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1. Table User with userInfo and another table User_Relationship with columns as User1 (Indexed) and User2 (Indexed) and relationship (with values as Friend). The User_Relationship could be bi-directional so i.e., if A is friend of B then USER_Relationship table can have it as A, B, Friend as a row or B,A, Friend. How do you find a good scalable solution to find count of friends for a given user

2. There are notifications sent out for documents upon they are signed by the users. The documents are in millions and we have the document ids in the table. However there are failed notifications and due to system issue they are not even captured on the logs. Only the sent notifications are logged. How do you scale the solution to identify all the failed notifications.

3. Google document sharing application has a round robin scheme of serving by the load balancer. Do you foresee any issue? If so how do you overcome it?

4. There is a graph of node capabilities across various nodes and will have to identify the throughput of the entire system through the nodes.

5. In what cases do you choose strong consistency vs eventual consistency and there are 3 scenarios:

    - In case of banking application where there are deposits and payments
    - Metadata retrieval for media streaming
    - Data analytics for # of viewers etc.,

6. We are working on a service that generates subtitles for users' videos. This process starts a new thread for every video and is processor-intensive. Currently, this service runs as a single process on a machine.We've run into a bug where if the service is processing more than 10 videos at the same time, the service crashes the server, losing all requests currently being processed and affecting other processes on the machine. It may take a long time to find and fix this bug. What workarounds could we implement to continue running the service while we do so?

7. We are working on a mobile app for the board game Go. We'd like to add a feature where the computer will analyze a completed game. The analysis looks at each position from the game and provides suggested moves to help improve our users' play. We've found a library we can use to do this analysis. It takes an average of a minute on a modern desktop computer to analyze an entire game. An average game consists of about 200 moves.We are considering two approaches. 1) running this analysis on the phone itself, and 2) sending the game to a server farm for analysis that will be returned to the user.What are some advantages or disadvantages of each approach?

8. You're working on infrastructure for internet-connected vending machines. The plan is to install around 100,000 of these vending machines in the coming year, in major cities around the world. These machines will connect to the internet through cellular devices. Each machine will connect to a central server at midnight to report remaining stock and any maintenance issues like coin jams or stuck items. These machine status updates will be stored in a database, and a batch job will run at 1 AM to schedule the restocking and maintenance of machines. Are there any problems with the above design?

9. We are running a simple photo storage and sharing service. People upload their photos to our servers and then give links to other users who can then view them. Instead of using a cloud service, we have

our own server farms. You've been tasked with creating an estimate of the storage required over the coming year and the cost of that storage. What information would you need and what factors would you consider as you generate this estimate?

10. We are running a simple photo storage and sharing service. People upload their photos to our servers and then give links to other users who can then view them. We're trying to figure out how to split the photos and associated data evenly onto multiple machines, especially as we get new users. We've decided to shard the photos evenly alphabetically by username. For example, if we had 26 servers, all the usernames starting with 'a' would be on server 1, usernames starting with 'b' would be on server 2, and so on. We have created a scheme like this that will work for any number of servers. Are there any problems with this design and how to solve it?

11. A recipe website is based on a central database. The website suddenly becomes popular, and access speed slows down. What would you do?

12. A sports data website pulls data from third-party APIs. Now, one of the APIs is unstable. What would you do? (The APIs are unique and cannot be replaced.)

13. A freezer manufacturer previously sent all refrigerator data to a server for processing via the internet. Now, they want to replace this with an offline microcontroller. What factors should you consider?

14. A video-sharing website allows users to upload 1-minute videos that have an expiration date and are deleted after expiring. What data would you need to predict next year's costs?

15. There's a children's app whose main functionality is generating animations. It has its own server farm, and each request requires some processing time on the servers. What are some ways to reduce costs?

16. What factors to consider when implementing Implementing an A/B test for the thumbs-up feature in a video streaming service?

17. When implementing a notification system for a clinic, where people at the top of the queue are notified, and if they do not respond within 30 minutes, they are placed back in the queue. If they respond, they are removed. What should be considered?

18. A scoreboard system needs to display scores, query the top 100 players, and fetch the score of a specific player. If the system is slow, how can this be resolved?

19. Designing a news push system that displays news in the local language based on IP addresses across multiple countries. What challenges might arise?

20.

