

# AWS INSTANCE REVIEW

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## Summary:

In this exercise, I will demonstrate my review about instances setup in an AWS environment. I have completed the following steps in the order below:

- Setup instances in AWS
  - The instances use Virtual Machines with a Linux OS
  - They have all been set-up within the free tier provision
- Measure the highest possible bandwidth over the Virtual Private Cloud (VPC) with small packet sizes
- Comparative analysis of instances

This report contains explanations regarding the network choices, what was available and what I chose in order to complete the exercise. I conclude the report with my suggestions and justification to a hypothetical customer who plans to use either of the instance types.

## Introduction:

I launched two instances each in LightSail and EC2. They both use a pay as you go, on demand pricing model with 1 vCPU processing. The delivery method is 64-bit (x86) Amazon Machine Image (AMI).

Their features are mentioned in the table below. I have used iPerf3 to check the bandwidth performance between the two instances over the VPC network using small packet sizes.

Instance Type	LightSail Linux	EC2, t2.micro, Linux
Storage	20 GB SSD	8GiB EBS
Memory	512 MB	1 GiB
Price	\$3.5/month	\$9USD/month (\$0.012/hr)

## Network Choices for Instance Setup:

I have used all the default choices that were provided on the interface for launching an instance. EC2 came with a default VPC network configuration and a static IP. The deviations from default settings are given below.

### LightSail

- Setup a static IP
- Configured instances to connect with default VPC
- Firewall configuration to allow traffic on new port
  - Custom Transmission Control Protocol (TCP) on port 5201 to allow iPerf3 test

### EC2

- Configured security group and Network Access Control List (NACL) to allow traffic on my EC2 port
  - Custom TCP on port 8001 to allow iPerf3 test

## Iperf Test:

LightSail - TCP – single stream

```
bitnami@ip-172-26-3-40:~$ iperf3 -s
```

```
bitnami@ip-172-26-0-144:~$ iperf3 -c 172.26.3.40
```

```
Server listening on 5201
Accepted connection from 172.26.0.144, port 44356
[ 5] local 172.26.3.40 port 5201 connected to 172.26.0.144 port 44358
[ ID] Interval      Transfer    Bitrate
[ 5]  0.00-1.00  sec    232 MBytes  1.95 Gbits/sec
[ 5]  1.00-2.00  sec    118 MBytes  994 Mbits/sec
[ 5]  2.00-3.00  sec    119 MBytes  994 Mbits/sec
[ 5]  3.00-4.00  sec    119 MBytes  994 Mbits/sec
[ 5]  4.00-5.00  sec    118 MBytes  994 Mbits/sec
[ 5]  5.00-6.00  sec    119 MBytes  994 Mbits/sec
[ 5]  6.00-7.00  sec    119 MBytes  994 Mbits/sec
[ 5]  7.00-8.00  sec    118 MBytes  994 Mbits/sec
[ 5]  8.00-9.00  sec    119 MBytes  994 Mbits/sec
[ 5]  9.00-10.00 sec    118 MBytes  994 Mbits/sec
[ 5] 10.00-10.04 sec    4.76 MBytes  992 Mbits/sec
[ ID] Interval      Transfer    Bitrate
[ 5]  0.00-10.04 sec  1.27 GBytes  1.09 Gbits/sec
Receiver
Server listening on 5201

bitnami@ip-172-26-0-144:~$ iperf3 -c 172.26.3.40
Connecting to host 172.26.3.40, port 5201
[ 5] local 172.26.0.144 port 44358 connected to 172.26.3.40 port 5201
[ ID] Interval      Transfer    Bitrate    Retr  Cwnd
[ 5]  0.00-1.00  sec    239 MBytes  2.01 Gbits/sec  228   69
0 KBytes
[ 5]  1.00-2.00  sec    119 MBytes  994 Mbits/sec    7   53
3 KBytes
[ 5]  2.00-3.00  sec    119 MBytes  995 Mbits/sec    3   69
0 KBytes
[ 5]  3.00-4.00  sec    119 MBytes  995 Mbits/sec    4   55
9 KBytes
[ 5]  4.00-5.00  sec    119 MBytes  995 Mbits/sec    7   69
9 KBytes
[ 5]  5.00-6.00  sec    119 MBytes  995 Mbits/sec    6   56
8 KBytes
[ 5]  6.00-7.00  sec    119 MBytes  995 Mbits/sec    3   70
8 KBytes
[ 5]  7.00-8.00  sec    119 MBytes  995 Mbits/sec    4   59
4 KBytes
[ 5]  8.00-9.00  sec    119 MBytes  995 Mbits/sec    5   71
7 KBytes
[ 5]  9.00-10.00 sec    118 MBytes  994 Mbits/sec    7   57
7 KBytes
[ ID] Interval      Transfer    Bitrate    Retr
[ 5]  0.00-10.00 sec  1.28 GBytes  1.10 Gbits/sec  274
sender
[ 5]  0.00-10.04 sec  1.27 GBytes  1.09 Gbits/sec
receiver
iperf Done.
```

