Serverless Computing

CS 4740: Cloud Computing Fall 2024 Lecture 14a

Yue Cheng

UNIVERSITY VIRGINIA

Some material taken/derived from:

- Berkeley CS 262a (Spring '18) by Ali Ghodsi and Ion Stoica;
- Tyler Harter's HotCloud '18 OpenLambda talk;

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Motivation

When to use the cloud?

- Data
 - Large amounts of data can't store locally
 - Shared data across users
 - Long-term storage
- Compute
 - Need lots of CPUs for data processing
 - Varying computing demands (resources)
 - No admin (for managing your local hardware)

EC2Instances.info Easy Amazon EC2 Instance Comparison

EC2 RDS

Region: US East (N. Virginia) -	Cost: Hourly -	Reserved: 1-year - No Upfront -	Columns -	Compare Selected	Clear Filters	CSV	
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Filter: Min Memory (GiB): 0 Min vCPUs: 0 Min Storage (GiB): 0

EC2 Instances (724)

Based on your inputs, this is the lowest-cost EC2 instance: t4g.nano

Name	API Name	Memory 🔅	vCPUs	Instance Storage	Network Performance	Linux On Demand cost	Linux Reserved cost	Windows On Demand cost	Windows Reserved cos
Search	Search	Search	Search	Search	Search	Search	Search	Search	Search
M5DN Extra Large	m5dn.xlarge	16.0 GiB	4 vCPUs	150 GiB NVMe SSD	Up to 25 Gigabit	\$0.272000 hourly	\$0.173000 hourly	\$0.456000 hourly	\$0.357000 hourly
M5A Double Extra Large	m5a.2xlarge	32.0 GiB	8 vCPUs	EBS only	Up to 10 Gigabit	\$0.344000 hourly	\$0.219000 hourly	\$0.712000 hourly	\$0.587000 hourly
R5N 12xlarge	r5n.12xlarge	384.0 GiB	48 vCPUs	EBS only	50 Gigabit	\$3.576000 hourly	\$2.253000 hourly	\$5.784000 hourly	\$4.461000 hourly
R5AD Extra Large	r5ad.xlarge	32.0 GiB	4 vCPUs	150 GiB NVMe SSD	10 Gigabit	\$0.262000 hourly	\$0.166000 hourly	\$0.446000 hourly	\$0.350000 hourly
R5N Extra Large	r5n.xlarge	32.0 GiB	4 vCPUs	EBS only	Up to 25 Gigabit	\$0.298000 hourly	\$0.188000 hourly	\$0.482000 hourly	\$0.372000 hourly
I3EN 12xlarge	i3en.12xlarge	384.0 GiB	48 vCPUs	30000 GiB (4 * 7500 GiB NVMe SSD)	50 Gigabit	\$5.424000 hourly	\$3.694000 hourly	\$7.632000 hourly	\$5.902000 hourly
I3EN Metal	i3en.metal	768.0 GiB	96 vCPUs	60000 GiB (8 * 7500 GiB NVMe SSD)	100 Gigabit	\$10.848000 hourly	\$7.388000 hourly	\$15.264000 hourly	\$11.804000 hourly
R5DN Extra Large	r5dn.xlarge	32.0 GiB	4 vCPUs	150 GiB NVMe SSD	Up to 25 Gigabit	\$0.334000 hourly	\$0.211000 hourly	\$0.518000 hourly	\$0.395000 hourly
12 Extra Large	i2.xlarge	30.5 GiB	4 vCPUs	800 GiB SSD	Moderate	\$0.853000 hourly	\$0.424000 hourly	\$0.973000 hourly	\$0.565000 hourly
M5N 16xlarge	m5n.16xlarge	256.0 GiB	64 vCPUs	EBS only	75 Gigabit	\$3.808000 hourly	\$2.419000 hourly	\$6.752000 hourly	\$5.363000 hourly
T2 Micro	t2.micro	1.0 GiB	1 vCPUs for a 2h 24m burst	EBS only	Low to Moderate	\$0.011600 hourly	\$0.007200 hourly	\$0.016200 hourly	\$0.011800 hourly
D2 Eight Extra Large	d2.8xlarge	244.0 GiB	36 vCPUs	48000 GiB (24 * 2000 GiB HDD)	10 Gigabit	\$5.520000 hourly	\$3.216000 hourly	\$6.198000 hourly	\$3.300000 hourly
I3EN 3xlarge	i3en.3xlarge	96.0 GiB	12 vCPUs	7500 GiB NVMe SSD	Up to 25 Gigabit	\$1.356000 hourly	\$0.924000 hourly	\$1.908000 hourly	\$1.476000 hourly
Z1D 3xlarge	z1d.3xlarge	96.0 GiB	12 vCPUs	450 GiB NVMe SSD	Up to 10 Gigabit	\$1.116000 hourly	\$0.705000 hourly	\$1.668000 hourly	\$1.257000 hourly
X1E 16xlarge	x1e.16xlarge	1952.0 GiB	64 vCPUs	1920 GiB SSD	10 Gigabit	\$13.344000 hourly	\$8.223000 hourly	\$16.288000 hourly	\$11.167000 hourly
R5N 24xlarge	r5n.24xlarge	768.0 GiB	96 vCPUs	EBS only	100 Gigabit	\$7.152000 hourly	\$4.506000 hourly	\$11.568000 hourly	\$8.922000 hourly
12 Eight Extra Large	i2.8xlarge	244.0 GiB	32 vCPUs	6400 GiB (8 * 800 GiB SSD)	10 Gigabit	\$6.820000 hourly	\$3.392000 hourly	\$7.782000 hourly	\$4.521000 hourly
R5A Eight Extra Large	r5a.8xlarge	256.0 GiB	32 vCPUs	EBS only	Up to 10 Gigabit	\$1.808000 hourly	\$1.141000 hourly	\$3.280000 hourly	\$2.613000 hourly
A1 Metal	a1.metal	32.0 GiB	16 vCPUs	EBS only	Up to 10 Gigabit	\$0.408000 hourly	\$0.257000 hourly	unavailable	unavailable
12 Double Extra Large	i2.2xlarge	61.0 GiB	8 vCPUs	1600 GiB (2 * 800 GiB SSD)	High	\$1.705000 hourly	\$0.848000 hourly	\$1.946000 hourly	\$1.131000 hourly
I3EN Double Extra Large	i3en.2xlarge	64.0 GiB	8 vCPUs	5000 GiB (2 * 2500 GiB NVMe SSD)	Up to 25 Gigabit	\$0.904000 hourly	\$0.616000 hourly	\$1.272000 hourly	\$0.984000 hourly
M5A Extra Large	m5a.xlarge	16.0 GiB	4 vCPUs	EBS only	Up to 10 Gigabit	\$0.172000 hourly	\$0.109000 hourly	\$0.356000 hourly	\$0.293000 hourly
P3 Double Extra Large	p3.2xlarge	61.0 GiB	8 vCPUs	EBS only	Up to 10 Gigabit	\$3.060000 hourly	\$2.088000 hourly	\$3.428000 hourly	\$2.456000 hourly
T2 Double Extra Large	t2.2xlarge	32.0 GiB	8 vCPUs for a 4h 4.8m burst	EBS only	Moderate	\$0.371200 hourly	\$0.230000 hourly	\$0.433200 hourly	\$0.292000 hourly
H1 Eight Extra Large	h1.8xlarge	128.0 GiB	32 vCPUs	8000 GIB (4 * 2000 GIB HDD)	10 Gigabit	\$1.872000 hourly	\$1.272000 hourly	\$3.344000 hourly	\$2.744000 hourly
R5D 24xlarge	r5d.24xlarge	768.0 GiB	96 vCPUs	3600 GiB (4 * 900 GiB NVMe SSD)	25 Gigabit	\$6.912000 hourly	\$4.362000 hourly	\$11.328000 hourly	\$8.778000 hourly
I3EN 6xlarge	i3en.6xlarge	192.0 GiB	24 vCPUs	15000 GiB (2 * 7500 GiB NVMe SSD)	25 Gigabit	\$2.712000 hourly	\$1.847000 hourly	\$3.816000 hourly	\$2.951000 hourly
R4 High-Memory Eight Extra Large	r4.8xlarge	244.0 GiB	32 vCPUs	EBS only	10 Gigabit	\$2.128000 hourly	\$1.344000 hourly	\$3.600000 hourly	\$2.816000 hourly
T2 Large	t2.large	8.0 GiB	2 vCPUs for a 7h 12m burst	EBS only	Low to Moderate	\$0.092800 hourly	\$0.057500 hourly	\$0.120800 hourly	\$0.085500 hourly
X1 Extra High-Memory 16xlarge	x1.16xlarge	976.0 GiB	64 vCPUs	1920 GiB SSD	High	\$6.669000 hourly	\$4.110000 hourly	\$9.613000 hourly	\$7.054000 hourly
M5A 16xlarge	m5a.16xlarge	256.0 GiB	64 vCPUs	EBS only	12 Gigabit	\$2.752000 hourly	\$1.751000 hourly	\$5.696000 hourly	\$4.695000 hourly
R5 Metal	r5.metal	768.0 GiB	96 vCPUs	EBS only	25 Gigabit	\$6.048000 hourly	\$3.810000 hourly	\$10.464000 hourly	\$8.226000 hourly
R5A Large	r5a.large	16.0 GiB	2 vCPUs	EBS only	10 Gigabit	\$0.113000 hourly	\$0.071000 hourly	\$0.205000 hourly	\$0.163000 hourly
C3 High-CPU Large	c3.large	3.75 GIB	2 vCPUs	32 GiB (2 * 16 GiB SSD)	Moderate	\$0.105000 hourly	\$0.073000 hourly	\$0.188000 hourly	\$0.165000 hourly
R5A 24xlarge	r5a.24xlarge	768.0 GiB	96 vCPUs	EBS only	20 Gigabit	\$5.424000 hourly	\$3.423000 hourly	\$9.840000 hourly	\$7.839000 hourly
G3 16xlarge	g3.16xlarge	488.0 GiB	64 vCPUs	EBS only	20 Gigabit	\$4.560000 hourly	\$3.112200 hourly	\$7.504000 hourly	\$6.056200 hourly
A1 Double Extra Large	a1.2xlarge	16.0 GiB	8 vCPUs	EBS only	Up to 10 Gigabit	\$0.204000 hourly	\$0.128500 hourly	unavailable	unavailable
C4 High-CPU Extra Large	c4.xlarge	7.5 GIB	4 vCPUs	EBS only	High	\$0.199000 hourly	\$0.126000 hourly	\$0.383000 hourly	\$0.310000 hourly
X1E Quadruple Extra Large	x1e.4xlarge	488.0 GiB	16 vCPUs	480 GiB SSD	Up to 10 Gigabit	\$3.336000 hourly	\$2.056000 hourly	\$4.072000 hourly	\$2.792000 hourly
M5AD Extra Large	m5ad.xlarge	16.0 GIB	4 vCPUs	150 GiB NVMe SSD	Up to 10 Gigabit	\$0.206000 hourly	\$0.132000 hourly	\$0.390000 hourly	\$0.316000 hourly