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Given some numerical data, calculate the required storage capacity and CPU responsiveness ba
    - Text-based service
    - 3,000 users
    - Each user uses the service 5 times per day
    - On workdays, 10 times per day?
    - Each time the data size is 2–10 KB, with an average of 5 KB
    - How much storage is required for a year?
    - What CPU and memory specifications are needed?
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21. Music server load balancing: If each server stores the same number of songs, what potential issues could arise?
22. Game app hints: Compare the advantages and disadvantages of storing hints on a server versus in-app.
23. XML file processing: Due to sensitivity, the file must be processed locally, but it is too large to fit into RAM. What should be done?
24. We are building a music streaming application in which users connect to our server to hear one of many music playlists for various purposes such as studying, working, sleeping, exercising, etc. We are considering whether to host this application on a single dedicated server or use multiple servers. What are some advantages and disadvantages of using multiple servers for this application?
25.

```
We are designing a system for our entertainment machines where players must pay for games us
Players purchase game cards preloaded with credits. When starting a game, players tab their
The machine connects to our account server via the Internet to verify the game card.
If the player has sufficient credits, they are deducted from the card and the game begins.
To recharge their payment cards, players have two options:
    1. pay in cash at designated terminals,
    2. attach a credit card to the payment card, enabling automatic refills when the credit
We expect to install this system on approximately 125,000 machines in the next year.
What concerns do you have with this system?
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26. We are responsible for query logging and analysis for a search engine. We are trying to estimate how much storage we will need to store our logs for the coming year. What kinds of information would you gather to make such an estimate?
27.

```
We are working on a remote public file storage solution. Users upload files to the server, w
Often multiple users want to upload the same file, and we would like to avoid having many co
Two files are considered copies if they have byte-for-byte identical contents.
To accomplish this, we do the following:
    - A user uploads a file to our server.
    - We look for all files on our server that are the same length and compare them bytewise
    - If we find two files that are the same, we create a symbolic link from the new file lo
What are some problems with this design and how would you fix them? Are there any ways to ma
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28.

```
We are designing a password validation system. The system enforces the following rules:
    - Check whether or not a password is a valid English word, and reject it if it is.
    - Ensure that the password otherwise meets the following rules:
        - Its length is between 8-16 characters.
        - It contains one uppercase letter, one lowercase letter, and one symbol.
Are there any issues with these rules? If so, how would you fix them?
```

29. Web service running slow, why & solution?

30. Design an internal controller for a refrigerator with no networking involved.

31. I was given a CPU and RAM usage graph of a process and was asked to debug if there's any issue and what that issue could be and how would I solve that. I observed that the CPU was constant but the RAM was increasing linearly. I told that there could be some memory leak in the process. It could be because of resource not closed properly and hence the GC was not able to clear them. I told that I would capture the heap dump to analyse further.

32. There is a multi threaded application which is seeing that the threads are not sufficient. I was asked how would I debug this? I said that I would capture a thread dump to see if the threads are blocked on some operations or if there's a deadlock scenario.

33. There's a service which is handle 1 RPS traffic. How would I find out if the service can handle 1000 RPS? I said that I would take a host which has the same specs of the hosts in production and use a load generating tool like jmeter and stress out the host to see the maximum requests it could handle per second with in the thresholds of CPU and RAM. I would take that number and multiple with the total number of hosts available in Prod to find out the scale in Prod.

34. What is the difference between composition and inheritance. Can you state some usecase where you use them? Multiple servers uploading and streaming music and load is distributed using consistent hashing based on the number of files on each server equally. Any concerns ?(Follow-up: How would you improve this system?)

35. What are the estimation required in next 6 months for a system which accepts web URLS from users, parses them and derives information using machine learning models?

36. How to handle a large file that cannot fit on a single machine?

37. What changes would you make to the system when your app is going from single country to multiple countries internationally?

38. What are advantages and disadvantages of pre-loading hints vs loading from the server for a puzzle game?

39. Multiple servers uploading and streaming music and load is distributed using consistent hashing based on the number of files on each server equally. Any concerns? (Follow-up: How would you improve this system?)

40. We are building a music streaming application in which users connect to our server to hear one of many music playlists for various purposes such as studying, working, sleeping, exercising, etc.
    We are considering whether to host this application on a single dedicated server or use multiple servers.
    What are some advantages and disadvantages of using multiple servers for this application?