LightSail – TCP – multiple streams

```
bitnami@ip-172-26-0-144:~$ iperf3 -c 172.26.3.40 -P 10 -V
```

```
[ 18] receiver
[ 18] 0.00-60.04 sec 695 MBytes 97.1 Mbits/sec
[ 20] receiver
[ 20] 0.00-60.04 sec 736 MBytes 103 Mbits/sec
[ 22] receiver
[ 22] 0.00-60.04 sec 709 MBytes 99.0 Mbits/sec
[ 24] receiver
[ 24] 0.00-60.04 sec 788 MBytes 110 Mbits/sec
[SUM] 0.00-60.04 sec 7.06 GBytes 1.01 Gbits/sec
Receiver
Server listening on 5201

[ 23] 0.00-60.00 sec 789 MBytes 110 Mbits/sec 552
sender
[ 23] 0.00-60.04 sec 788 MBytes 110 Mbits/sec
receiver
[SUM] 0.00-60.00 sec 7.07 GBytes 1.01 Gbits/sec 6094
sender
[SUM] 0.00-60.04 sec 7.06 GBytes 1.01 Gbits/sec
receiver
CPU Utilization: local/sender 5.0% (0.5%u/4.5%u), remote/receiver
14.5% (2.3%u/12.3%u)
snd_tcp_congestion cubic
rcv_tcp_congestion cubic
iperf Done.
bitnami@ip-172-26-0-144:~$
```

There is a noticeably higher throughput in the case of multiple TCP streams, since the packet loss is spread over several streams. Only one stream is reducing the TCP window size and other windows are unaffected.

## LightSail – User Datagram Protocol (UDP) – 1G bandwidth

```
bitnami@ip-172-26-0-144:~$ iperf3 -c 172.26.3.40 -u -b 1G
```

```
bits/sec 0.040 ms 0/13405 (0%)
[ 5] 1.00-2.00 sec 119 MBytes 1.00 G
bits/sec 0.035 ms 0/13971 (0%)
[ 5] 2.00-3.00 sec 119 MBytes 1.00 G
bits/sec 0.031 ms 0/13967 (0%)
[ 5] 3.00-4.00 sec 119 MBytes 998 M
bits/sec 0.029 ms 28/13968 (0.2%)
[ 5] 4.00-5.00 sec 119 MBytes 1000 M
bits/sec 0.033 ms 4/13967 (0.029%)
[ 5] 5.00-6.00 sec 119 MBytes 999 M
bits/sec 0.039 ms 1/13961 (0.0072%)
[ 5] 6.00-7.00 sec 119 MBytes 1.00 G
bits/sec 0.036 ms 0/13971 (0%)
[ 5] 7.00-8.00 sec 119 MBytes 999 M
bits/sec 0.044 ms 7/13966 (0.05%)
[ 5] 8.00-9.00 sec 119 MBytes 1.00 G
bits/sec 0.029 ms 0/13976 (0%)
[ 5] 9.00-10.00 sec 119 MBytes 999 M
bits/sec 0.050 ms 7/13960 (0.05%)
[ 5] 10.00-10.04 sec 4.76 MBytes 1.00 G
bits/sec 0.040 ms 0/558 (0%)
-----
[ ID] Interval Transfer Bitrate
[ 5] 0.00-10.04 sec 1.16 GBytes 1000 Mbits/sec
Jitter 0.000 ms
Lost/Totl Datagram 0/139670 (0%) send
iver
er
iperf Done.
bitnami@ip-172-26-0-144:~$
```