4

EC2Instances.info Easy Amazon EC2 Instance Comparison

EC2 RDS



Based on your inputs, this is the lowest-cost EC2 instance: t4g.nano

Filter: Min Memory (GiB): 0	Min vCPUs: 0 Min Storag	ge (GiB): 0							
Name	API Name	Memory	vCPUs	Instance Storage	Network Performance	Linux On Demand cost	Linux Reserved cost	Windows On Demand cost	Windows Reserved co
							Search	Search	Search
							\$0.173000 hourly	\$0.456000 hourly	\$0.357000 hourly
							\$0.219000 hourly	\$0.712000 hourly	\$0.587000 hourly
Az	ure						\$2.253000 hourly	\$5.784000 hourly	\$4.461000 hourly
							\$0.166000 hourly	\$0.446000 hourly	\$0.350000 hourly
Select	1/8 4						\$0.188000 hourly	\$0.482000 hourly	\$0.372000 hourly
Select	a VIVI s	ize -	MAC				\$3.694000 hourly	\$7.632000 hourly	\$5.902000 hourly
		C					\$7.388000 hourly	\$15.264000 hourly	\$11.804000 hourly
		-					\$0.211000 hourly	\$0.518000 hourly	\$0.395000 hourly
							\$0.424000 hourly	\$0.973000 hourly	\$0.565000 hourly
							\$2.419000 hourly	\$6.752000 hourly	\$5.363000 hourly
				1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			\$0.007200 hourly	\$0.016200 hourly	\$0.011800 hourly
Q Searc	h by VM size	s E	C2 > I	nstance ty	pes		\$3.216000 hourly	\$6.198000 hourly	\$3.300000 hourly
, ocure							\$0.924000 hourly	\$1.908000 hourly	\$1.476000 hourly
							\$0.705000 hourly	\$1.668000 hourly	\$1.257000 hourly
		1					\$8.223000 hourly	\$16.288000 hourly	\$11.167000 hourly
Chausing 7	20 1/14	Cul					\$4.506000 hourly	\$11.568000 hourly	\$8.922000 hourly
Showing 7	28 VIVI	Sub		-			\$3.392000 hourly	\$7.782000 hourly	\$4.521000 hourly
			Insta	nce type	s (634)		\$1.141000 hourly	\$3.280000 hourly	\$2.613000 hourly
		_			100.1		\$0.257000 hourly	unavailable	unavailable
		0.1	- North Street of Street		and the second second		\$0.848000 hourly	\$1.946000 hourly	\$1.131000 hourly
Vhy is Ku	lbernet	es So l		Time	-		\$0.616000 hourly	\$1.272000 hourly	\$0.984000 hourly
			000	Time sp	ent		\$0.109000 hourly	\$0.356000 hourly	\$0.293000 hourly
Complica	ited?			arguing	about		\$2.088000 hourly	\$3.428000 hourly	\$2.456000 hourly
							\$0.230000 hourly	\$0.433200 hourly	\$0.292000 hourly
is Parlie Balances & Will				Kubern	etes features		\$1.272000 hourly	\$3.344000 hourly	\$2.744000 hourly
vis Smith, November 8, 2021							\$4.362000 hourly	\$11.328000 hourly	\$8.778000 hourly
og Kubernetes							\$1.847000 hourly	\$3.816000 hourly	\$2.951000 hourly
			10				\$1.344000 hourly	\$3.600000 hourly	\$2.816000 hourly
	ANT DE TRANSFER						\$0.057500 hourly	\$0.120800 hourly	\$0.085500 hourly
100 100 100 100 100 100 100 100 100 100	Contraction of the local division of the loc	C. F. Martin					\$4.110000 hourly	\$9.613000 hourly	\$7.054000 hourly
and the same	and the second second		78				\$1.751000 hourly	\$5.696000 hourly	\$4.695000 hourly
1400	29	- Land - La					\$3.810000 hourly	\$10.464000 hourly	\$8.226000 hourly
	and the second	ARCEL T	Time s	nent T	WICE		\$0.071000 hourly	\$0.205000 hourly	\$0.163000 hourly
100	A State of the sta	CARLE IN	the second se	and the second	THEE		\$0.073000 hourly	\$0.188000 hourly	\$0.165000 hourly
	NUM N	10 - 13 - 3 C	buildi	ng			\$3.423000 hourly	\$9.840000 hourly	\$7.839000 hourly
and the second se	State of State of State of State	Provide Street Street					\$3.112200 hourly	\$7.504000 hourly	\$6.056200 hourly
			server	ess app			\$0.128500 hourly	unavailable	unavailable
							\$0.126000 hourly	\$0.383000 hourly	\$0.310000 hourly
X1E Quadruple Extra Large	x1e.4xlarge	488	8.0 GiB 16 vCPUs	480	GiB SSD Up to 10 Gigabit	\$3.336000 hourly	\$2.056000 hourly	\$4.072000 hourly	\$2.792000 hourly
M5AD Extra Large	m5ad.xlarge	16	6.0 GiB 4 vCPUs	150 GIB N	/Me SSD Up to 10 Gigabit	\$0.206000 hourly	\$0.132000 hourly	\$0.390000 hourly	\$0.316000 hourly

Compare Selected Clear Filters CSV

Y. Cheng

UVA CS4740 Fall '24

https://instances.vantage.sh/

1. What type of instances?

EC2Instances.info Easy Amazon EC2 Instance Comparison

Region: US East (N. Virginia) -	Cost: Hourly - Reser	ved: 1-year - No Upfront - Co		d Clear Filters CSV
		torage (GiB): 0	Compare Selecte	
Name	API Name	Memory	vCPUs	Instance Storage
Search	Search	Search	Search	Search
M5DN Extra Large	m5dn.xlarge	16.0 G		150 GiB N
M5A Double Extra Large	m5a.2xlarge	32.0 G		100 010 1
R5N 12xlarge	r5n.12xlarge	384.0 G		
R5AD Extra Large	r5ad.xlarge	32.0 G		150 GiB N
R5N Extra Large	r5n.xlarge	32.0 G		100 010 11
I3EN 12xlarge	i3en.12xlarge	384.0 G		30000 GiB (4 * 7500 GiB N
I3EN Metal	i3en.metal	768.0 G		60000 GiB (8 * 7500 GiB N
R5DN Extra Large	r5dn.xlarge	32.0 G		150 GiB N
12 Extra Large	i2.xlarge	30.5 G		800
M5N 16xlarge	m5n.16xlarge	256.0 G		
T2 Micro	t2.micro	1.0 G		
D2 Eight Extra Large	d2.8xlarge	244.0 G		48000 GiB (24 * 2000
I3EN 3xlarge	i3en.3xlarge	96.0 G		7500 GiB N
Z1D 3xlarge	z1d.3xlarge	96.0 G		450 GiB N
X1E 16xlarge	x1e.16xlarge	1952.0 G		1920
R5N 24xlarge	r5n.24xlarge	768.0 G	iB 96 vCPUs	
12 Eight Extra Large	i2.8xlarge	244.0 G	iB 32 vCPUs	6400 GiB (8 * 800
R5A Eight Extra Large	r5a.8xlarge	256.0 G	iB 32 vCPUs	
A1 Metal	a1.metal	32.0 G		
12 Double Extra Large	i2.2xlarge	61.0 G	iB 8 vCPUs	1600 GiB (2 * 800
I3EN Double Extra Large	i3en.2xlarge	64.0 G	iB 8 vCPUs	5000 GiB (2 * 2500 GiB N
M5A Extra Large	m5a.xlarge	16.0 G	iB 4 vCPUs	
P3 Double Extra Large	p3.2xlarge	61.0 G	iB 8 vCPUs	
T2 Double Extra Large	t2.2xlarge	32.0 G	iB 8 vCPUs for a 4h 4.8m burst	
H1 Eight Extra Large	h1.8xlarge	128.0 G	iB 32 vCPUs	8000 GiB (4 * 2000
R5D 24xlarge	r5d.24xlarge	768.0 G	iB 96 vCPUs	3600 GiB (4 * 900 GiB N
I3EN 6xlarge	i3en.6xlarge	192.0 G	iB 24 vCPUs	15000 GiB (2 * 7500 GiB N
R4 High-Memory Eight Extra Large	r4.8xlarge	244.0 G	iB 32 vCPUs	
T2 Large	t2.large	8.0 G	iB 2 vCPUs for a 7h 12m burst	
X1 Extra High-Memory 16xlarge	x1.16xlarge	976.0 G		1920
M5A 16xlarge	m5a.16xlarge	256.0 G	iB 64 vCPUs	
R5 Metal	r5.metal	768.0 G	iB 96 vCPUs	
R5A Large	r5a.large	16.0 G	iB 2 vCPUs	
C3 High-CPU Large	c3.large	3.75 G	iB 2 vCPUs	32 GIB (2 * 16
R5A 24xlarge	r5a.24xlarge	768.0 G	iB 96 vCPUs	
G3 16xlarge	g3.16xlarge	488.0 G	iB 64 vCPUs	
A1 Double Extra Large	a1.2xlarge	16.0 G	iB 8 vCPUs	
C4 High-CPU Extra Large	c4.xlarge	7.5 G	iB 4 vCPUs	
X1E Quadruple Extra Large	x1e.4xlarge	488.0 G	iB 16 vCPUs	480
M5AD Extra Large	m5ad_xlarge	16.0 G	iB 4 vCPUs	150 GiB N

- 1. What type of instances?
- 2. How many to spin up?

EC2Instances.info	Easy Amazon	EC2 Instance	Comparison
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Region: US East (N. Virginia) -	Cost: Hourly - Reserv	ed: 1-year - No Upfront - Colu	mns - Compare Selecte	d Clear Filters CSV
		orage (GiB): 0		
Name	API Name	Memory 0	vCPUs	Instance Storage
Search	Search	Search	Search	Search
M5DN Extra Large	m5dn.xlarge	16.0 GiB	4 vCPUs	150 GiB N
M5A Double Extra Large	m5a.2xlarge	32.0 GiB	8 vCPUs	
R5N 12xlarge	r5n.12xlarge	384.0 GiB	48 vCPUs	
R5AD Extra Large	r5ad.xlarge	32.0 GiB	4 vCPUs	150 GiB N
R5N Extra Large	r5n.xlarge	32.0 GiB	4 vCPUs	
I3EN 12xlarge	i3en.12xlarge	384.0 GiB	48 vCPUs	30000 GiB (4 * 7500 GiB N
I3EN Metal	i3en.metal	768.0 GiB	96 vCPUs	60000 GiB (8 * 7500 GiB N
R5DN Extra Large	r5dn.xlarge	32.0 GiB	4 vCPUs	150 GiB N
I2 Extra Large	i2.xlarge	30.5 GiB	4 vCPUs	800
M5N 16xlarge	m5n.16xlarge	256.0 GIB	64 vCPUs	
T2 Micro	t2.micro	1.0 GIB	1 vCPUs for a 2h 24m burst	
D2 Eight Extra Large	d2.8xlarge	244.0 GiB	36 vCPUs	48000 GiB (24 * 2000
I3EN 3xlarge	i3en.3xlarge	96.0 GiB	12 vCPUs	7500 GiB N
Z1D 3xlarge	z1d.3xlarge	96.0 GiB	12 vCPUs	450 GiB N
X1E 16xlarge	x1e.16xlarge	1952.0 GIB	64 vCPUs	1920
R5N 24xiarge	r5n.24xlarge	768.0 GiB	96 vCPUs	
I2 Eight Extra Large	i2.8xlarge	244.0 GiB	32 vCPUs	6400 GiB (8 * 800
R5A Eight Extra Large	r5a.8xlarge	256.0 GiB	32 vCPUs	
A1 Metal	a1.metal	32.0 GiB	16 vCPUs	
12 Double Extra Large	i2.2xlarge	61.0 GiB	8 vCPUs	1600 GiB (2 * 800
I3EN Double Extra Large	i3en.2xlarge	64.0 GiB	8 vCPUs	5000 GiB (2 * 2500 GiB N
M5A Extra Large	m5a.xlarge	16.0 GIB	4 vCPUs	
P3 Double Extra Large	p3.2xlarge	61.0 GiB	8 vCPUs	
T2 Double Extra Large	t2.2xlarge	32.0 GiB	8 vCPUs for a 4h 4.8m burst	
H1 Eight Extra Large	h1.8xlarge	128.0 GIB	32 vCPUs	8000 GiB (4 * 2000
R5D 24xlarge	r5d.24xlarge	768.0 GIB	96 vCPUs	3600 GIB (4 * 900 GIB N
I3EN 6xlarge	i3en.6xlarge	192.0 GiB	24 vCPUs	15000 GIB (2 * 7500 GIB N
R4 High-Memory Eight Extra Large	r4.8xlarge	244.0 GiB	32 vCPUs	
T2 Large	t2.large	8.0 GIB	2 vCPUs for a 7h 12m burst	
X1 Extra High-Memory 16xlarge	x1.16xlarge	976.0 GIB	64 vCPUs	1920
M5A 16xlarge	m5a.16xlarge	256.0 GiB	64 vCPUs	
R5 Metal	r5.metal	768.0 GiB	96 vCPUs	
R5A Large	r5a.large	16.0 GiB	2 vCPUs	
C3 High-CPU Large	c3.large	3.75 GiB	2 vCPUs	32 GiB (2 * 16
R5A 24xlarge	r5a.24xlarge	768.0 GiB	96 vCPUs	
G3 16xlarge	g3.16xlarge	488.0 GiB	64 vCPUs	
A1 Double Extra Large	a1.2xlarge	16.0 GiB	8 vCPUs	
C4 High-CPU Extra Large	c4.xlarge	7.5 GIB	4 vCPUs	
X1E Quadruple Extra Large	x1e.4xlarge	488.0 GiB	16 vCPUs	480
M5AD Extra Large	m5ad.xlarge	16.0 GIB	4 vCPUs	150 GiB N

- 1. What type of instances?
- 2. How many to spin up?
- 3. What base image?

