ and minimal ‘variables.

Workload

HammerDB

300 warehouses (60 GB) – 96 concurrent users – 5 min. warmup – 20 min. run

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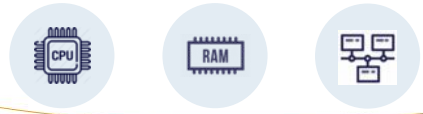
Challenge #2 – What compute?

- Example:
  Amazon gives you 55 choices in compute with 8 cores.
- From $102 to $825 per month



1 | Category

Category	Cate	Size	VM Price per mo	vCP	RA	RAM/CPU Ratio	Instance Storage	Network Burst Bandwidth (Gbps)	EBS Burst Bandwidth (Mbps)	M	Mod	Family	Burs Fa	Burs Fl	Processor
General	A1	a1.2xlarge	$102.78	8	16	2	EBS-Only	Up to 10	??	AWS		Graviton			AWS Graviton Processor with 64-bit Arm Neoverse cores
Compute	C6g	c6g.2xlarge	$137.02	8	16	2	EBS-Only	Up to 10	Up to 4,750	AWS		Graviton2			AWS Graviton2 Processor with 64-bit Arm Neoverse cores
Compute	C7g	c7g.2xlarge	$152.79	8	16	2	EBS-Only	Up to 15	Up to 10	AWS		Graviton3			AWS Graviton3 processors
General	M6g	m6g.2xlarge	$154.47	8	32	4	EBS-Only	Up to 10	Up to 4,750	AWS		Graviton2			AWS Graviton2 Processor with 64-bit Arm Neoverse cores
Compute	C6g	c6gd.2xlarge	$154.76	8	16	2	NVMe	Up to 10	Up to 4,750	AWS		Graviton2			AWS Graviton2 Processor with 64-bit Arm Neoverse cores
Compute	C5a	c5a.2xlarge	$155.49	8	16	2	EBS-Only	Up to 10	Up to 3,170	AMD	7R32	EPYC		3.30	2nd generation AMD EPYC 7002 series processors (AMD EPYC 7R32) running at frequencies up to 3.3 GHz
Compute	C6a	c6a.2xlarge	$162.54	8	16	2	EBS-Only	Up to 12.5	Up to 6.6	AMD	7R13	EPYC		3.60	Up to 3.6 GHz 3rd generation AMD EPYC processors (AMD EPYC 7R13)
General	T3	t3.2xlarge	$166.81	8	32	4	EBS-Only	Up to 5		Intel	8175M	Skylake		3.10	Up to 3.1 GHz Intel Xeon Scalable processor (Skylake 8175M or Cascade Lake 8259CL)
Compute	C5	c5.2xlarge	$171.55	8	16	2	EBS-Only	Up to 10	Up to 4,750	Intel	8223CL	Cascade Lake	3.10	3.40	8000 series (Skylake 8124M) processor with a sustained all core Turbo frequency of up to 3.4GHz, and
General	M5a	m5a.2xlarge	$173.01	8	32	4	EBS-Only	Up to 10	Up to 2,880	AMD	7571	EPYC	2.50		AMD EPYC 7000 series processors (AMD EPYC 7571) with an all core turbo clock speed of 2.5 GHz
Compute	C5a	c5ad.2xlarge	$173.74	8	16	2	NVMe	up to 10	up to 3,170	AMD	7R32	EPYC		3.30	2nd generation AMD EPYC 7002 series processors (AMD EPYC 7R32) running at frequencies up to 3.3 GHz
Compute	C6gn	c6gn.2xlarge	$175.16	8	16	2	EBS-Only	Up to 25	Up to 9.5	AWS		Graviton2			AWS Graviton2 Processor with 64-bit Arm Neoverse cores
Compute	C6i	c6i.2xlarge	$180.60	8	16	2	EBS-Only	Up to 12.5	Up to 10	Intel	8375C	Ice Lake	2.90	3.50	Up to 3.5 GHz 3rd generation Intel Xeon Scalable processors (Ice Lake 8375C)
General	M6g	m6gd.2xlarge	$182.14	8	32	4	NVMe	Up to 10	Up to 4,750	AWS		Graviton2			AWS Graviton2 Processor with 64-bit Arm Neoverse cores
General	M6a	m6a.2xlarge	$183.58	8	32	4	EBS-Only	Up to 12.5	Up to 6.6	AMD	7R13	EPYC		3.60	Up to 3.6 GHz 3rd generation AMD EPYC processors (AMD EPYC 7R13)
General	M5	m5.2xlarge	$193.45	8	32	4	EBS-Only	Up to 10	Up to 4,750	Intel	8175M	Skylake		3.10	Up to 3.1 GHz Intel Xeon Scalable processor (Skylake 8175M or Cascade Lake 8259CL)