## LightSail - UDP – 10G bandwidth

```
bitnami@ip-172-26-0-144:~$ iperf3 -c 172.26.3.40 -u -b 10G
```

```
bits/sec 0.018 ms 6/23126 (0.026%)
[ 5] 1.00-2.00 sec 154 MBytes 1.29 G
bits/sec 0.027 ms 4691/22702 (21%)
[ 5] 2.00-3.00 sec 119 MBytes 997 M
bits/sec 0.025 ms 8036/21957 (37%)
[ 5] 3.00-4.00 sec 119 MBytes 994 M
bits/sec 0.027 ms 8822/22712 (39%)
[ 5] 4.00-5.00 sec 119 MBytes 997 M
bits/sec 0.044 ms 11293/25215 (45%)
[ 5] 5.00-6.00 sec 119 MBytes 997 M
bits/sec 0.020 ms 9496/23417 (41%)
[ 5] 6.00-7.00 sec 119 MBytes 997 M
bits/sec 0.027 ms 8921/22843 (39%)
[ 5] 7.00-8.00 sec 119 MBytes 997 M
bits/sec 0.024 ms 9971/23891 (42%)
[ 5] 8.00-9.00 sec 119 MBytes 997 M
bits/sec 0.032 ms 8928/22849 (39%)
[ 5] 9.00-10.00 sec 119 MBytes 997 M
bits/sec 0.026 ms 10310/24231 (43%)
[ 5] 10.00-10.04 sec 4.88 MBytes 996 M
bits/sec 0.024 ms 344/916 (38%)
-----
[ ID] Interval Transfer Bitrate
[ 5] 0.00-10.04 sec 1.28 GBytes 1.09 G
Jitter 0.024 ms
Lost/Totl Datagram 80818/233859 (35%) rece
iver
iperf Done.
bitnami@ip-172-26-0-144:~$
```

## EC2 - TCP – single stream

```
[ec2-user@ip-172-31-27-107 ~]$ iperf3 -s -p 8001
```

```
[ec2-user@ip-172-31-24-194 ~]$ iperf3 -c 172.31.27.107
```

```

[ec2-user@ip-172-31-24-194 ~]$ iperf3 -c 172.31.27.107 -p 8001
Connecting to host 172.31.27.107, port 8001
[ 4] local 172.31.24.194 port 40830 connected to 172.31.27.107 port 8001
[ ID] Interval           Transfer     Bandwidth   Retr  Cwnd
[ 4] 0.00-1.00      sec    70.5 MBytes  591 Mb/s     34   778 KBytes
[ 4] 1.00-2.00      sec    57.5 MBytes  481 Mb/s      0   865 KBytes
[ 4] 2.00-3.01      sec    70.0 MBytes  584 Mb/s      2   542 KBytes
[ 4] 3.01-4.00      sec    65.0 MBytes  549 Mb/s      1   524 KBytes
[ 4] 4.00-5.00      sec    119 MBytes  996 Mb/s     12   533 KBytes
[ 4] 5.00-6.00      sec    120 MBytes  1.01 Gb/s     13   577 KBytes
[ 4] 6.00-7.00      sec    120 MBytes  1.01 Gb/s     16   603 KBytes
[ 4] 7.00-8.00      sec    120 MBytes  1.01 Gb/s     15   446 KBytes
[ 4] 8.00-9.00      sec    120 MBytes  1.01 Gb/s     14   489 KBytes
[ 4] 9.00-10.00     sec    120 MBytes  1.01 Gb/s     13   524 KBytes
[ ID] Interval           Transfer     Bandwidth
[ 5] 0.00-10.06     sec    0.00 Bytes  0.00 bits/sec
[ 5] 0.00-10.06     sec    978 MBytes  816 Mb/s
Server listening on 8001
Accepted connection from 172.31.24.194, port 40828
[ 5] local 172.31.27.107 port 8001 connected to 172.31.24.194 port 40830
[ ID] Interval           Transfer     Bandwidth
[ 5] 0.00-1.00      sec    64.5 MBytes  541 Mb/s
[ 5] 1.00-2.00      sec    56.6 MBytes  474 Mb/s
[ 5] 2.00-3.00      sec    69.4 MBytes  583 Mb/s
[ 5] 3.00-4.00      sec    64.8 MBytes  544 Mb/s
[ 5] 4.00-5.00      sec    116 MBytes  972 Mb/s
[ 5] 5.00-6.00      sec    120 MBytes  1.01 Gb/s
[ 5] 6.00-7.00      sec    120 MBytes  1.01 Gb/s
[ 5] 7.00-8.00      sec    120 MBytes  1.01 Gb/s
[ 5] 8.00-9.00      sec    120 MBytes  1.01 Gb/s
[ 5] 9.00-10.00     sec    120 MBytes  1.00 Gb/s
[ 5] 10.00-10.06    sec    7.42 MBytes  1.00 Gb/s
[ ID] Interval           Transfer     Bandwidth
[ 5] 0.00-10.06     sec    0.00 Bytes  0.00 bits/sec
[ 5] 0.00-10.06     sec    978 MBytes  816 Mb/s
Server listening on 8001
iperf Done.