EC2Instances.info Easy Amazon EC2 Instance Comparison

EC2 RDS

Region: US East (N. Virginia) -	Cost: Hourly -	Reserved: 1-y	ear - No Upfront -	Colur	nns - Compare Selected	d Clear Filters CS
Filter: Min Memory (GiB): 0 M	lin vCPUs: 0	Min Storage (G	iiB): 0			
Name	API Name		Memory		vCPUs	Instance Storage
Search	Search		Search		Search	Search
M5DN Extra Large	m5dn.xlarge	Ð	16.	0 GiB	4 vCPUs	150 GiB
M5A Double Extra Large	m5a.2xlarge		32.	0 GiB	8 vCPUs	
R5N 12xlarge	r5n.12xlarge	Ð	384.	0 GiB	48 vCPUs	
R5AD Extra Large	r5ad.xlarge		32.	0 GiB	4 vCPUs	150 GiB
R5N Extra Large	r5n.xlarge		32.	0 GiB	4 vCPUs	
I3EN 12xlarge	i3en.12xlarg	je	384.	0 GiB	48 vCPUs	30000 GiB (4 * 7500 GiB M
I3EN Metal	i3en.metal		768.	0 GiB	96 vCPUs	60000 GiB (8 * 7500 GiB M
R5DN Extra Large	r5dn.xlarge		32.	0 GiB	4 vCPUs	150 GiB
12 Extra Large	i2.xlarge		30.	5 GiB	4 vCPUs	80
M5N 16xlarge	m5n.16xlarg	ge	256.	0 GiB	64 vCPUs	
T2 Micro	t2.micro		1.	0 GiB	1 vCPUs for a 2h 24m burst	
D2 Eight Extra Large	d2.8xlarge		244.	0 GiB	36 vCPUs	48000 GiB (24 * 200
I3EN 3xlarge	i3en.3xlarge	•	96.	0 GiB	12 vCPUs	7500 GiB
Z1D 3xlarge	z1d.3xlarge		96.	0 GiB	12 vCPUs	450 GiB
X1E 16xlarge	x1e.16xlarg	e	1952.	0 GiB	64 vCPUs	192
R5N 24xlarge	r5n.24xlarge	Ð	768.	.0 GiB	96 vCPUs	
12 Eight Extra Large	i2.8xlarge		244.	0 GiB	32 vCPUs	6400 GiB (8 * 80
R5A Eight Extra Large	r5a.8xlarge		256.	0 GiB	32 vCPUs	
A1 Metal	a1.metal		32.	0 GiB	16 vCPUs	
12 Double Extra Large	i2.2xlarge		61.	0 GiB	8 vCPUs	1600 GiB (2 * 80
I3EN Double Extra Large	i3en.2xlarge	•	64.	0 GiB	8 vCPUs	5000 GiB (2 * 2500 GiB M
M5A Extra Large	m5a_xlarge		16.	0 GiB	4 vCPUs	
P3 Double Extra Large	p3.2xlarge		61.	0 GiB	8 vCPUs	
T2 Double Extra Large	t2.2xlarge		32.	0 GiB	8 vCPUs for a 4h 4.8m burst	
H1 Eight Extra Large	h1.8xlarge		128.	0 GiB	32 vCPUs	8000 GiB (4 * 200
R5D 24xlarge	r5d.24xlarg	e	768.	0 GiB	96 vCPUs	3600 GiB (4 * 900 GiB M
I3EN 6xlarge	i3en.6xlarge	,	192.	0 GiB	24 vCPUs	15000 GiB (2 * 7500 GiB M
R4 High-Memory Eight Extra Large	r4.8xlarge		244.	0 GiB	32 vCPUs	
T2 Large	t2.large		8.	0 GiB	2 vCPUs for a 7h 12m burst	
X1 Extra High-Memory 16xlarge	x1.16xlarge		976.	0 GiB	64 vCPUs	192
M5A 16xlarge	m5a.16xlarg	je	256.	0 GiB	64 vCPUs	
R5 Metal	r5.metal		768.	0 GiB	96 vCPUs	
R5A Large	r5a.large		16.	0 GiB	2 vCPUs	
C3 High-CPU Large	c3.large		3.7	5 GiB	2 vCPUs	32 GiB (2 * 1
R5A 24xlarge	r5a.24xlarge	Ð	768.	0 GiB	96 vCPUs	
G3 16xlarge	g3.16xlarge		488.	0 GiB	64 vCPUs	
A1 Double Extra Large	a1.2xlarge		16.	0 GiB	8 vCPUs	
C4 High-CPU Extra Large	c4.xlarge		7.	5 GiB	4 vCPUs	
X1E Quadruple Extra Large	x1e.4xlarge		488.	0 GiB	16 vCPUs	48
M5AD Extra Large	m5ad.xlarge	9	16.	0 GiB	4 vCPUs	150 GiB

- 1. What type of instances?
- 2. How many to spin up?
- 3. What base image?
- 4. On-demand or spot?

EC2Instances.info	asy Amazon EC2 Instance Comparison
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EC2 RDS

Region: US East (N. Virginia) - Cos	t: Hourly - Reserved: 1	-year - No Upfront - Colu	mns - Compare Selecte	d Clear Filters CS
Filter: Min Memory (GiB): 0 Min vC	CPUs: 0 Min Storage	(GiB): 0		
Name	API Name	Memory 0	vCPUs	Instance Storage
Search	Search	Search	Search	Search
M5DN Extra Large	m5dn.xlarge	16.0 GiB	4 vCPUs	150 GiB
M5A Double Extra Large	m5a.2xlarge	32.0 GiB	8 vCPUs	
R5N 12xlarge	r5n.12xlarge	384.0 GIB	48 vCPUs	
R5AD Extra Large	r5ad.xlarge	32.0 GIB	4 vCPUs	150 GiB
R5N Extra Large	r5n.xlarge	32.0 GIB	4 vCPUs	
I3EN 12xlarge	i3en.12xlarge	384.0 GIB	48 vCPUs	30000 GiB (4 * 7500 GiB M
I3EN Metal	i3en.metal	768.0 GiB	96 vCPUs	60000 GiB (8 * 7500 GiB
R5DN Extra Large	r5dn.xlarge	32.0 GiB	4 vCPUs	150 GiB
12 Extra Large	i2.xlarge	30.5 GiB	4 vCPUs	80
M5N 16xlarge	m5n.16xlarge	256.0 GiB	64 vCPUs	
T2 Micro	t2.micro	1.0 GIB	1 vCPUs for a 2h 24m burst	
D2 Eight Extra Large	d2.8xlarge	244.0 GiB	36 vCPUs	48000 GiB (24 * 200
I3EN 3xlarge	i3en.3xlarge	96.0 GIB	12 vCPUs	7500 GiB
Z1D 3xlarge	z1d.3xlarge	96.0 GIB	12 vCPUs	450 GiB
X1E 16xlarge	x1e.16xlarge	1952.0 GIB	64 vCPUs	192
R5N 24xlarge	r5n.24xlarge	768.0 GiB	96 vCPUs	
I2 Eight Extra Large	i2.8xlarge	244.0 GiB	32 vCPUs	6400 GiB (8 * 80
R5A Eight Extra Large	r5a.8xlarge	256.0 GIB	32 vCPUs	
A1 Metal	a1.metal	32.0 GiB	16 vCPUs	
12 Double Extra Large	i2.2xlarge	61.0 GIB	8 vCPUs	1600 GiB (2 * 80
I3EN Double Extra Large	i3en.2xlarge	64.0 GIB	8 vCPUs	5000 GiB (2 * 2500 GiB
M5A Extra Large	m5a_xlarge	16.0 GIB	4 vCPUs	
P3 Double Extra Large	p3.2xlarge	61.0 GIB	8 vCPUs	
T2 Double Extra Large	t2.2xlarge	32.0 GIB	8 vCPUs for a 4h 4.8m burst	
H1 Eight Extra Large	h1.8xlarge	128.0 GIB	32 vCPUs	8000 GiB (4 * 200
R5D 24xlarge	r5d.24xlarge	768.0 GIB	96 vCPUs	3600 GiB (4 * 900 GiB
I3EN 6xlarge	i3en.6xlarge	192.0 GiB	24 vCPUs	15000 GIB (2 * 7500 GIB
R4 High-Memory Eight Extra Large	r4.8xlarge	244.0 GiB	32 vCPUs	
T2 Large	t2.large	8.0 GIB	2 vCPUs for a 7h 12m burst	
X1 Extra High-Memory 16xlarge	x1.16xlarge	976.0 GIB	64 vCPUs	192
M5A 16xlarge	m5a.16xlarge	256.0 GIB	64 vCPUs	
R5 Metal	r5.metal	768.0 GIB	96 vCPUs	
R5A Large	r5a.large	16.0 GIB	2 vCPUs	
C3 High-CPU Large	c3.large	3.75 GiB	2 vCPUs	32 GiB (2 * 1
R5A 24xlarge	r5a.24xlarge	768.0 GiB	96 vCPUs	
G3 16xlarge	g3.16xlarge	488.0 GiB	64 vCPUs	
A1 Double Extra Large	a1.2xlarge	16.0 GIB	8 vCPUs	
C4 High-CPU Extra Large	c4.xlarge	7.5 GIB	4 vCPUs	
X1E Quadruple Extra Large	x1e.4xlarge	488.0 GIB	16 vCPUs	48
M5AD Extra Large	m5ad.xlarge	16.0 GIB	4 vCPUs	150 GiB

- 1. What type of instances?
- 2. How many to spin up?
- 3. What base image?
- 4. On-demand or spot?
- 5. What storage service to use?

