CS 553: Cloud Computing
Understanding the cost of the cloud

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***Abstract*—The main purpose of this project is to grasp the importance of economic concerns regarding cloud compiting. Since cloud computing becomes widespread within the industry of computer science, the management of prices has become a huge topic of cloud computing these years. We are to study the incentives of setting up a public rather than a private cloud.**

I. Introduction

We are to compare the price of setting up a public cloud using Amazon Web Services, and the price of buying all the ressources in order to build a private cloud. In our study, we will consider different cloud size expressed in Flops, (floating point operations per second). Finally we will see in what extent it is interesting to use public ressources rather than buying and setting up a private cloud from scratch.

II. Cost of Amazon instances

In this section we will study the cost a compute cloud according to the amount of floating operations per seconds they provide. We will make the assumption that one EC2 instance provides 4.4 GFlops and compute the cost of the compute cloud for every following type a Amazon instance: t2.small, m3.large, c3.8xlarge, g2.2xlarge, r3.4xlarge, i2.8xlarge, and hs1.8xlarge. Our graph will plot the subsequent price from a cloud providing from 1 GFlop to 1PFlop. We first need to determine the GFlop provided by every instance and then compute the price per hour per flop. We get the following array:

Instance type	Hourly Price/GFlop
t2.small	$0.0059
m3.large	$0.0049
c3.8xlarge	$0.0035
g2.2xlarge	$0.0056
r3.4xlarge	$0.0061
i2.8xlarge	$0.014
hs1.8xlarge	$0.029

Note that we made an approximation while computing the hourly price per instance, given that for a small ammount of Flops, we might not need more instances to increase the ammount of Flop. Then the price per FLop becomes greater because we cannot rent ”small parts” of instances. Now we are able to compute the hourly price per instance type using the hourly pricing from Amazon instances and we plot it on the following graph:

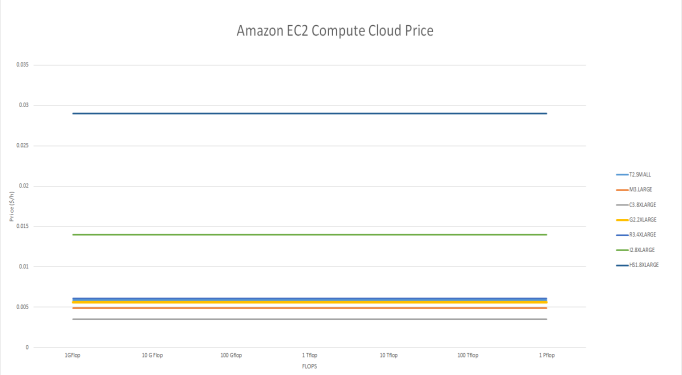

Fig. 1: Public Cloud price

Unlike what we could expect from the Amazon hourly pricing per instance, the small instances are not the cheaper as we increase the computation need for our cloud. Then we require a large number of small instances to reach our needs in term of Flops, which is more expensive than using instances with more computational power such as GPU instances. On the other hand, instances such as hs1.8xlarge and

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i2.8xlarge are very expensive and are most likely to be used by a small number of users. Still, the fact that Amazon provides such powerful instances can lead users to consume other cheaper Amazon's products and the ammount of such powerful instances owned by Amazon must be wisely chosen.

III. Cost of a private cloud

In this section we will compute the cost of buying and setting up a private cloud of which instances are built similarly to Amazon's instances. That means that we will compute the price of each equivalent instance and consider a 5 year usage. Then we will factorize some components of each instances such as GPUs to share them across different machines.

We will also take in account the price of the power supply, the cooliing price and the administration cost for our private cloud, which is a very important part of the budget. For instance for low Flops ammount, the administration cost will be important beacause one person will be paid to monitor one instance, but by increasing Flops, this cost will drop until more administrators are required.

