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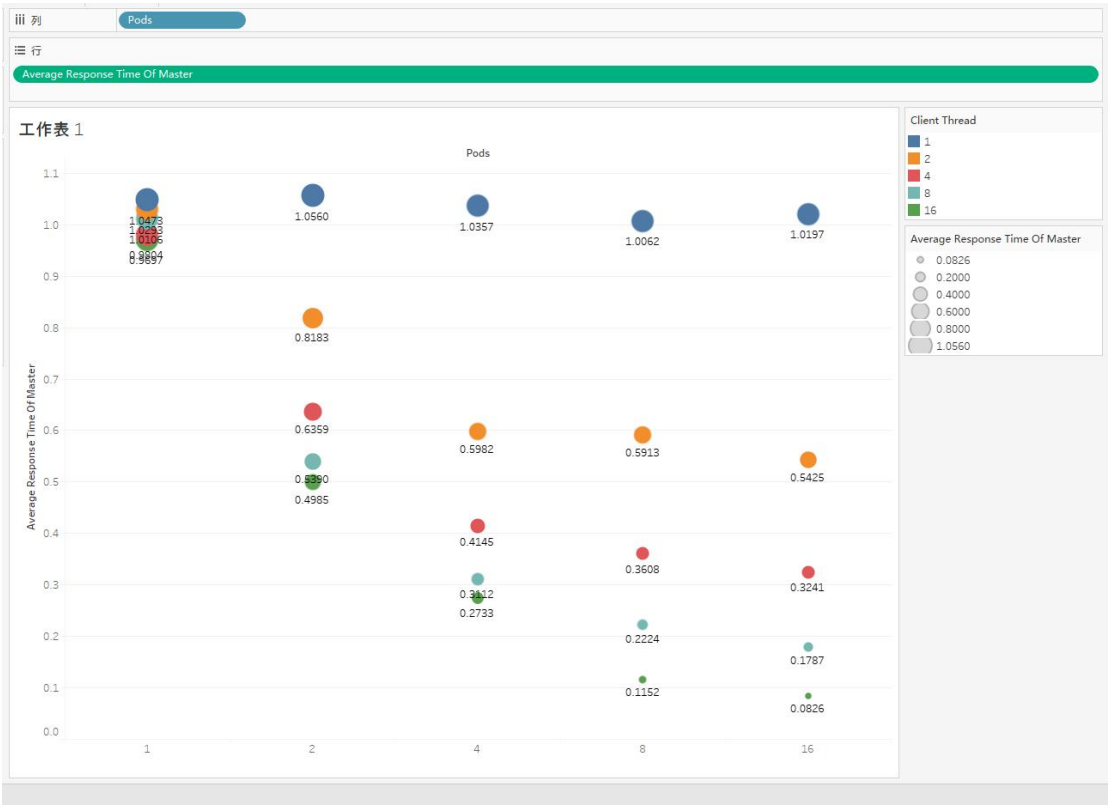
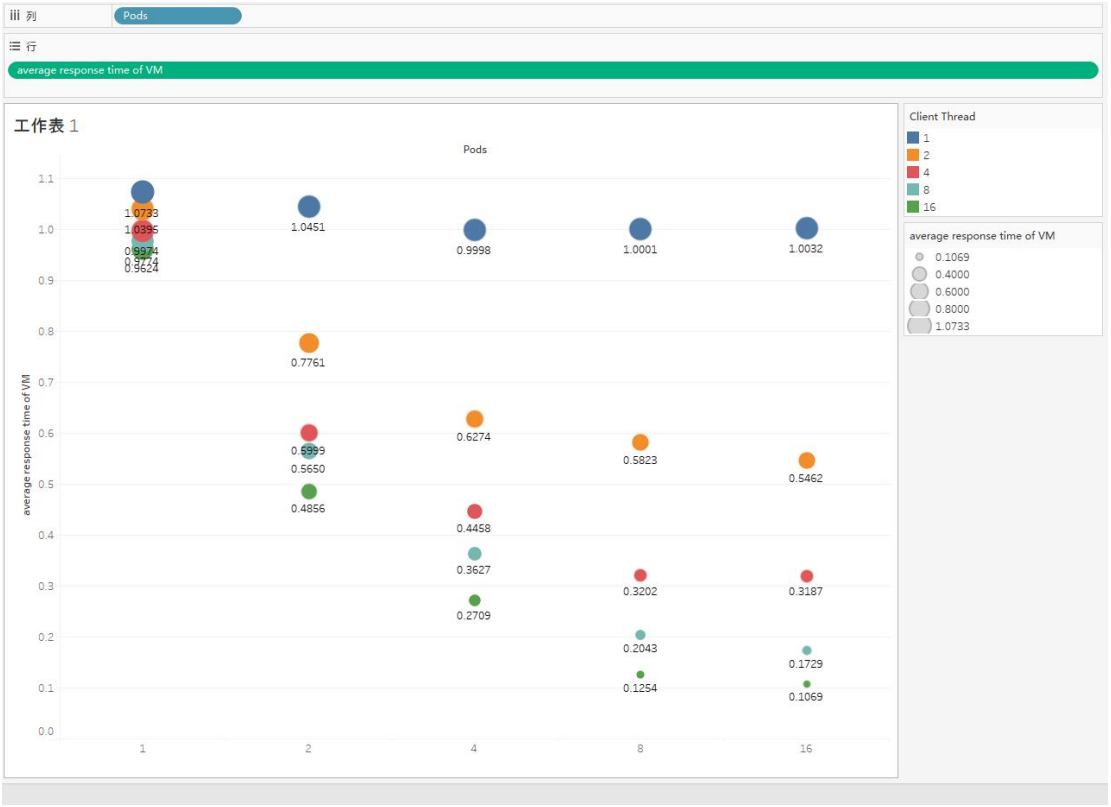
1.A plot showing the average response time of the web service versus the number of pods for different number of threads for the local client.