EC2Instances.info	Easy Amazon EC2 Instance Comparison
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EC2 RDS

Region: US East (N. Virginia) -	Cost: Hourly -	Reserved: 1-y	rear - No Upfront -	Colur	nns - Compare Selecte	d Clear Filters CS
Filter: Min Memory (GiB): 0	Min vCPUs: 0	Min Storage (GiB): 0			
Name	API Nar	ne	Memory		vCPUs	Instance Storage
Search	Search		Search		Search	Search
M5DN Extra Large	m5dn.xla	arge	16.0	0 GiB	4 vCPUs	150 GiB I
M5A Double Extra Large	m5a.2xla	irge	32.0	0 GiB	8 vCPUs	
R5N 12xlarge	r5n.12xia	arge	384.0	0 GiB	48 vCPUs	
R5AD Extra Large	r5ad.xlar	ge	32.0	0 GiB	4 vCPUs	150 GIB I
R5N Extra Large	r5n.xlarg	e	32.0	0 GiB	4 vCPUs	
I3EN 12xlarge	i3en.12x	large	384.0	0 GiB	48 vCPUs	30000 GiB (4 * 7500 GiB M
I3EN Metal	i3en.met	al	768.0	0 GiB	96 vCPUs	60000 GiB (8 * 7500 GiB M
R5DN Extra Large	r5dn.xlar	ge	32.0	0 GiB	4 vCPUs	150 GiB I
12 Extra Large	i2.xlarge		30.5	5 GiB	4 vCPUs	80
M5N 16xlarge	m5n.16x	large	256.0	0 GiB	64 vCPUs	
T2 Micro	t2.micro		1.0	0 GiB	1 vCPUs for a 2h 24m burst	
D2 Eight Extra Large	d2.8xlarg	je	244.0	0 GiB	36 vCPUs	48000 GiB (24 * 2000
I3EN 3xlarge	i3en.3xla	irge	96.0	0 GiB	12 vCPUs	7500 GiB I
Z1D 3xlarge	z1d.3xla	rge	96.0	0 GiB	12 vCPUs	450 GIB 1
X1E 16xlarge	x1e.16x	arge	1952.0	0 GiB	64 vCPUs	192
R5N 24xlarge	r5n.24xk	irge	768.0	0 GiB	96 vCPUs	
I2 Eight Extra Large	i2.8xlarg	e	244.0	0 GiB	32 vCPUs	6400 GiB (8 * 80
R5A Eight Extra Large	r5a.8xlar	ge	256.0	0 GiB	32 vCPUs	
A1 Metal	a1.metal		32.0	0 GiB	16 vCPUs	
12 Double Extra Large	i2.2xlarg	e	61.0	0 GiB	8 vCPUs	1600 GiB (2 * 80
I3EN Double Extra Large	i3en.2xla	irge	64.0	0 GiB	8 vCPUs	5000 GiB (2 * 2500 GiB N
M5A Extra Large	m5a.xlar	ge	16.0	0 GiB	4 vCPUs	
P3 Double Extra Large	p3.2xlarg	je	61.0	0 GiB	8 vCPUs	
T2 Double Extra Large	t2.2xlarg	e	32.0	0 GiB	8 vCPUs for a 4h 4.8m burst	
H1 Eight Extra Large	h1.8xlarg	je	128.0		32 vCPUs	8000 GiB (4 * 2000
R5D 24xlarge	r5d.24xk	nde	768.0	0 GiB	96 vCPUs	3600 GIB (4 * 900 GIB N
I3EN 6xlarge	i3en.6xla	irge	192.0	0 GiB	24 vCPUs	15000 GiB (2 * 7500 GiB N
R4 High-Memory Eight Extra Larg	e r4.8xlarg	e	244.0	0 GiB	32 vCPUs	
T2 Large	t2.large		8.0	0 GiB	2 vCPUs for a 7h 12m burst	
X1 Extra High-Memory 16xlarge	x1.16xla	rge	976.0	0 GiB	64 vCPUs	192
M5A 16xlarge	m5a.16x	large	256.0	0 GiB	64 vCPUs	
R5 Metal	r5.metal		768.0	0 GiB	96 vCPUs	
R5A Large	r5a.large		16.0	0 GiB	2 vCPUs	
C3 High-CPU Large	c3.large		3.7	5 GiB	2 vCPUs	32 GIB (2 * 1
R5A 24xlarge	r5a.24xla	arge	768.0	0 GiB	96 vCPUs	
G3 16xlarge	g3.16xla	rge	488.0	0 GiB	64 vCPUs	
A1 Double Extra Large	a1.2xlarg	je	16.0	0 GiB	8 vCPUs	
C4 High-CPU Extra Large	c4.xlarge	,	7.5	5 GiB	4 vCPUs	
X1E Quadruple Extra Large	x1e.4xla	rge	488.0	0 GiB	16 vCPUs	48
M5AD Extra Large	m5ad.xla		16.0	0 GiB	4 vCPUs	150 GiB
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- 1. What type of instances?
- 2. How many to spin up?
- 3. What base image?
- 4. On-demand or spot?
- 5. What storage service to use?
- 6. And then wait to start...

EC2Instances.info Easy Amazon EC2 Instance Comparison

Region: US East (N. Virginia) -	Cost: Hourly - Re	served: 1-year - No Upfront -	Columns -	Compare Selected	d Clear Filters CS
Filter: Min Memory (GiB): 0 N	Ain vCPUs: 0 Mir	n Storage (GiB): 0			
Name	API Name	Memory	VCP	Us é	Instance Storage
Search	Search	Search	Sea	arch	Search
M5DN Extra Large	m5dn.xlarge		16.0 GiB 4 vC	PUs	150 GiB M
M5A Double Extra Large	m5a.2xlarge		32.0 GiB 8 vC	PUs	
R5N 12xlarge	r5n.12xlarge	3	184.0 GiB 48 vi	CPUs	
R5AD Extra Large	r5ad.xlarge		32.0 GiB 4 vC	PUs	150 GiB M
R5N Extra Large	r5n.xlarge		32.0 GiB 4 vC	PUs	
I3EN 12xlarge	i3en.12xlarge	3	184.0 GiB 48 vi	CPUs	30000 GiB (4 * 7500 GiB N
I3EN Metal	i3en.metal	7	68.0 GiB 96 v	CPUs	60000 GiB (8 * 7500 GiB N
R5DN Extra Large	r5dn.xlarge		32.0 GiB 4 vC	PUs	150 GIB M
I2 Extra Large	i2.xlarge		30.5 GiB 4 vC	PUs	80
M5N 16xlarge	m5n.16xlarge	2	56.0 GiB 64 v	CPUs	
T2 Micro	t2.micro		1.0 GiB 1 vC	PUs for a 2h 24m burst	
D2 Eight Extra Large	d2.8xlarge	2	44.0 GiB 36 vi	CPUs	48000 GiB (24 * 2000
I3EN 3xlarge	i3en.3xlarge		96.0 GiB 12 v	CPUs	7500 GIB M
Z1D 3xlarge	z1d.3xlarge		96.0 GiB 12 vi	CPUs	450 GiB M
X1E 16xlarge	x1e.16xlarge	19	152.0 GiB 64 vi	CPUs	192
R5N 24xlarge	r5n.24xlarge	7	68.0 GiB 96 vi	CPUs	
12 Eight Extra Large	i2.8xlarge	2	44.0 GiB 32 vi	CPUs	6400 GiB (8 * 800
R5A Eight Extra Large	r5a.8xlarge	1	56.0 GiB 32 vi	CPUs	
A1 Metal	a1.metal		32.0 GiB 16 v	CPUs	
12 Double Extra Large	i2.2xlarge		61.0 GiB 8 vC		1600 GiB (2 * 800
I3EN Double Extra Large	i3en.2xlarge		64.0 GiB 8 vC	PUs	5000 GIB (2 * 2500 GIB N
M5A Extra Large	m5a_xlarge		16.0 GiB 4 vC	PUs	
P3 Double Extra Large	p3.2xlarge		61.0 GiB 8 vC	PUs	
T2 Double Extra Large	t2.2xlarge		32.0 GiB 8 vC	PUs for a 4h 4.8m burst	
H1 Eight Extra Large	h1.8xlarge	1		CPUs	8000 GiB (4 * 2000
R5D 24xiarge	r5d.24xlarge	7	68.0 GiB 96 v	CPUs	3600 GiB (4 * 900 GiB N
I3EN 6xlarge	i3en.6xlarge	1	92.0 GiB 24 v	CPUs	15000 GiB (2 * 7500 GiB N
R4 High-Memory Eight Extra Large	r4.8xlarge	2	44.0 GiB 32 vi	CPUs	
T2 Large	t2.large		8.0 GiB 2 vC	PUs for a 7h 12m burst	
X1 Extra High-Memory 16xlarge	x1.16xlarge	6	76.0 GiB 64 vi	CPUs	192
M5A 16xlarge	m5a.16xlarge	2	56.0 GiB 64 vi	CPUs	
R5 Metal	r5.metal	7	768.0 GiB 96 vi	CPUs	
R5A Large	r5a.large		16.0 GiB 2 vC	PUs	
C3 High-CPU Large	c3.large		3.75 GiB 2 vC	PUs	32 GiB (2 * 16
R5A 24xlarge	r5a.24xlarge	7	68.0 GiB 96 vi	CPUs	
G3 16xlarge	g3.16xlarge	4	188.0 GiB 64 vi	CPUs	
A1 Double Extra Large	a1.2xlarge		16.0 GiB 8 vC	PUs	
C4 High-CPU Extra Large	c4.xlarge		7.5 GiB 4 vC	PUs	
X1E Quadruple Extra Large	x1e.4xlarge	4	188.0 GiB 16 vi	CPUs	48
M5AD Extra Large	m5ad.xlarge		16.0 GiB 4 vC	PUs	150 GiB M

- 1. What type of instances?
- 2. How many to spin up?
- 3. What base image?
- 4. On-demand or spot?
- 5. What storage service to use?
- 6. And then wait to start...
- 7. Not the end of the horror story:
 - 1. When to scale out?
 - 2. When to scale in?
 - 3. When to switch to different instance types?