41. We are designing a system for our entertainment machines where players must pay for games using our proprietary payment system.
    Players purchase game cards preloaded with credits. When starting a game, players tab their card to a sensor on the machine. The machine connects to our account server via the Internet to verify the game

card. If the player has sufficient credits, they are deducted from the card and the game begins.
To recharge their payment cards, players have two options:

i. pay in cash at designated terminals,
ii. attach a credit card to the payment card, enabling automatic refills when the credit gets low.
We expect to install this system on approximately 125,000 machines in the next year.
What concerns do you have with this system?

42. We are responsible for query logging and analysis for a search engine. We are trying to estimate how much storage we will need to store our logs for the coming year. What kinds of information would you gather to make such an estimate?

43. we are working on a remote public file storage solution. Users upload files to the server, which other users can browse, download, and so on. Often multiple users want to upload the same file, and we would like to avoid having many copies of the same file on our server to reduce our storage costs. Two files are considered copies if they have byte-for-byte identical contents.
To accomplish this, we do the following:

- A user uploads a file to our server.
- We look for all files on our server that are the same length and compare them bytewise.
- If we find two files that are the same, we create a symbolic link from the new file location to the existing file location.
What are some problems with this design and how would you fix them? Are there any ways to make file uploading and storage even more efficient?

44. We are designing a password validation system. The system enforces the following rules:

- Check whether or not a password is a valid English word, and reject it if it is.
- Ensure that the password otherwise meets the following rules:
    - Its length is between 8-16 characters.
    - It contains one uppercase letter, one lowercase letter, and one symbol.
    Are there any issues with these rules? If so, how would you fix them?

System Internals

1. What is context switch? How does it get triggered?
2. What is swap space?
3. Explain the difference between user mode and kernel mode
4. What is difference between Thread and Process? How do they communicate?
5. Difference between stack and heap
6. What is the difference between garbage collection and traditional memory management. Give an example GC is not suitable

OOD/General Programming

1. Explain the difference between overloading and overriding
2.

```
// Derived is a child class of Base. What's the advantage of initializing foo as a Base obje
Base foo = new Base();
Derived foo = new Derived();
```

3. Difference between composition and inheritance
4. Explain what is dependence injection
5. What is the most important object oriented programming principle for complex system
6. You implemented a new interface like Linked List, what to document, already have the function signature
7. What documentation to add when you add a new class to a Collection framework?
8. What is Static Binding and Dynamic Binding?
9. Given a UserManager class with lots of methods, each calling UserService. What's the issue with this class? Answer: The class is redundant, adds no value — could just use UserService directly.
10. What's the benefit of having a stateless class with all non-static methods?

Web/API/frontend Concepts

1. What is same origin in javascript? What is the work around?
2. What is your preferred way to version rest api? Ans: Version through URI, it is most popular and easy
3. How cookies works between web server and browser and how to access it?
4. What is web worker?
5. What's wrong with this line of code: "domElement.innerHTML = customerInputString"? How to mitigate?
6. Difference of HTML5 Web Storage and Cookies

Database Concepts and Internals

1. What is idempotency and how it is used in database
2. What is optimistic concurrency control
3. What is strong consistency vs eventual consistency and what are the usages

Production Issues

1. Given a graph which shows 100% cpu usage and constant memory usage. What issue can you see from this graph? Why would such issue arise and how to prevent?
2. Possible reasons for a slow SQL query?
3. How to measure performance of a GET request API?
4. What are the most important metrics to monitor the health of service?
5. How to maintain service availability?

6. Given a service is currently handling 1 request/sec. What are the steps to handle 1000 req/sec.
7. Given the number of threads have become a bottleneck. why this is happening and a possible solution.
8. There is an image-sharing service where a user can share images with their friends with a TTL. You are asked what information you need to predict the system's scale for next year.
9. There is an analysis service that calls a third-party API for data analysis, but one of the APIs frequently fails. You are asked what solutions you have to address this issue.
10. A service calls a cloud service for data processing and logging. Now, they want to convert it into a microservice to handle this processing locally (without requiring network API support). You are asked what changes are needed for this transition.
11. A service for image processing for children (users upload images, process them, and return results) has become popular, and the current servers can no longer handle the increasing traffic. You are asked how to address this.
12. A service has become slower as traffic increases. You are asked how to solve this issue.
13. What's the difference between a DDoS attack and an increase in request volume due to a website becoming popular?
14. An endpoint can no longer handle the traffic, and now all the clients are retrying because they’re not getting responses. What should you do?

Testing

1. How to test web application on mobile application browser?
2. How to test multithreaded code?

Production Support

1. What are the challenges or drawbacks of using virtual machines compared to physical servers?