```

## EC2- TCP – multiple streams

```
[ec2-user@ip-172-31-24-194 ~]$ iperf3 -c 172.31.27.107 -P 10 -V  
-p 8001
```

```

[ 21] 0.00-60.03 sec 0.00 Bytes 0.00 bits/sec      sende
[ 21] 0.00-60.03 sec 675 MBytes 94.3 Mbits/sec      rec
eiver
[ 23] 0.00-60.03 sec 0.00 Bytes 0.00 bits/sec      sende
[ 23] 0.00-60.03 sec 686 MBytes 95.9 Mbits/sec      rec
eiver
[SUM] 0.00-60.03 sec 0.00 Bytes 0.00 bits/sec      sende
[SUM] 0.00-60.03 sec 6.69 GBytes 957 Mbits/sec     rec
eiver
-----
Server listening on 8001
-----
[ 20] 0.00-60.00 sec 675 MBytes 94.3 Mbits/sec      rec
iver
[ 22] 0.00-60.00 sec 687 MBytes 96.0 Mbits/sec 2063   sen
der
[ 22] 0.00-60.00 sec 686 MBytes 96.0 Mbits/sec      rece
iver
[SUM] 0.00-60.00 sec 6.70 GBytes 959 Mbits/sec 20746   se
nder
[SUM] 0.00-60.00 sec 6.69 GBytes 958 Mbits/sec      rece
iver
CPU Utilization: local/sender 3.6% (0.9%u/2.7%), remote/receiver 9.3% (2.
3%u/7.0%)
snd_tcp_congestion cubic
rcv_tcp_congestion cubic
iperf Done.
[ec2-user@ip-172-31-24-194 ~]$

```

As mentioned in the TCP tests earlier, in the case of multiple TCP streams, the TCP window size is reduced in one stream and the other windows are unaffected. This causes the packet loss to spread over several streams, and hence there is a higher throughput.