EC2Instances.info Easy Amazon EC2 Instance Comparison

	st: Hourly - Reserved: CPUs: 0 Min Storag	1-year - No Upfront - Colu	mns - Compare Selecter	d Clear Filters C
Name	API Name	Memory	vCPUs	Instance Storage
Search	Search	Search	Search	Search
M5DN Extra Large	m5dn.xlarge	16.0 GiB		150 GiB
MSDN Extra Large	m5a.2xlarge	32.0 GIB	8 vCPUs	150 GIB
R5N 12xlarge	r5n.12xlarge	384.0 GIB	48 vCPUs	
R5AD Extra Large	r5ad.xlarge	32.0 GIB	4 vCPUs	150 GiB
R5N Extra Large	r5n.xlarge	32.0 GIB	4 vCPUs	100 010
I3EN 12xlarge	i3en.12xlarge	384.0 GiB	48 vCPUs	30000 GiB (4 * 7500 GiB
I3EN Metal	i3en.metal	768.0 GiB	96 vCPUs	60000 GiB (8 * 7500 GiB
R5DN Extra Large	r5dn.xlarge	32.0 GiB	4 vCPUs	150 GiB
12 Extra Large	i2.xlarge	30.5 GiB	4 vCPUs	8
M5N 16xlarge	m5n.16xlarge	256.0 GiB	64 vCPUs	
T2 Micro	t2.micro	1.0 GiB	1 vCPUs for a 2h 24m burst	
D2 Eight Extra Large	d2.8xlarge	244.0 GiB	36 vCPUs	48000 GiB (24 * 200
I3EN 3xlarge	i3en.3xlarge	96.0 GIB	12 vCPUs	7500 GIB
Z1D 3xlarge	z1d.3xlarge	96.0 GIB	12 vCPUs	450 GiB
X1E 16xlarge	x1e.16xlarge			19
R5N 24xiarge	r5n.24xlarge	768.0 GiB	96 vCPUs	
12 Eight Extra Large	i2.8xlarge	244.0 GiB	32 vCPUs	6400 GiB (8 * 8
R5A Eight Extra Large	r5a.8xlarge	256.0 GiB	32 vCPUs	
A1 Metal	a1.metal	32.0 GiB	16 vCPUs	
12 Double Extra Large	i2.2xlarge	61.0 GiB	8 vCPUs	1600 GiB (2 * 8
I3EN Double Extra Large	i3en.2xlarge	64.0 GiB	8 vCPUs	5000 GiB (2 * 2500 GiB
M5A Extra Large	m5a.xlarge	16.0 GiB	4 vCPUs	
P3 Double Extra Large	p3.2xlarge	61.0 GIB	8 vCPUs	
T2 Double Extra Large	t2.2xlarge	32.0 GIB	8 vCPUs for a 4h 4.8m burst	
H1 Eight Extra Large	h1.8xlarge	128.0 GiB	32 vCPUs	8000 GiB (4 * 200
R5D 24xlarge	r5d.24xlarge	768.0 GiB	96 vCPUs	3600 GiB (4 * 900 GiB
I3EN 6xlarge	i3en.6xlarge	192.0 GiB	24 vCPUs	15000 GiB (2 * 7500 GiB
R4 High-Memory Eight Extra Large	r4.8xlarge	244.0 GiB	32 vCPUs	
T2 Large	t2.large	8.0 GiB	2 vCPUs for a 7h 12m burst	
X1 Extra High-Memory 16xlarge	x1.16xlarge	976.0 GiB	64 vCPUs	19
M5A 16xiarge	m5a.16xlarge	256.0 GiB	64 vCPUs	
R5 Metal	r5.metal	768.0 GiB	96 vCPUs	
R5A Large	r5a.large	16.0 GiB	2 vCPUs	
C3 High-CPU Large	c3.large	3.75 GiB	2 vCPUs	32 GiB (2 *
R5A 24xlarge	r5a.24xlarge	768.0 GiB	96 vCPUs	
G3 16xlarge	g3.16xlarge	488.0 GiB	64 vCPUs	
A1 Double Extra Large	a1.2xlarge	16.0 GiB	8 vCPUs	
C4 High-CPU Extra Large	c4.xlarge	7.5 GIB	4 vCPUs	
X1E Quadruple Extra Large	x1e.4xlarge	488.0 GiB	16 vCPUs	4
M5AD Extra Large	m5ad.xlarge	16.0 GiB	4 vCPUs	150 GiE

- 1. What type of instances?
 - 2. How many to spin up?
 - 3. What base image?
 - 4. On-demand or spot?
 - 5. What storage service to use?
 - 6. And then wait to start...
 - 7. Not the end of the horror story:
 - 1. When to scale out?
 - 2. When to scale in?
 - 3. When to switch to different instance types?
 - 8. Go back to Step 1...