Compute	C5	c5d.2xlarge	$193.45	8	16	2	NVMe	Up to 10	Up to 4,750	Intel	8223CL	Cascade Lake	3.10	3.40	8000 series (Skylake 8124M) processor with a sustained all core Turbo frequency of up to 3.4GHz, and
General	M4	m4.2xlarge	$199.00	8	32	4	EBS-only	High	1000	Intel	E5-2686	Broadwell	2.30	2.40	Up to 2.4 GHz Intel Xeon Scalable Processor (Broadwell E5-2686 v4 or Haswell E5-2676 v3)
Compute	C4	c4.2xlarge	$202.21	8	15	2	EBS-Only	High	1000	Intel	E5-2666	Haswell		2.90	Up to 2.9 GHz Intel Xeon Scalable Processor (Haswell E5-2666 v3)
Memory	R6g	r6g.2xlarge	$203.09	8	64	8	EBS-Only	Up to 10	Up to 4,750	AWS		Graviton2			AWS Graviton2 Processor
General	M6i	m6i.2xlarge	$203.98	8	32	4	EBS-Only	Up to 12.5	Up to 10	Intel	8375C	Ice Lake	2.90	3.50	Up to 3.5 GHz 3rd generation Intel Xeon Scalable processors (Ice Lake 8375C)
Compute	C6i	c6id.2xlarge	$204.04	8	16	2	VMe SSD	Up to 12.5	Up to 10	Intel	8375C	Ice Lake	2.90	3.50	Up to 3.5 GHz 3rd generation Intel Xeon Scalable processors (Ice Lake 8375C)
General	M5a	m5ad.2xlarge	$207.32	8	32	4	NVMe	Up to 10	Up to 2,880	AMD	7571	EPYC	2.50		AMD EPYC 7000 series processors (AMD EPYC 7571) with an all core turbo clock speed of 2.5 GHz
Compute	C5n	c5n.2xlarge	$217.54	8	21	3	EBS-Only	Up to 25	Up to 4,750	Intel	8124	Skylake	3.00		3.0 GHz Intel Xeon Platinum processors (Skylake 8124)
Memory	R5a	r5a.2xlarge	$227.76	8	64	8	EBS-Only	Up to 10	Up to 2,880	AMD	7571	EPYC	2.50		AMD EPYC 7000 series processors (AMD EPYC 7571) with an all core turbo clock speed of 2.5 GHz
General	M5	m5d.2xlarge	$227.76	8	32	4	NVMe	Up to 10	Up to 4,750	Intel	8175M	Skylake		3.10	Up to 3.1 GHz Intel Xeon Scalable processor (Skylake 8175M or Cascade Lake 8259CL)
Memory	R6g	r6gd.2xlarge	$232.14	8	64	8	NVMe	Up to 10	Up to 4,750	AWS		Graviton2			AWS Graviton2 Processor
General	M5n	m5n.2xlarge	$239.44	8	32	4	EBS-Only	Up to 25	Up to 4,750	Intel	8259CL	Cascade Lake	3.10	3.50	frequency of 3.1 GHz and maximum single core turbo frequency of 3.5 GHz
General	M6i	m6id.2xlarge	$240.10	8	32	4	VMe SSD	Up to 12.5	Up to 10	Intel	8375C	Ice Lake	2.90	3.50	Up to 3.5 GHz 3rd generation Intel Xeon Scalable processors (Ice Lake 8375C)
Memory	R6a	r6a.2xlarge	$240.94	8	64	8	EBS-Only	Up to 12.5	Up to 6.6	AMD	7R13	EPYC		3.60	Up to 3.6 GHz 3rd generation AMD EPYC processors (AMD EPYC 7R13)
Storage	H1	h1.2xlarge	$254.04	8	32	4	HDD	Up to 10	??	Intel	E5-2686	Broadwell	2.30		2.3 GHz Intel Xeon Scalable Processor (Broadwell E5 2686 v4)
Memory	R5	r5.2xlarge	$254.04	8	64	8	EBS-Only	up to 10	Up to 4,750	Intel	8175M	Skylake		3.10	Up to 3.1 GHz Intel Xeon® Platinum 8000 series processors (Skylake 8175M or Cascade Lake 8259CL)
Memory	R5a	r5ad.2xlarge	$264.26	8	64	8	NVMe	Up to 10	Up to 2,880	AMD	7571	EPYC	2.50		AMD EPYC 7000 series processors (AMD EPYC 7571) with an all core turbo clock speed of 2.5 GHz
Memory	R6i	r6i.2xlarge	$267.72	8	64	8	EBS-Only	Up to 12.5	Up to 10	Intel	8375C	Ice Lake	2.90	3.50	Up to 3.5 GHz 3rd generation Intel Xeon Scalable processors (Ice Lake 8375C)