## EC2 - UDP – 100M bandwidth

```
[ec2-user@ip-172-31-24-194 ~]$ iperf3 -c 172.31.27.107 -p 8001 -u -b 100M
```

```
-----
Accepted connection from 172.31.24.194, port 39860
[ 5] local 172.31.27.107 port 8001 connected to 172.31.24.194 port 44537
[ ID] Interval      Transfer    Bandwidth  Jitter    Lost/Tota
Datagrams
[ 5] 0.00-1.00    sec  10.8 MBytes  90.8 Mbits/sec  0.103 ms  0/1269 (0
%)
[ 5] 1.00-2.00    sec  11.9 MBytes  99.8 Mbits/sec  0.053 ms  0/1394 (0
%)
[ 5] 2.00-3.00    sec  11.9 MBytes  100 Mbits/sec   0.084 ms  0/1399 (0
%)
[ 5] 3.00-4.00    sec  11.9 MBytes  100 Mbits/sec   0.094 ms  0/1397 (0
%)
[ 5] 4.00-5.00    sec  11.8 MBytes  99.4 Mbits/sec   0.043 ms  8/1396 (0
.57%)
[ 5] 5.00-6.00    sec  11.9 MBytes  100 Mbits/sec   0.039 ms  1/1398 (0
.072%)
[ 5] 6.00-7.00    sec  11.9 MBytes  99.9 Mbits/sec   0.045 ms  0/1395 (0
%)
[ 5] 7.00-8.00    sec  11.9 MBytes  100 Mbits/sec   0.041 ms  0/1397 (0
%)
[ 5] 8.00-9.00    sec  11.9 MBytes  99.9 Mbits/sec   0.041 ms  0/1396 (0
%)
[ 5] 9.00-10.00   sec  11.9 MBytes  99.9 Mbits/sec   0.039 ms  0/1396 (0
%)
[ 5] 10.00-10.04  sec   0.00 Bytes   0.00 bits/sec   0.039 ms  0/0 (0%)
[ ID] Interval      Transfer    Bandwidth  Jitter    Lost/Tota
Datagrams
[ 5] 0.00-10.04   sec   0.00 Bytes   0.00 bits/sec   0.039 ms  9/13837 (0
.065%)
-----
Server listening on 8001
-----

[ec2-user@ip-172-31-24-194 ~]$ iperf3 -c 172.31.27.107 -p 8001 -u -b 100M
Connecting to host 172.31.27.107, port 8001
[ 4] local 172.31.24.194 port 44537 connected to 172.31.27.107 port 8001
[ ID] Interval      Transfer    Bandwidth  Jitter    Lost/Tota
Datagrams
[ 4] 0.00-1.00    sec  10.8 MBytes  90.8 Mbits/sec  0.1269 ms  0/1269
[ 4] 1.00-2.00    sec  11.9 MBytes  99.8 Mbits/sec  0.053 ms  0/1394
[ 4] 2.00-3.00    sec  11.9 MBytes  100 Mbits/sec  0.084 ms  0/1399
[ 4] 3.00-4.00    sec  11.9 MBytes  100 Mbits/sec  0.094 ms  0/1397
[ 4] 4.00-5.00    sec  11.9 MBytes  99.9 Mbits/sec  0.043 ms  8/1396
[ 4] 5.00-6.00    sec  11.9 MBytes  100 Mbits/sec  0.039 ms  1/1398
[ 4] 6.00-7.00    sec  11.9 MBytes  99.9 Mbits/sec  0.045 ms  0/1395
[ 4] 7.00-8.00    sec  11.9 MBytes  100 Mbits/sec  0.041 ms  0/1397
[ 4] 8.00-9.00    sec  11.9 MBytes  99.9 Mbits/sec  0.041 ms  0/1396
[ 4] 9.00-10.00   sec  11.9 MBytes  99.9 Mbits/sec  0.039 ms  0/1396
[ ID] Interval      Transfer    Bandwidth  Jitter    Lost/Tota
Datagrams
[ 4] 0.00-10.00   sec  118 MBytes  99.1 Mbits/sec  0.039 ms  9/13837 (0
.065%)
[ 4] Sent 13837 datagrams
iperf Done.
[ec2-user@ip-172-31-24-194 ~]$
```