2.A plot showing the average response time of the web service versus the number of pods for different number of threads for the Nectar client.



3. Explain and justify results, plots, trends and observations in your experiments.

From plots above, we can see that the trend of plots are nearly same.

We can find below results, and I will give the reason of each result:

1. When the number of pods equal to 1, the average response time of different number of threads are nearly same. This result tells me that when the number of pods is small, the limitation of the performance is mainly in CPU, the cluster can not deal with data in time, so they have nearly same average response time.

2. When the number of threads equal to 1, the average response time of different number of pods are nearly same. This result tells me that when the number of threads is small, the limitation of the performance is mainly in client. Because the number of threads is small, there are just little data being sent to the server, and a lot of resource of the cluster are standing idle. And the performance will not be improved for this reason.

3. For each thread (except 1 thread), when the number of threads increases, the average response time decreases. Because the number of threads increases, more and more data are sent to the server, the vacancy rate of resource decreases. However, resource have a upper limit, when all resource are used, the performance will not be improved any more.

4. For each pods(except 1 pod), when the number of pods increases, the average response time decreases. Because the number of pods increases, the cluster has more and more resource, it can deal with more and more data in the same time. However, the data has a upper limit, when all data are addressed in the same time, the performance will not be improved any more.

5. the relationship between pods, threads and average response time is not linear. Because pods has a life cycle, the kubernetes will spend some time to start a new pod.

4. Select three challenges of your choice from the list of distributed systems challenges discussed in the first week lecture, give a practical example from your project that illustrates that challenge and how it is addressed in your system (500 words).

1.security:

phenomenon: I can not connect to the master of kubernetes from another VM.

methods: add ingress rules in OCI, allow that IP connect to the master of kubernetes .

2. openness:

phenomenon:1 VM doesn't have enough resource.

methods: use two workers to connect to the master and make them to a cluster, so they can work together and have enough resource. (kubernetes)

3. Quality of Service (QoS)

phenomenon: there are too may requests to the flask server, it can not deal with it because the limitation of memory.

methods: use del function to release some memory, so the server can handle more requests in the same time.