Memory	R4	r4.2xlarge	$269.81	8	61	8	EBS-Only	Up to 10		Intel	E5-2686	Broadwell	2.30	2.30	Intel Xeon scalable (Broadwell E5-2686 v4) processors up to 2.3 Ghz
General	M5n	m5dn.2xlarge	$273.75	8	32	4	NVMe	Up to 25	Up to 4,750	Intel	8259CL	Cascade Lake	3.10	3.50	frequency of 3.1 GHz and maximum single core turbo frequency of 3.5 GHz
Memory	R5	r5d.2xlarge	$289.81	8	64	8	NVMe	up to 10	Up to 4,750	Intel	8175M	Skylake		3.10	Up to 3.1 GHz Intel Xeon® Platinum 8000 series processors (Skylake 8175M or Cascade Lake 8259CL)
Memory	R5n	r5n.2xlarge	$300.03	8	64	8	EBS-Only	Up to 25	Up to 4,750	Intel	8259CL	Cascade Lake	3.10	3.50	frequency of 3.1 GHz and maximum single core turbo frequency of 3.5 GHz
Memory	R5b	r5b.2xlarge	$301.51	8	64	8	EBS-Only	up to 10	Up to 10,000	Intel	8259CL	Cascade Lake	3.10	3.50	GHz and maximum single core turbo frequency of 3.5 GHz
Memory	R6i	r6id.2xlarge	$305.22	8	64	8	NVMe	Up to 12.5	Up to 10	Intel	8375C	Ice Lake	2.90	3.50	Up to 3.5 GHz 3rd generation Intel Xeon Scalable processors (Ice Lake 8375C)
Memory	X2gd	x2gd.2xlarge	$330.54	8	128	16	NVMe	Up to 10	Up to 4.75	AWS		Graviton2			AWS Graviton2 Processor
General	M5zn	m5zn.2xlarge	$334.27	8	32	4	EBS-Only	Up to 25	3170	Intel	8252C	Cascade Lake		4.50	4.5 GHz
Memory	R5n	r5dn.2xlarge	$336.53	8	64	8	NVMe	Up to 25	Up to 4,750	Intel	8259CL	Cascade Lake	3.10	3.50	frequency of 3.1 GHz and maximum single core turbo frequency of 3.5 GHz
Storage	I3	i3.2xlarge	$343.83	8	61	8	NVMe	Up to 10	??	Intel	E5-2686	Broadwell	2.30		Intel Xeon Scalable Processors (Broadwell E5-2686 v4) with base frequency of 2.3 GHz
Storage	I4i	i4i.2xlarge	$357.70	8	64	8	AWS	Up to 12	Up to 10	Intel	8375C	Ice Lake	2.90	3.50	Up to 3.5 GHz 3rd generation Intel Xeon Scalable Processors (Ice Lake 8375C)
Memory	z1d	z1d.2xlarge	$374.49	8	64	8	NVMe	Up to 10	??	Intel	8151	Skylake		4.00	GHz
Storage	Im4gn	Im4gn.2xlarge	$374.69	8	32	4	3750 A	Up to 25	Up to 9.5	AWS		Graviton2			AWS Graviton2
Storage	I3en	i3en.2xlarge	$492.02	8	64	8	NVMe	Up to 25	??	Intel		Skylake	3.10		3.1 GHz all core turbo Intel® Xeon® Scalable (Skylake) processors
Storage	D3	d3.2xlarge	$505.16	8	64	8	HDD	Up to 15	1700	Intel	8259CL	Cascade Lake	3.10	3.10	Up to 3.1 GHz 2nd Generation Intel® Xeon® Scalable (Cascade Lake) processors
Storage	D3en	d3en.2xlarge	$532.17	8	32	4	HDD	Up to 25	1700	Intel		Cascade Lake	3.10		3.1 GHz all core turbo 2nd Generation Intel® Xeon® Scalable (Cascade Lake) processors
Storage	D2	d2.2xlarge	$645.32	8	61	8	2000 H	High	??	Intel	E5-2676	Haswell	2.40		Intel Xeon Scalable Processors (Haswell E5-2676 v3) at 2.4 Ghz
Memory	x2iedn	x2iedn.2xlarge	$823.76	8	256	32	NVMe	Up to 25	Up to 20	Intel	8375C	Ice Lake	2.90	3.50	Up to 3.5 GHz 3rd generation Intel Xeon Scalable processors (Ice Lake 8375C)
Memory	x2iezn	x2iezn.2xlarge	$824.61	8	256	32	EBS-Only	Up to 25	3	Intel	8252C	Cascade Lake		4.50	Up to 4.5 GHz 2nd generation Intel Xeon Scalable processors (Cascade Lake 8252C)
Memory	X1e	x1e.2xlarge	$825.63	8	244	31	1 x 240	Up to 10	1000	Intel	8880	Haswell	2.30		2.3 GHz Intel Xeon Scalable Processor (Haswell E7-8880 v3)