## EC2 - UDP – 1G bandwidth

```
[ec2-user@ip-172-31-24-194 ~]$ iperf3 -c 172.31.27.107 -p 8001 -u -b 1G
```

```
[ 5] local 172.31.27.107 port 8001 connected to 172.31.24.194 port 57617
[ ID] Interval      Transfer    Bandwidth  Jitter    Los
t/Total Datagrams
[ 5] 0.00-1.00    sec  62.6 MBytes  525 Mbits/sec  0.033 ms  533
0/12670 (42%)
[ 5] 1.00-2.00    sec  67.6 MBytes  567 Mbits/sec  0.037 ms  596
0/13885 (43%)
[ 5] 2.00-3.00    sec  67.6 MBytes  567 Mbits/sec  0.044 ms  597
9/13900 (43%)
[ 5] 3.00-4.00    sec  68.7 MBytes  577 Mbits/sec  0.047 ms  600
3/14057 (43%)
[ 5] 4.00-5.00    sec  68.4 MBytes  574 Mbits/sec  0.057 ms  604
0/14058 (43%)
[ 5] 5.00-6.00    sec  66.5 MBytes  558 Mbits/sec  0.044 ms  606
2/13853 (44%)
[ 5] 6.00-7.00    sec  69.0 MBytes  579 Mbits/sec  0.038 ms  589
4/13982 (42%)
[ 5] 7.00-8.00    sec  83.8 MBytes  703 Mbits/sec  0.048 ms  441
0/14227 (31%)
[ 5] 8.00-9.00    sec  87.6 MBytes  735 Mbits/sec  0.041 ms  326
7/13532 (24%)
[ 5] 9.00-10.00   sec  96.5 MBytes  809 Mbits/sec  0.040 ms  352
3/14829 (24%)
[ 5] 10.00-10.04  sec   140 KBytes  25.9 Mbits/sec  0.040 ms  5/2
1 (24%)
[ ID] Interval      Transfer    Bandwidth  Jitter    Los
t/Total Datagrams
[ 5] 0.00-10.04   sec   0.00 Bytes   0.00 bits/sec  0.040 ms  52473
/139014 (38%)

[ec2-user@ip-172-31-24-194 ~]$ iperf3 -c 172.31.27.107 -p 8001 -u -b 1G
Connecting to host 172.31.27.107, port 8001
[ 4] local 172.31.24.194 port 57617 connected to 172.31.27.107 port 8001
[ ID] Interval      Transfer    Bandwidth  Jitter    Lost/Tota
Datagrams
[ 4] 0.00-1.00    sec  119 MBytes  998 Mbits/sec  0.13938 ms  13938
[ 4] 1.00-2.00    sec  119 MBytes  996 Mbits/sec  0.13911 ms  13911
[ 4] 2.00-3.00    sec  118 MBytes  994 Mbits/sec  0.13884 ms  13884
[ 4] 3.00-4.00    sec  120 MBytes  1.01 Gbits/sec  0.14065 ms  14065
[ 4] 4.00-5.00    sec  119 MBytes  999 Mbits/sec  0.13957 ms  13957
[ 4] 5.00-6.00    sec  119 MBytes  1.00 Gbits/sec  0.13969 ms  13969
[ 4] 6.00-7.00    sec  119 MBytes  995 Mbits/sec  0.13899 ms  13899
[ 4] 7.00-8.00    sec  119 MBytes  1000 Mbits/sec  0.13965 ms  13965
[ 4] 8.00-9.00    sec  115 MBytes  967 Mbits/sec  0.13512 ms  13512
[ 4] 9.00-10.00   sec  119 MBytes  996 Mbits/sec  0.13915 ms  13915
[ ID] Interval      Transfer    Bandwidth  Jitter    Lost/Tota
Datagrams
[ 4] 0.00-10.00   sec  1.16 GBytes  995 Mbits/sec  0.040 ms  52473/139014 (38%)
[ 4] Sent 139014 datagrams
iperf Done.
[ec2-user@ip-172-31-24-194 ~]$
```

### Iperf Summary:

#### TCP

		TCP – single stream	TCP – multi stream
LightSail	Transfer	1.27 GBytes	7.06 GBytes
	Bandwidth	1.09 GBits/sec	1.01 GBits/sec
EC2	Transfer	978 MBytes	6.69 GBytes/sec
	Bandwidth	821 Mbits/sec	958 MBits/sec