EC2Instances.info Easy Amazon EC2 Instance Comparison

Barter Manager Barter in an antional sector Barter in antional sector Barter in antional sector Name Barter in antional sector Barter in antional sector Barter in antional sector Manager in antional sector Maxima in antional sector Barter in antional sector Barter in antional sector Maxima in antional sector Maxima in antional sector Barter in antional sector Barter in antional sector Maxima in antional sector Maxima in antional sector Barter in antional sector Barter in antional sector Barter in antional sector Maxima in antional sector Barter in antional sector Barter in antional sector Barter in antional sector Barter in antional sector Barter in antional sector Barter in antional sector Barter in antional sector Barter in antional sector Barter in antional sector Barter in antional sector Barter in antional sector Barter in antional sector Barter in antional sector Barter in antional sector Barter in antional sector Barter in antional sector Barter in antional sector Barter in antional sector Barter in antional sector Barter in antional sector Barter in antionantin antional sector Barter in antion	Region: US East (N. Virginia)	- Cost: Hourly	/ - Reserved: 1-y	ear - No Upfront - Colu	mns - Compare Selecter	d Clear Filters CS
SearchSearc	Filter: Min Memory (GiB): 0	Min vCPUs:	0 Min Storage (0	BiB): 0		
NomeNomeNomeNomeNomeMSDN Extra Largem6da.xlarge84 CPUs1150 GBMSA Double Extra Largerfn.t.Xlarge323.04844 CPUsRSN Extra Largerfn.t.Xlarge334.04844 CPUsRSN Extra Largerfn.t.Klarge323.04844 CPUsRSN Extra Largerfdn.t.Marge323.04844 CPUsRSN Extra Largerfdn.t.Marge325.04844 CPUsRSN Extra Largerfdn.t.Marge326.04844 CPUsRSN Extra Largerfdn.t.Marge224.04854 CPUsRSN Extra Largerfd.t.Marge244.04854 CPUsRSN Extra Largerfd.t.Marge778.04824 CPUsRSN Extra Largerfd.t.Marge778.04824 CPUsZEight Extra Largerfd.t.Marge778.04824 CPUsRSN Extra Largerfd.t.Marge778.04824 CPUsRSN Extra Largerfd.t.Marge24 CPUs100 CBE 2* 200 CBERSN Extra Largerfd.t.Marge24 CPUs100 CBE 2* 200 CBERSN Extra Largerfd.t.Marge24 CPUs100 CBE 2* 200 CBERSN Extra Largerfd.t.Marge24 CPUs24 CPUsRSN Extra Largerfd.t.Marge24 CPUs24 CPUsRSN Extra Largerfd.t.M	Name	. API N	lame 👋	Memory	vCPUs	Instance Storage
Max Double Erra LargeMax DoubleMax Double Erra LargeMax Double Erra LargeM	Search	Sear	rch	Search	Search	Search
RN 12xargein.12xarge3.44.0.0044.VPUsInterpretRSA Exta LargeGas.Xarge3.20.0004.VPUs1.90.000RSN MetalGan.12dage3.40.0004.VPUs0000.00.00.00.00.00.00.00.00.00.00.00.0	M5DN Extra Large	m5dn	.xlarge	16.0 GiB	4 vCPUs	150 GiB
BAD Evra Large deal.xinge L.2.0.00 4 VCPUs 1.1.0.0.00 RND Evra Large do.xinge 3.2.0.000 4 VCPUs 3.0000.000.000.000.000.000.000.000.000.	M5A Double Extra Large	m5a.2	xlarge	32.0 GiB	8 vCPUs	
RN Extra Large rinx.varge rinx.varge rinx.varge rinx.varge BNE Nata Large Gen. Natal G. 20.0.08 4V-PUs 0000 GB (# 7500 GB 1) BNE Nata Large Gen. Natal G. 20.0.08 4V-PUs 0000 GB (# 7500 GB 1) RSD Extra Large Gen. Natarge G. 30.0.5.08 4V-PUs 0.000 GB (# 7500 GB 1) RSD Extra Large G. Alarge G. 30.0.5.08 4V-PUs 0.000 GB (# 7500 GB 1) T2 Moro Extra Large G. 20.0.68 4V-PUs 0.000 GB (# 7500 GB 1) T2 Moro Extra Large G. 20.0.68 6V-PUs 0.000 GB (# 7500 GB 1) T2 Moro Extra Large G. 20.0.0.68 12 CVPUs 0.000 GB (# 7500 GB 1) T2 Moro Extra Large G. 20.0.0.68 12 CVPUs 0.000 GB (# 7500 GB 1) T2 Datalage G. 0.0.68 12 CVPUs 0.0.0.0.8 10.0.0.0.8 T2 Datalage G. 0.0.68 12 CVPUs 0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.	R5N 12xlarge	r5n.12	xlarge	384.0 GiB	48 vCPUs	
Ban Tolunge Ban Tolunge Ban Aug Ban Colunge Ban Aug Ban Aug <td>R5AD Extra Large</td> <td>r5ad.)</td> <td>darge</td> <td>32.0 GiB</td> <td>4 vCPUs</td> <td>150 GiB</td>	R5AD Extra Large	r5ad.)	darge	32.0 GiB	4 vCPUs	150 GiB
Bar. Metal Bes. metal T86.0 GB 96 VCPUs 60000 GB (§ 7:500 GB / 150 GB) R5DN Extra Large fidn.xlarge 3.2.0 GB 4 VCPUs 150 GB) R5DN Extra Large fidn.xlarge 3.0.5 GB 4 VCPUs 150 GB) R5DN Extra Large fidn.xlarge 3.0.5 GB 4 VCPUs 6.0.6 B R5N Metal fidn.starge 3.0.5 GB 4 VCPUs 6.0.6 B R5N Metal GExtra Large G.2.80 GB 24 VCPUs 4.000 GB (24 200 GB) SEN Metal Gas.0.5 GB 24 VCPUs 4.000 GB (24 200 GB) 3.0.0 GB SEN Marge Gas.0.5 GB 24 VCPUs 4.000 GB (24 200 GB) 3.0.0 GB SEN Marge Gas.0.5 GB 24 VCPUs 4.000 GB (24 200 GB) 3.0.0 GB SEN Marge Gas.0.5 GB 24 VCPUs 4.000 GB (24 200 GB) 3.0.0 GB SEN Marge Gas.0.5 GB 24 VCPUs 6.000 GB (24 200 GB) 3.0.0 GB SEN Marge Gas.0.5 GB 3.0.0 GB (2 200 GB) 3.0.0 GB (2 200 GB) 3.0.0 GB (2 200 GB) SEN Marge Gas.0.5 GB	R5N Extra Large	r5n.xi	arge	32.0 GiB	4 vCPUs	
RND Extra Large rind.natarge rind.natar	I3EN 12xlarge	i3en.1	2xlarge	384.0 GiB	48 vCPUs	30000 GiB (4 * 7500 GiB M
Image Result Result </td <td>I3EN Metal</td> <td>i3en.n</td> <td>netal</td> <td>768.0 GiB</td> <td>96 vCPUs</td> <td>60000 GiB (8 * 7500 GiB M</td>	I3EN Metal	i3en.n	netal	768.0 GiB	96 vCPUs	60000 GiB (8 * 7500 GiB M
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D2 Eght Extra Large D2 Ablarge D2 40.0 GB V P D4 4000 GB (4 * 200 I3EN 3darge 3en.3darge 96.0 GB 12 v CPUs 7500 GB Z15 3darge z1d.3darge 96.0 GB 12 v CPUs 7500 GB Z15 3darge z1d.3darge 96.0 GB 12 v CPUs 14.500 GB X15 fidarge rfn.24 viarge 10952 OGB 64 v CPUs 1012 Z15 pht Extra Large rfn.24 viarge 2.2 viarge 2.2 viorge 2.0 viorge 64.0 GB (4 × CPUs 1000 GB (4 × CPUs 10	M5N 16xlarge	m5n.1	6xlarge	256.0 GiB	64 vCPUs	
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No. No. No. No. No. RE1 Hakinge Xte. Hakinge 11952.0.000 64 VCPUs 11952.000 REN 24xlarge r6n.24xlarge 160.24xlarge 26.20xlase 64.00.000 6	I3EN 3xlarge	i3en.3	ixlarge	96.0 GiB	12 vCPUs	7500 GiB
RN 244arge rfn.244arge rfn.244arge <thrfn.244arge< th=""> <thrfn.244arge< th=""></thrfn.244arge<></thrfn.244arge<>	Z1D 3xlarge	z1d.3	xlarge	96.0 GiB	12 vCPUs	450 GiB
Constant	X1E 16xlarge	x1e.1	5xlarge	1952.0 GIB	64 vCPUs	192
RAB Light Extra Large fia.8karge 250.008 24 VCPUs 1 A1 Metal a1.metal 3.20.068 64 VCPUs 1600 GB 2* 80 I2 Double Extra Large 62.xlarge 66.0.068 8 VCPUs 1600 GB 2* 80 ISEN Double Extra Large 62.xlarge 66.0.068 8 VCPUs 1600 GB 2* 2500 GB	R5N 24xlarge	r5n.24	lxlarge	768.0 GiB	96 vCPUs	
Anterial	I2 Eight Extra Large	i2.8xla	arge	244.0 GiB	32 vCPUs	6400 GiB (8 * 80
I2 Double Extra Large 2.2 darge 6.6 0.6 0.6 0.6 0.6 0.6 0.0 0.6 0.6 0.6	R5A Eight Extra Large	r5a.8x	darge	256.0 GiB	32 vCPUs	
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H1 Bght Extra Large h1.8.karge 12.0.0.08 2V CPUs 8000 GB (4 '200 GB) R5D 24xlarge r6d.24xlarge 766.0.08 96 vCPUs 3600 GB (4 '900 GB) ISEN 8xlarge Gen.24xlarge 766.0.08 96 vCPUs 3600 GB (4 '900 GB) ISEN 8xlarge Gen.24xlarge 192.0.08 24 vCPUs 15000 GB (2 '7500 GB) R4 High-Memory Eght Extra Large r4.8xlarge 224.0.068 22 vCPUs (or a 7h 12m buss) 1000 72 Large 23.19p 8.0.608 24 vCPUs 60.000 1000 74.8xlarge r6.16klarge 3676.018 64 vCPUs 1000 1000 R5A feblarge r6.18retal 768.026 64 vCPUs 1000 100	P3 Double Extra Large	p3.2x	large	61.0 GiB	8 vCPUs	
R6D 24xlarge r6d 2xklarge 768.0 GB 96 VCPUs 3660 GB (4*00 GB f ISEN 8xlarge San.bdarge 192.0 GB 24 VCPUs 15000 GB (4*00 GB f R4 High-Memory Eight Extra Large r4.8xlarge 24.40 GB 24.40 GB 24.40 CB 15000 GB (4*00 GB f R1 High-Memory Eight Extra Large r4.8xlarge 6.8.0 GB 24.40 GB 24.40 CB	T2 Double Extra Large	t2.2xl	arge	32.0 GiB	8 vCPUs for a 4h 4.8m burst	
ISEN bokurge Ben. bokurge 192.0.0.8 24 VCPUs 19000 GB (2 * 7500 GB P R4 High-Memory Eght Extra Large r4.8xlarge 244.0.0.68 2 vCPUs 1 T2 Large r2.large 8.0.0.018 2 vCPUs (or a 7h 12m burnt 1 X1 Extra High-Memory Eght Extra Large r4.8xlarge 6.0.018 2 vCPUs 1 MSA Tokurge x1.6xlarge 6.0.018 2 vCPUs 1 1 R5A Tokurge r5.metal 7.0.028 64 vCPUs 1 1 R5A Tokurge r5.metal 7.0.028 64 vCPUs 1 1 R5A Large r5.metal 7.0.028 64 vCPUs 2	H1 Eight Extra Large	h1.8x	large	128.0 GiB	32 vCPUs	8000 GiB (4 * 200
R4 Hgh-Memory Eight Extra Large r4.8karge 24.40.0 LB 22 VCPUs Image: Comparison of the comparison of	R5D 24xlarge	r5d.24	txlarge	768.0 GIB	96 vCPUs	3600 GiB (4 * 900 GiB M
Targe Targe Concept Concept <thconcept< th=""> <thconcept< th=""> <thconce< td=""><td>I3EN 6xlarge</td><td>i3en.6</td><td>ixlarge</td><td>192.0 GiB</td><td>24 vCPUs</td><td>15000 GiB (2 * 7500 GiB M</td></thconce<></thconcept<></thconcept<>	I3EN 6xlarge	i3en.6	ixlarge	192.0 GiB	24 vCPUs	15000 GiB (2 * 7500 GiB M
Xi Exra High-Memory 16klarge xt.16klarge 976.0.GB 64/VPL 192 MSA 16klarge m5a.16klarge 256.0.GB 64/VPLs 192 R5 Metal r5.metal 75.metal 768.0.GB 64/VPLs 192 R5 Metal r5.metal 768.0.GB 64/VPLs 200 200 200 R5 Atlarge r5.allage 768.0.GB 64/VPLs 32.0.B2 (21) 32.0.B2 (21) R5A 24klarge r5.allage 768.0.GB 64/VPLs 32.0.B2 (21) 32.0.B2 (21) R5A 24klarge r5.allage 778.0.GB 64/VPLs 32.0.B2 (21) 32.0.B2 (21) R5A 24klarge r5.allage 788.0.GB 64/VPLs 32.0.B2 (21) 32.0.B2 (21) R5A 24klarge r5.allage 788.0.GB 64/VPLs 32.0.B2 (21) 32.0.B2 (21) R5A 24klarge r5.allage 788.0.GB 64/VPLs 32.0.B2 (21) 32.0.B2 (21) R5A 24klarge r5.allage r5.allage 788.0.GB 64/VPLs 32.0.B2 (21) R5A 24klarge r5.allage	R4 High-Memory Eight Extra La	rge r4.8xl	arge	244.0 GiB	32 vCPUs	
MSA 16karge mSa. 16karge 2256.0 GB 64 VCPUs R5M telal r5metal 768.0 GB 64 VCPUs 1 R6A Large r5metal 768.0 GB 64 VCPUs 1 R6A Large r5metal 16.0 GB 2 VCPUs 32 GB (2 r) R6A Large r5a.large 3.75 GB 2 VCPUs 32 GB (2 r) R6A Alarge r5a.lskarge 786.0 GB 64 VCPUs 32 GB (2 r) R6A Large r5a.lskarge 786.0 GB 64 VCPUs 32 GB (2 r) R6A Large r5a.lskarge 4486.0 GB 64 VCPUs 1 R6A Large r5a.lskarge 16.0 GB 84 VCPUs 1 R6A Large r5a.lskarge 16.0 GB 84 VCPUs 1 R6A Large r5a.lskarge 16.0 GB 84 VCPUs 1 R6A Large r5a.lskarge r6a.lskarge 1 1 R6A Large r5a.lskarge r6a.lskarge 1 1 R6A Large r5a.lskarge r6a.lskarge 1 1 1 <td>T2 Large</td> <td>t2.larg</td> <td>je</td> <td>8.0 GIB</td> <td>2 vCPUs for a 7h 12m burst</td> <td></td>	T2 Large	t2.larg	je	8.0 GIB	2 vCPUs for a 7h 12m burst	
R8 Metal r5.metal 768.0 GB 94 VPUs R8A Large r5a.large 16.0 GB 2 VPUs 2 C3 High-CPU Large c3.large 3.75 GB 2 VPUs 3.22 GB (2 * 1) R8A Advange r5a.24 Jarge 766.0 GB 94 VPUs 3.22 GB (2 * 1) R8A Advange r5a.24 Jarge 766.0 GB 94 VPUs 3.22 GB (2 * 1) R3A Advange r5a.24 Jarge 16.0 GB 94 VPUs 3.22 GB (2 * 1) A1 Double Extra Large a1.24 arge 16.0 GB 4 VPUs 3.22 GB (2 * 1) X1E Quadruple Extra Large x1.4 xJarge 7.5 GB 4 VPUs 4.44 Adv	X1 Extra High-Memory 16xlarge	x1.16	xlarge	976.0 GIB	64 vCPUs	192
R8A Large ráa.large 1.0.0.08 2xVPUs	M5A 16xlarge	m5a.1	6xlarge	256.0 GIB	64 vCPUs	
C3 High-CPU Large c3 Jarge 3.75 GB 2 vCPUs 3.2 GB (2 * 1) R5A 24xlarge f5a.24xlarge 768.0 GB 9 vCPUs G3 16xlarge g3.15klarge 488.0 GB 64 vCPUs A1 Double Extra Large a1.2xlarge 160.0 GB 8 vCPUs C4 High-CPU Extra Large o4.xlarge 7.5 GB 4 vCPUs X1E Quadruple Extra Large xte.4xlarge 488.0 GB 16 vCPUs 448.0 GB	R5 Metal	r5.me	tal	768.0 GIB	96 vCPUs	
RSA 2xdarge f5a.2xdarge 766.0 GB 94 VPUs G3 16xlarge g3.16xlarge 486.0 GB 64 VPUs A1 Double Extra Large a1.2xlarge 160.0 GB 82 VPUs C4 High-CPU Extra Large o4.xlarge 7.5 GB 42 VPUs X1E Quadruple Extra Large x16.4xlarge 488.0 GB 16 VPUs	R5A Large	r5a.la	rge	16.0 GIB	2 vCPUs	
G3 18xlarge g3.18xlarge 448.0.0.08 e4 vCPUs A1 Double Extra Large a1.2xlarge 16.0.018 8 vCPUs C4 High-CPU Extra Large o4.xlarge 7.5.018 4 vCPUs X1E Quadruple Extra Large x1e.4xlarge 488.0.018 6 vCPUs	C3 High-CPU Large	c3.lan	ge	3.75 GiB	2 vCPUs	32 GiB (2 * 1
A1 Double Extra Large a1.2xlarge 16.0 GB 8 VCPUs C4 High-CPU Extra Large c4.xlarge 7.5 GB 4 VCPUs X1E Quadruple Extra Large x1e.4xlarge 488.0 GB 16 VCPUs 48	R5A 24xlarge	r5a.24	Ixlarge	768.0 GIB	96 vCPUs	
C4 High-CPU Extra Large o4.xlarge 7.5 GilB 4 VCPUs X1E Quadruple Extra Large x1e.4xlarge 488.0 GiB 16 vCPUs 488	G3 16xlarge	g3.16	xlarge	488.0 GiB	64 vCPUs	
X1E Quadruple Extra Large x1e.4xlarge 488.0 GiB 16 vCPUs 48	A1 Double Extra Large	a1.2x	arge	16.0 GiB	8 vCPUs	
	C4 High-CPU Extra Large	c4.xia	rge	7.5 GiB	4 vCPUs	
MSAD Extra Large 16.0 GiB 4 vCPUs 150 GiB	X1E Quadruple Extra Large	x1e.4	klarge	488.0 GiB	16 vCPUs	48
	M5AD Extra Large	m5ad	xlarge	16.0 GiB	4 vCPUs	150 GiB

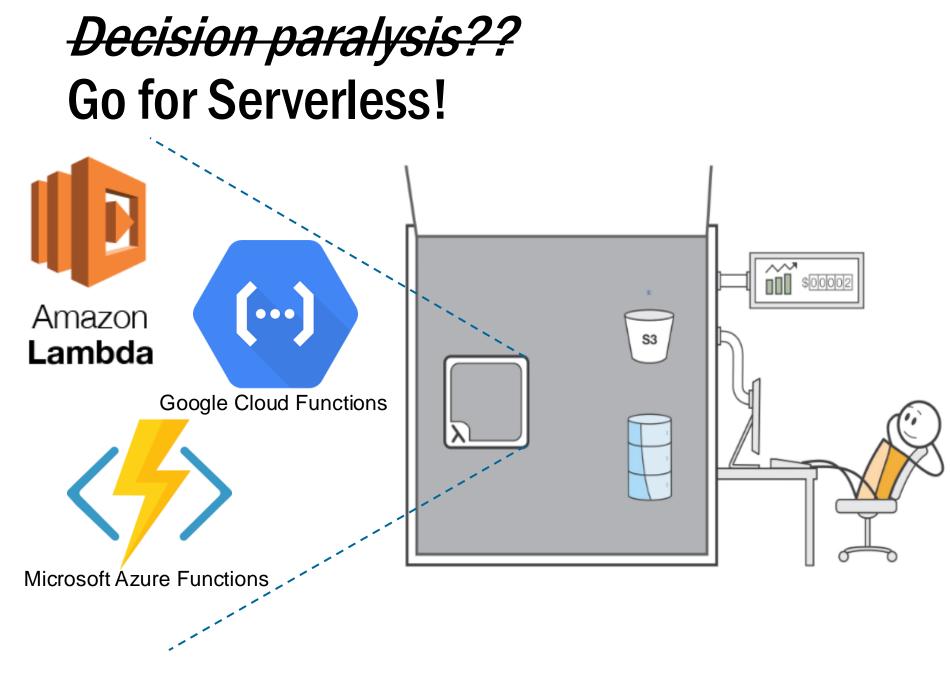
#thecloudistoodamn

- 1. What type of instances?
 - 2. How many to spin up?
 - 3. What base image?
 - 4. On-demand or spot?
 - 5. What storage service to use?
 - 6. And then wait to start...
 - 7. Not the end of the horror story:
 - 1. When to scale out?
 - 2. When to scale in?
 - 3. When to switch to different instance

Why is there no "cloud button"?