$102

$825

CONSTANT #2: Compute

To measure and compare, we need maximum ‘constants’ and minimal ‘variables.

Workload

CPU/RAM

HammerDB

300 warehouses (60 GB) – 96 concurrent users – 5 min. warmup – 20 min. run

AWS RDS	AWS AURORA	AWS BIG ANIMAL	AZURE FLEX SERVER	AZURE BIG ANIMAL
R6i-4xlarge Intel Ice Lake 16 cores 64GB RAM	R6i-4xlarge Intel Ice Lake 16 cores 64GB RAM	R6i-4xlarge Intel Ice Lake 16 cores 64GB RAM	E16ds_v4 (Intel® Ice Lake or the Intel® Cascade Lake processors) 16 cores 64GB RAM	E16s_v5 (Intel Ice Lake) 16 mores 128GB RAM

Challenge #3 – What storage

Google Cloud

- No performance control
- Quoted for **600GB**

Type	MAX 'sustained' IOPS	MAX 'sustained' Throughput
Standard	*Read: 450 Write: 900*	*Read: 72 MB/sec Write: 72 MB/sec*
Balanced	*Read: 3,600 Write: 3,600*	*Read: 72 MB/sec Write: 72 MB/sec*
SSD	*Read: 15,000 Write: 15,000*	*Read: 240 MB/sec Write: 240 MB/sec*

https://cloud.google.com/compute/docs/disks/?&_ga=2.62767211.-658045011.1598996595#pdperformance

aws

- All about which level and what you are willing to pay – **600GB sizing**

Type	MAX 'sustained' IOPS	MAX Throughput
Optimized HHD (st1)		*MAX 147 MB/s max*
General Purpose SSD (gp2)	*3000*	
General Purpose SSD (gp3)	3000	500 MB/sec
Provisioned IOPS SSD (io1)	MAX 30,000	
Provisioned IOPS SSD (io2)	MAX 64,000	

https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/ebs-volume-types.html?icmpid=docs_ec2_console