First we compute the private equivalent to every single Amazon instance in the table below:

Component	t2.small	m3.large	c3.8xlarge	g2.2xlarge	r3.4xlarge	i2.8xlarge	hs1.8xlarge
CPU			$1727	$1600			
Memory			$628	$82			
Motherboard			$219	$219			
Case			$40	$40			
Power supply			$34	$34			
Disk			$529	$48			
Network			$90	$90			
GPU	X	X	X	$90	X	X	X
Cooling							
Power							
Administration							
Total/unit			$7940	$6136			

Thus the main difference with the public cloud is that we have a fixed cost per instance per hour but we can factorize the administration, cooling and power price among instance although Amazon cannot do that with its pas as you go policy has fixed prices for instances. We plots the comparison between the public and private clouds below.

As we forecasted, low scales involves a waste of administration ressources which is high for only few instances monitoring. We also see that our private instances have roughly the same price since the administration cost per hour and per flop is most higher than the hardware or power cost per flop per hour. Then the price eventually remains steady for large scales.

Now we finally want to know which of the public or the private cloud is the more interesting and cheap. Thus we plot the the needed utilization of the private cloud from 1GFlop to 1PFlop for the different instance types in order to break even cost wise. For each instance, the percentage of discount we make over the public cloud is plot acording to the scale of the cloud. If no value appears for low scale, it means that the public cloud is more profitable than the private one:

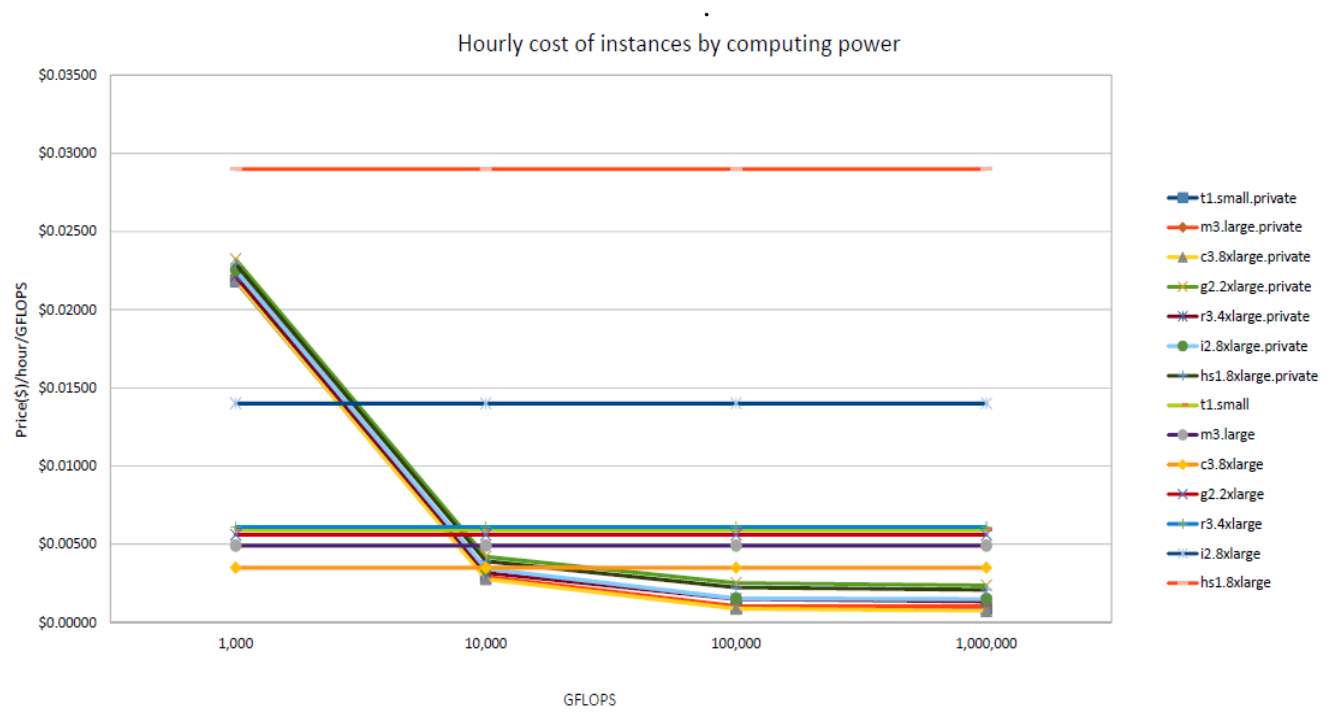

Fig. 2: Public vs. private cloud

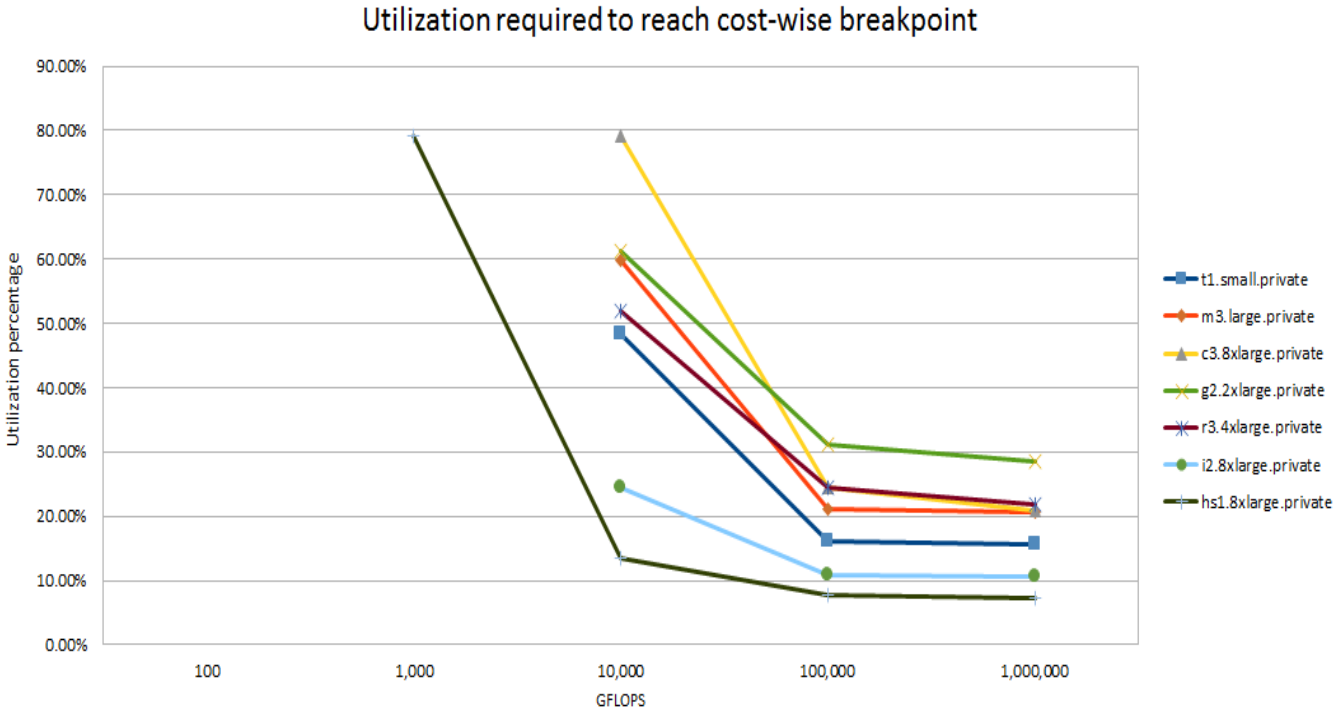

Fig. 3: Cost-wise breakpoint

REFERENCES

[1] http://h