R5A Eight Extra Large	r5a.8xlarge	256.0 GiB	32 vCPUs	
A1 Metal	a1.metal	32.0 GiB	16 vCPUs	
12 Double Extra Large	i2.2xlarge	61.0 GiB	8 vCPUs	1600 GiB (2 * 800
I3EN Double Extra Large	i3en.2xlarge	64.0 GiB	8 vCPUs	5000 GIB (2 * 2500 GIB NV
M5A Extra Large	m5a_xlarge	16.0 GiB	4 vCPUs	
P3 Double Extra Large	p3.2xlarge	61.0 GiB	8 vCPUs	
T2 Double Extra Large	t2.2xlarge	32.0 GiB	8 vCPUs for a 4h 4.8m burst	
H1 Eight Extra Large	h1.8xlarge	128.0 GiB	32 vCPUs	8000 GiB (4 * 2000 G
R5D 24xlarge	r5d.24xlarge	768.0 GiB	96 vCPUs	3600 GiB (4 * 900 GiB NV
I3EN 6xlarge	i3en.6xlarge	192.0 GiB	24 vCPUs	15000 GiB (2 * 7500 GiB NV
R4 High-Memory Eight Extra Large	r4.8xlarge	244.0 GiB	32 vCPUs	
T2 Large	t2.large	8.0 GiB	2 vCPUs for a 7h 12m burst	
X1 Extra High-Memory 16xlarge	x1.16xlarge	976.0 GiB	64 vCPUs	1920
M5A 16xiarge	m5a.16xlarge	256.0 GiB	64 vCPUs	
R5 Metal	r5.metal	700 0 0 0	96 vCPUs	
R5A Large	r5a.large			
				32 GiB (2 * 16



What is serverless computing?

What is serverless computing?

Serverless computing (Function-as-a-Service, or FaaS) is a **programming abstraction** that enables users to upload programs, run them at (virtually) any scale, and **pay only for the resources used**

A car analogy

Car analogy



Own a car

(Bare metal servers)



Rent a car (VPS)



City car-sharing (Serverless)

Cars are parked **95%** of the time (loige.link/car-parked-95) How much do you use the car?

https://www.slideshare.net/loige/building-a-serverless-company-with-nodejs-react-and-the-serverless-framework-jsday-2017-verona

Concept of serverless is not new

- Google App Engine
 - Fully managed platform as a service (PaaS) for developing and hosting web applications
- Google BigQuery
 - Fully managed data warehouse
 - "Arbitrarily" large data and queries
 - Pay per byte being processed
 - No concept of server or cluster
- AWS S3
 - Fully managed object storage service
 - Pay per byte being stored and written
 - No server maintenance or resource scaling

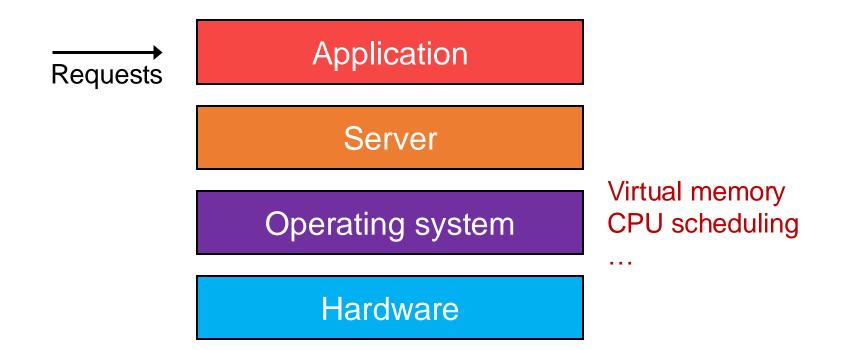




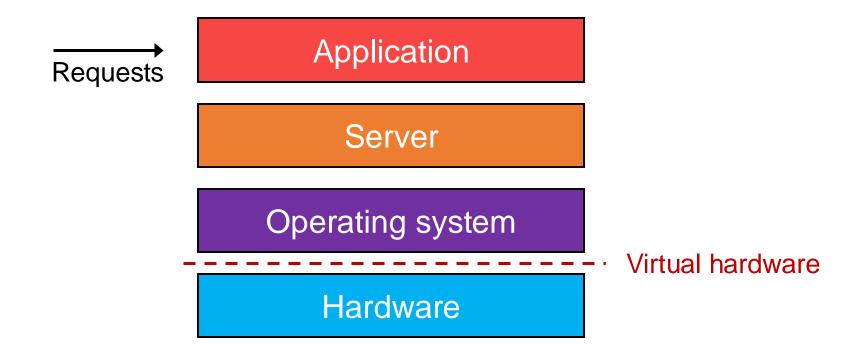


Recap: Cloud evolution history – A virtualization story

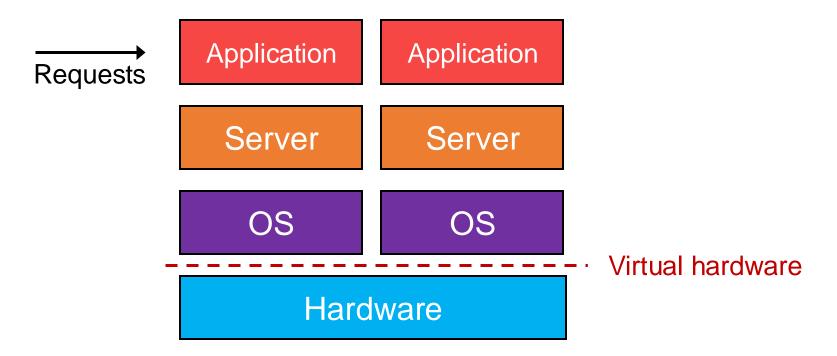
Classic cloud app stack



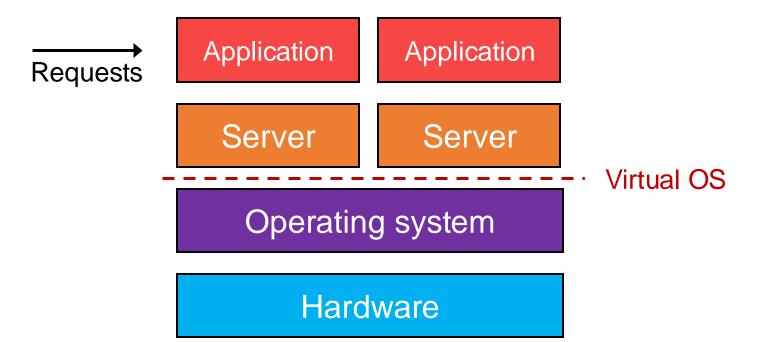
1st generation: virtual machine (VM)



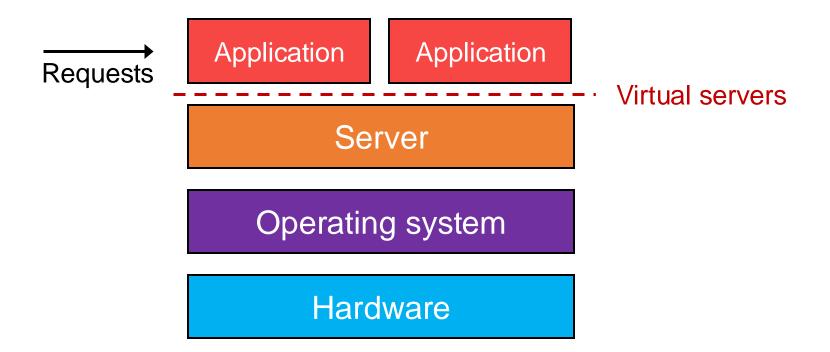
1st generation: virtual machine (VM)



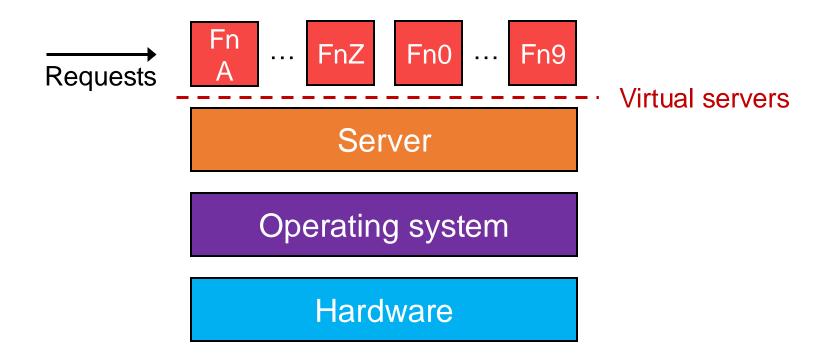
2nd generation: containers



3rd generation: serverless functions



3rd generation: serverless functions



Tradeoff discussion

Serverless functions (AWS Lambdas)	Containers	VMs	
++	+	+++	Isolation?
+	++	+++	Flexibility?
+	++	+++	Overhead?

1. (Provider) Manage a set of user-defined functions

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- 2. Take an event sent over HTTP or received from an event source

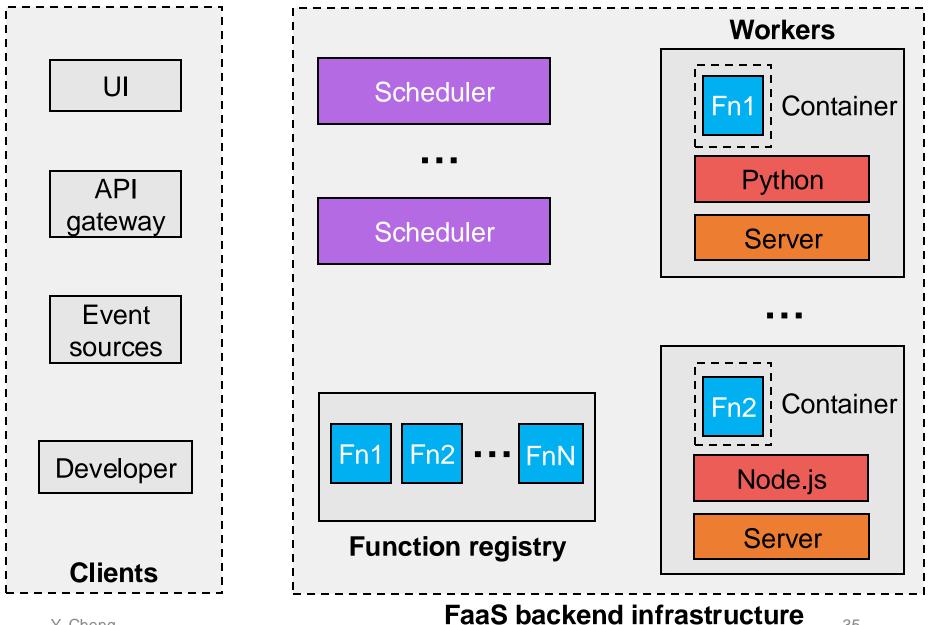
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- 5. Send the event to the function instance