Azure

- Azure has 'binary' pricing = 128GB, 256, 512GB, etc.
- **Assume 1024 GB**

Type	MAX 'sustained' IOPS	MAX Throughput
Standard HDD	*500*	*60 MB/sec*
Standard SSD	*500*	*60 MB/sec*
Premium SSD	*5000*	*200 MB/sec*
Ultra Disk	51,200*	768 MB/sec*

https://docs.microsoft.com/en-us/azure/virtual-machines/disks-types

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CONSTANT #3: Storage

To measure and compare, we need maximum ‘constants’ and minimal ‘variables.

Workload

CPU/RAM

STORAGE

HammerDB

300 warehouses (60 GB) – 96 concurrent users – 5 min. warmup – 20 min. run

AWS RDS	AWS AURORA	AWS BIG ANIMAL	AZURE FLEX SERVER	AZURE BIG ANIMAL
R6i-4xlarge Intel Ice Lake 16 cores 64GB RAM	R6i-4xlarge Intel Ice Lake 16 cores 64GB RAM	R6i-4xlarge Intel Ice Lake 16 cores 64GB RAM	E16ds_v4 (Intel® Ice Lake or the Intel® Cascade Lake processors) 16 cores 64GB RAM	E16s_v5 (Intel Ice Lake) 16 mores 128GB RAM
300GB - io1 storage at 7000 IOPS	I have no idea	300GB - io2 storage at 7000 IOPS	Provisioned 2TB to get 7500 IOPS	300GB - Ultradisk at 7000 IOPS

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Challenge #3 – Storage cost is confusing

((# of GB * $0.14746)+(# of IOPS * $0.06132)+(# of MBps * $0.39566))*12

Azure

- Top performing storage: **Ultra Disk**
- You pay for it in discrete increments: 256GB, 512GB, 1024GB, etc
  - i.e. Even if you want a volume of 300GB you pay for 512GB
- You configure:
  - IOPS = operations/sec
  - Throughput = MBps

- Pricing (central-us)
  - $0.14746/mon per GB
  - $0.06132/mon per IOPS
  - $0.39566/mon per MBps
- Example of VMs and their 'limits':

Good Willing Hunting

Name	Size	"Max uncached disk throughput IOPS/MBps"
E4ds_v4	4 CPU/32 GB	6,400 / 96
E8ds_v4	8 CPU/64 GB	12,800 / 192
E16ds_v4	16 CPU/128 GB	25,600 / 384
E32ds_v4	32 CPU/256 GB	51,200 / 768

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https://azure.microsoft.com/en-us/pricing/details/managed-disks/

Challenge #3.1 – Storage cost is confusing

((# of GB * $0.10)+((730 hours * 60 mins * 60 sec * # of IOPS that second) * $0.0000002))*12

- Inputs/Outputs per Second/Volume
  - Gp2 has “Up to” 3 IOPS/GB
  - Gp3 has them - ”Up to” 16,000
  - IO1 and IO2 has them – “Up to” 64,000
  - IO2 Block Express has them – “Up to” 256,000
- RDS supports gp2, gp3 and io1
- Aurora is based on ”Solid state drives”

Amazon Aurora PostgreSQL

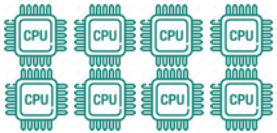
- Aurora Pricing
  - $0.10/mon per GB
  - $0.0000002 /mon per IOPS
- Example of VMs and their ‘limits’:

Name	Size	Storage Bandwidth (Gbps)
R6i.xlarge	4 CPU/32 GB	“Up to” 10
R6i.2xlarge	8 CPU/64 GB	“Up to” 10
R6i.4xlarge	16 CPU/128 GB	“Up to” 10
R6i.8xlarge	32 CPU/256 GB	10

QUICK POLL

Do you find this pricing of storage in the cloud as complicated as I do?