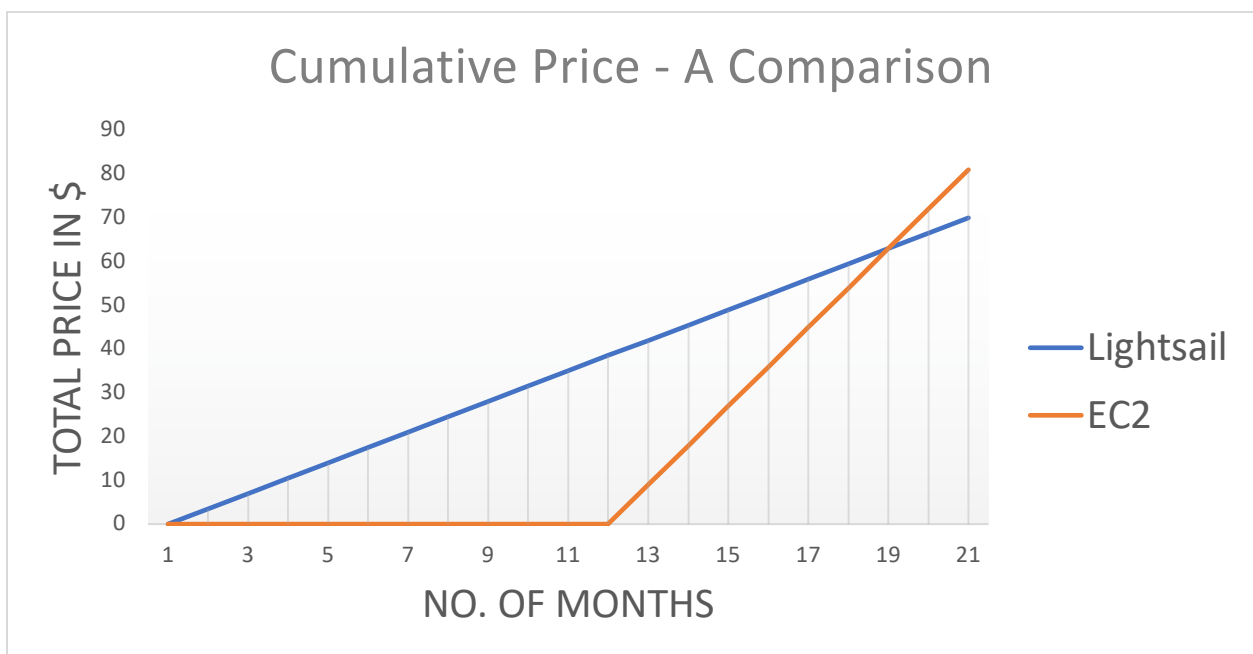
#### UDP

	Specified bandwidth	Packet Loss
LightSail	1G	0.34%
	10G	35%
EC2	100M	0.065%
	1G	38%

We can conclude that the overall network performance of LightSail is better than EC2.

### Pricing:

LightSail has a \$3.50/month charge for this server with the first month being free. EC2 has a \$9/month charge with the first 12 months being in the free tier. However, after the 19<sup>th</sup> month, the total price of EC2 far exceeds LightSail. A graphical view is presented below.



## Conclusion:

For a customer who intends to use the instance over a long period of time (19+ months), I would recommend AWS LightSail. This is after considering both the price and performance. It is ideal for a small business or a department within a larger institution. EC2 is a good choice for applications that have high compute needs.

Some of the additional configurations that can enhance the network efficiency are:

- Use of Load Balancer (~\$18/month)
- Use of CloudFront for Content Delivery Network (CDN), caching media close to the endpoints in the AWS regions across the globe (~\$60/month after the 12 months free tier)
- Additional storage using Elastic Block Storage (EBS) at \$0.10 per GB-month of provisioned storage (if needed)

A poorly scripted application can undermine the efficiency of the underlying network infrastructure. It is best to use good software architecture practices at the application level itself to enhance network efficiency.