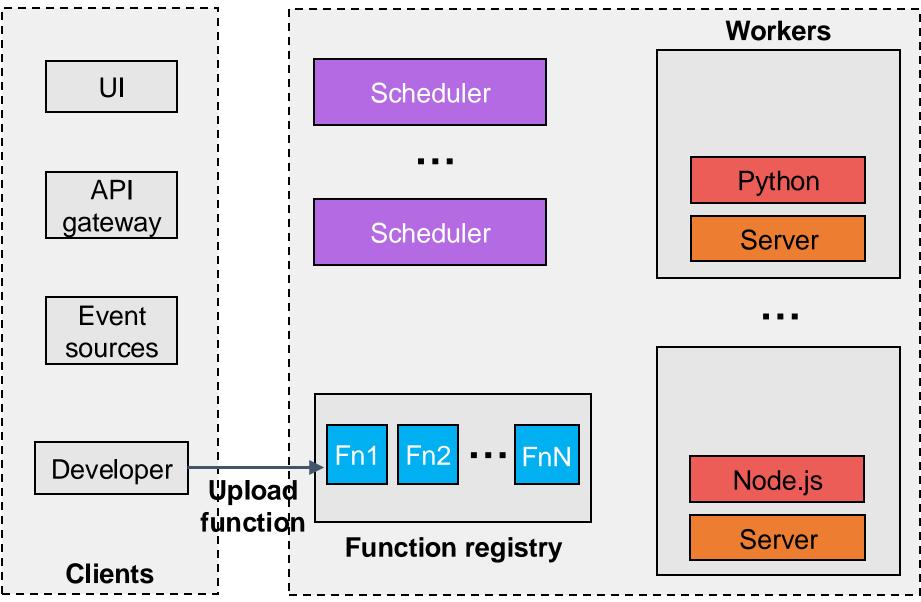
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- 5. Send the event to the function instance
- 6. Wait for a response
- 7. Gather execution logs
- 8. Make the response available to the user
- 9. Stop the function when the execution terminates

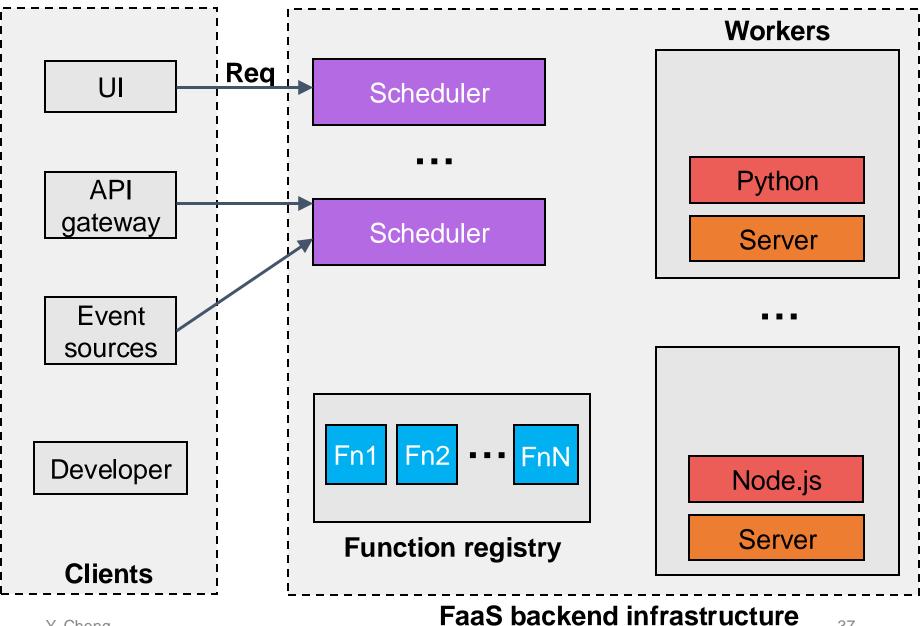


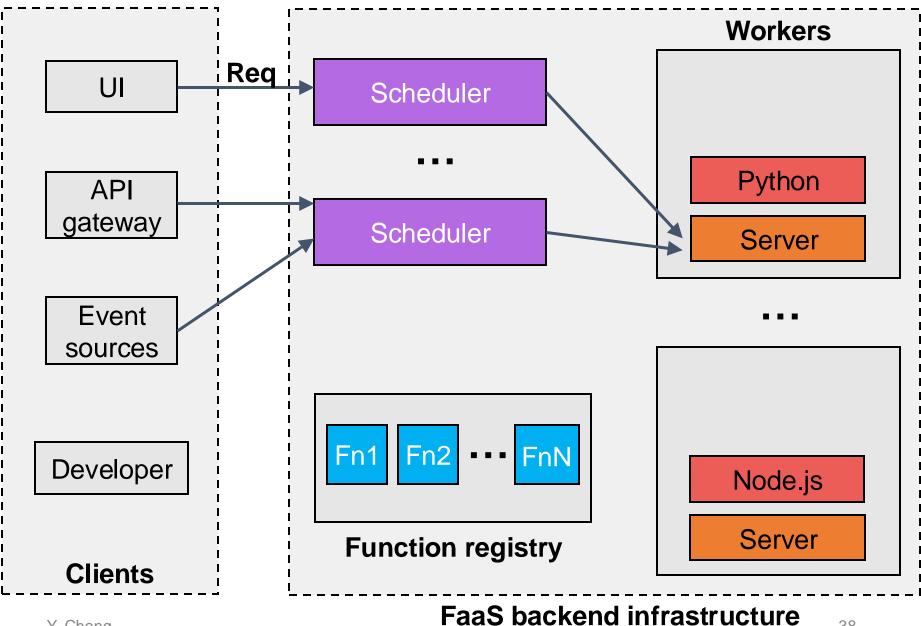
Y. Cheng

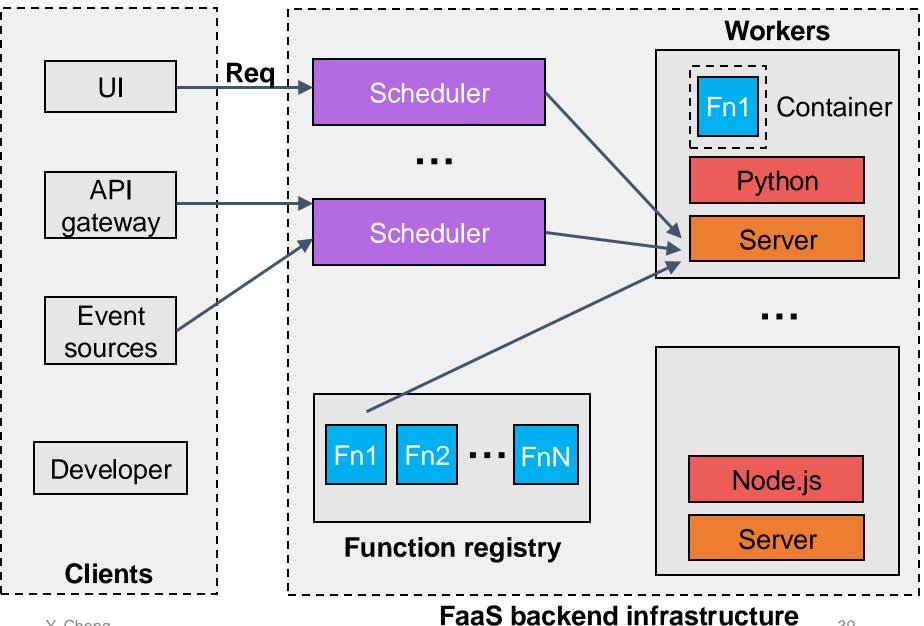
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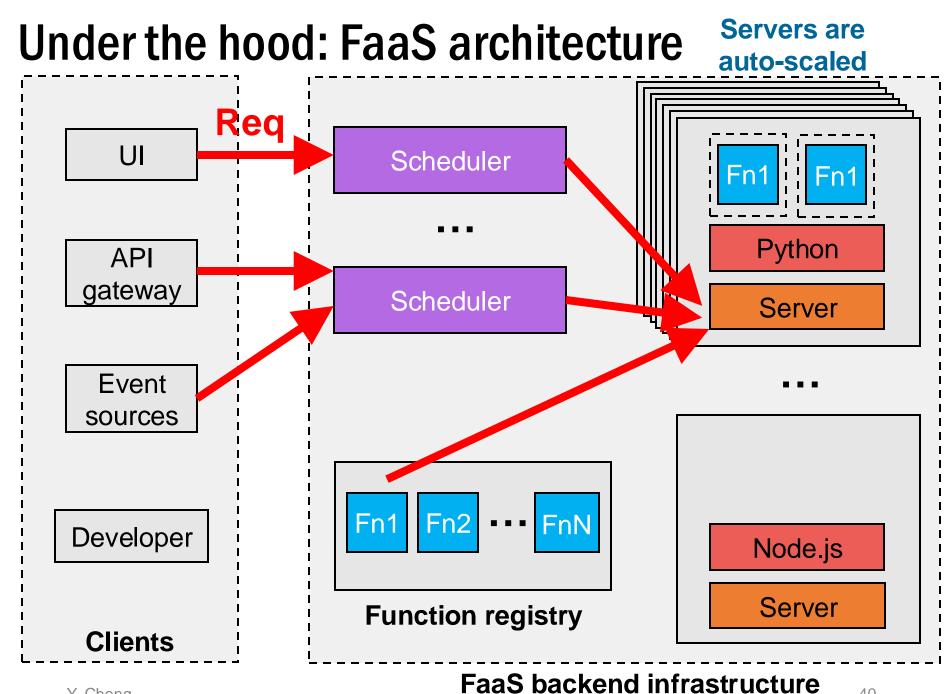


FaaS backend infrastructure









Y. Cheng

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AWS Lambda

- Lambda capacity config keeps evolving:
- 1st gen 300 seconds 900 seconds (15 minutes)1st gen $1.5 \text{ GB} \rightarrow 10 \text{ GB} \text{ memory}$ $512 \text{ MB} \rightarrow \text{ up to } 10 \text{ GB of /tmp file system}$

Current offering

Python, Java, Node.js, Go, ...

Pricing:

- Fine-grained billing: 1-millisecond billed duration
- \$0.20 per 1M requests (invocations charge \$)
- \$0.0000166667 for every GB-second (compute time) charges \$\$)
- 6,000 1 GB Lambda functions for one second: 10¢

Desirable properties

- Operationally
 - "No-ops" (almost) no configuration
 - Autoscaling down to 0
 - Closer to pay-per-use (rather than pay-perallocation)
 - Fine-grained billing



FaaS today

- FaaS is used mostly for simple or coarse-grained tasks
 - Stateless, embarrassingly parallel tasks, simple workflows
 - ETL, software testing, API middleware, image processing, etc.
 - Glue to other serverless backends
- Lots of problems are limiting FaaS' scope
 - Poor performance (vs. time to run actual code) at scale
 - Mismatch of infrastructure support (e.g., today's OS not designed for FaaS)
 - Rule-breaking research needed to reimagine/broaden the scope
 - Very resource-inefficient and costly for serverless providers
 - Lack of support for accelerators
 - .

Orders of magnitude slower and inefficient for many "killer" apps

• ML inference, microservices, ...

Limitations

- Banned inbound network
- No guaranteed data availability
- Lambdas are **resource-constrained**
- Lambdas have **limited execution time**
- High cold startup cost and invocation cost