AWS RDS: IOPS, Tuning and Cost



8 CPU

64 GB RAM

IO1 IOPS	Annual Storage Cost	Annual Total Cost
30,000	$36,900	$45,531
20,000	$24,900	$32,331
15,000	$18,900	$25,731
10,000	$12,900	$19,131
7,000	$9,300	$15,171
5,000	$6,900	$12,531
4,000	$5,700	$11,211

CONSTANT #4: Database

To measure and compare, we need maximum ‘constants’ and minimal ‘variables.

Workload

CPU/RAM

STORAGE

DATABASE

HammerDB

600 warehouses (120 GB) – 96 concurrent users – 5 min. warmup – 20 min. run

AWS RDS	AWS AURORA	AWS BIG ANIMAL	AZURE FLEX SERVER	AZURE BIG ANIMAL
R6i-4xlarge Intel Ice Lake 16 cores 64GB RAM	R6i-4xlarge Intel Ice Lake 16 cores 64GB RAM	R6i-4xlarge Intel Ice Lake 16 cores 64GB RAM	E16ds_v4 (Intel® Ice Lake or the Intel® Cascade Lake processors) 16 cores 64GB RAM	E16s_v5 (Intel Ice Lake) 16 mores 128GB RAM
300GB - io1 storage at 7000 IOPS	I have no idea	300GB - io2 storage at 7000 IOPS	Provisioned 2TB to get 7500 IOPS	300GB - Ultradisk at 7000 IOPS
Community Postgres v14.5	Postgres ‘Compatible’ v14.5	Community Postgres v15.1	Community Postgres v14.4	Community Postgres v15.1

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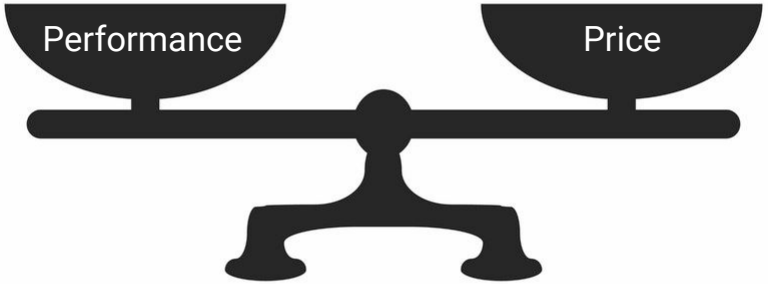
Challenge #4 – How to get to “optimized”

- Components
  - Picking the optimal CPU/RAM
  - Picking the optimal storage
- Postgres
  - Latest version
  - Configuration settings



OBJECTIVE: LEAST COST PER TPM

Sum of Effort – thus far

- The effort
  - Ran over 500 unique runs of HammerDB across the 3 clouds
  - Maximized ‘constants’ – database size, concurrency, run time, etc.
  - Generated >30TBs of total data
  - Each load-and-run takes 2 hours
- Objective
  - Compare and contrast offerings price AND performance
  - Identify optimizations

BigAnimal closes the gap between what enterprises need and the cloud service providers are offering today.

EDB

Unleash the power of Big Animal

Your Postgres database is too important to leave to generalists

Postgres Expertise

EDB's expertise goes above the infrastructure; we help steer the database roadmap and patch its bugs

Oracle Compatibility

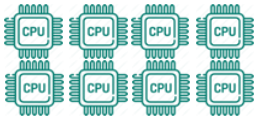
Leave Oracle and further your cloud journey with a fully managed Postgres service

Extreme High Availability

High availability of your PostgreSQL clusters so you're always on, always available

EDB

Finally – COST & MONEY - Aurora



8 CPU

64 GB RAM

Amazon Aurora on aws

What	AWS Aurora	EDB Big Animal with Community Postgres			
Cost	$4,690.40	$787.38	$1,105.88	$1,235.88	$1,430.88
Storage	????	Gp3 at 7000 IOPS	Io2 at 5000 IOPS	Io2 at 7000 IOPS	Io2 at 10,000 IOPS
Optimized Results	282,250	246,624	275,980	307,653	311,875
$s/TPM	$0.017	$0.003	$0.004	$0.004	$0.005
TPMs/$	60	313	249	250	218

Higher better

Lower better

Higher better

EDB

Let’s look at the environments

BigAnimal compared to…

	Azure		amazon web services			Google Cloud	
	Big Animal	Flexible Server	Big Animal	RDS Postgres	Aurora Postgres	Big Animal	Google SQL Postgres
Max Storage	65TB/160K IOPS with Ultradisk	16.3TB/18K IOPS with Premium Disk	65.5TB/ 256K IOPS with io2 Disk	65.5TB/ 256K IOPS with io1 Disk	128TB/ Unknown IOPS with unknown storage	TBD (Coming 1Q, 2023)	65TB/30K IOPS with SSD disk
Postgres Tunability	**98%**	51%	**98%**	64%	57%	**98%**	51%
Max Backup Retention	**180 days**	35 days	**180 days**	35 days	35 days	**180 days**	365 ‘backup’ actions
Backup Costs	**$0.023 per GB (Azure BLOB)**	$0.095 per GB-month	**$0.023 per GB (cost of S3)**	$0.095 per GiB-month	$0.021 per GB-month	**$0.023 per GB (Google Cloud Std)**	$0.08 per GB/month
Support	**24x7 break-fix included | portal w/ health check | sev 1 response <15 min/remedy <4 hours**	Additional Cost | ‘Pro-Direct Support’ | 24x7 access ‘after a support request is submitted’ | sev ‘A’ response **60 min**/remedy ???	**24x7 break-fix included | portal w/ health check | sev 1 response <15 min/remedy <4 hours**	Additional cost | 24x7 access | sev 1 response **4 hours**/ remedy ???		**24x7 break-fix included | portal w/ health check | sev 1 response <15 min/remedy <4 hours**	Additional cost | 24x7 ‘Enhanced Support’ | ‘P1’ response **60 min** / remedy ???

What is next

- **Other databases:** Size/Benchmark other databases: MySql, SQLServer and Oracle
- **Publish best-practices materials** from raw data
  - Presentations, papers, blogs, webinars, etc
  - Get some immediate wins and renewals
- **Help you make the right decisions in $optimizing$ cloud**

Innovation Roadmap

Availability

- Cross-region availability
- Cross-region multi-master clustering
- Cross-cloud clustering
- Custom maintenance windows
- Adding Google Cloud Platform
- Adding new regions

Performance

- Faster access to clustered data
- Automate usage of connection pooler
- Realtime database tuning based on workload
- Separate WAL logs into own disk volume

Automation

- Storage auto clustering
- Self-serve major upgrade control
- Autoscale storage across clusters
- Automated Tuner

Cost Optimization

- Automate Hibernate/Resume
- Best price/ performance CPU VMs
- VM and storage workload optimization

So what did we learn today

- There are a lot of ways cloud gets expensive – with no value
- Confusion in how to select the right components
- You want to work with the right vendor with a focus on open-source Postgres
- Consider using a workload tool like HammerDB to give you something to measure-and-compare

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Q+A Session

Got a question? Ask us using the button below

Contact Us

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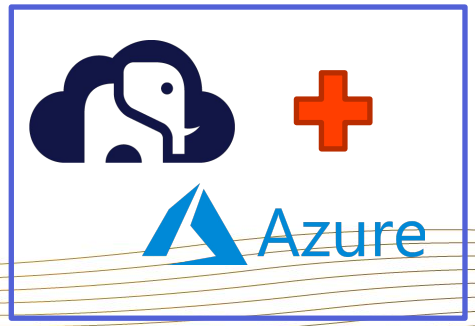

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