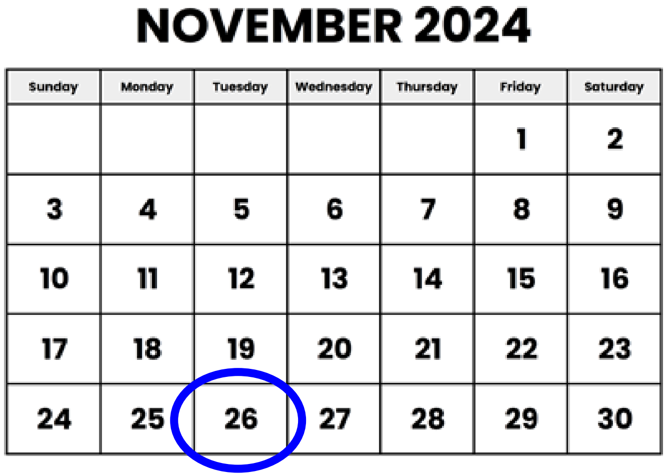
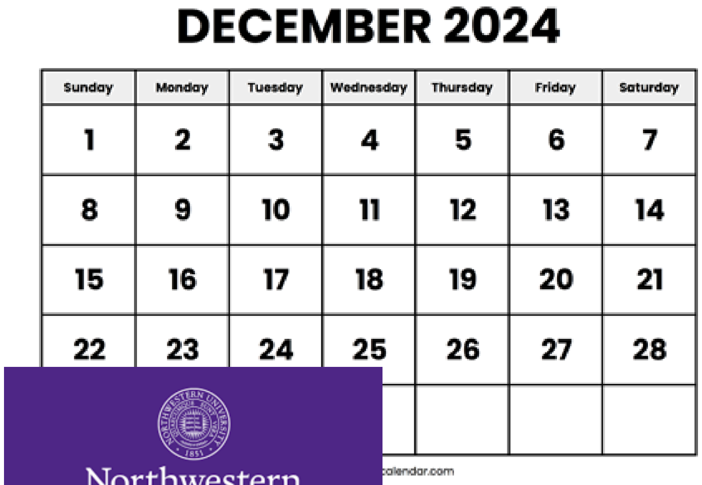
CS 310 : Scalable Software Architectures

Class session on Tuesday, November 26th



NOVEMBER 2024

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30



DECEMBER 2024

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28

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Notes:

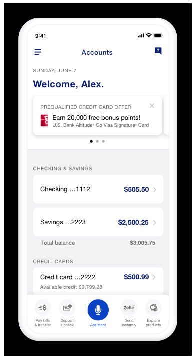
- ***What's left?***
  - *Exam 02 on Tuesday 12/03*
  - *Final project due Friday 12/06*
  - *Project #04 due Friday 12/13 (finals week)*
- ***Class today?***
  - *Review for next Tuesday's exam*
  - *Exam covers all material since last exam*

Security in Multi-tier Systems

- Trust
- HTTPS handshake
- Certificates
- Encryption
- Best Practices
- Authentication
- Authorization

Public/private key encryption

- Encryption is performed using a pair of keys
- Private, secure communication is only guaranteed in one direction. Which direction is NOT private/secure? Why?



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Accounts

SUNDAY, JUNE 7

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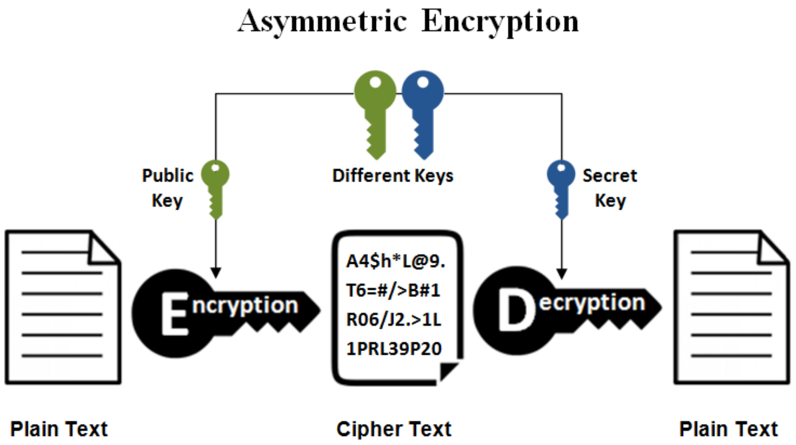
Checking ...1112	$505.50
Savings ...2223	$2,500.25
Total balance	$3,005.75

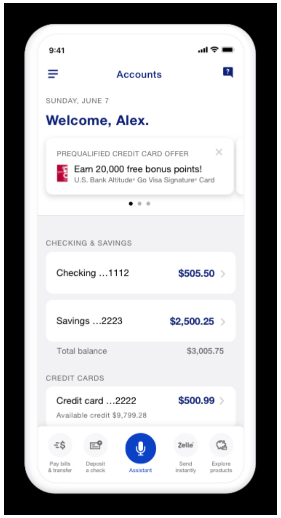
CREDIT CARDS

Credit card ...2222	$500.99
Available credit $9,799.28	



HTTPS "handshake"

- HTTPS is designed for a client to securely obtain the server's public key
- How does it prevent "person-in-the-middle" attacks?



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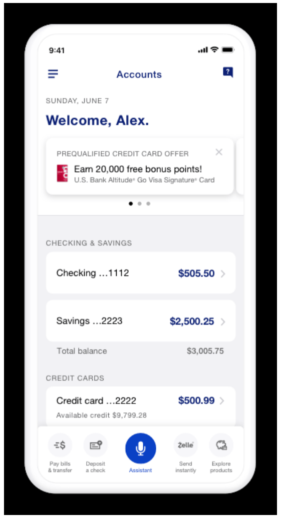
HTTPS "handshake"

- How does the handshake prevent attacks where the user is encouraged to enter/click the wrong URL?



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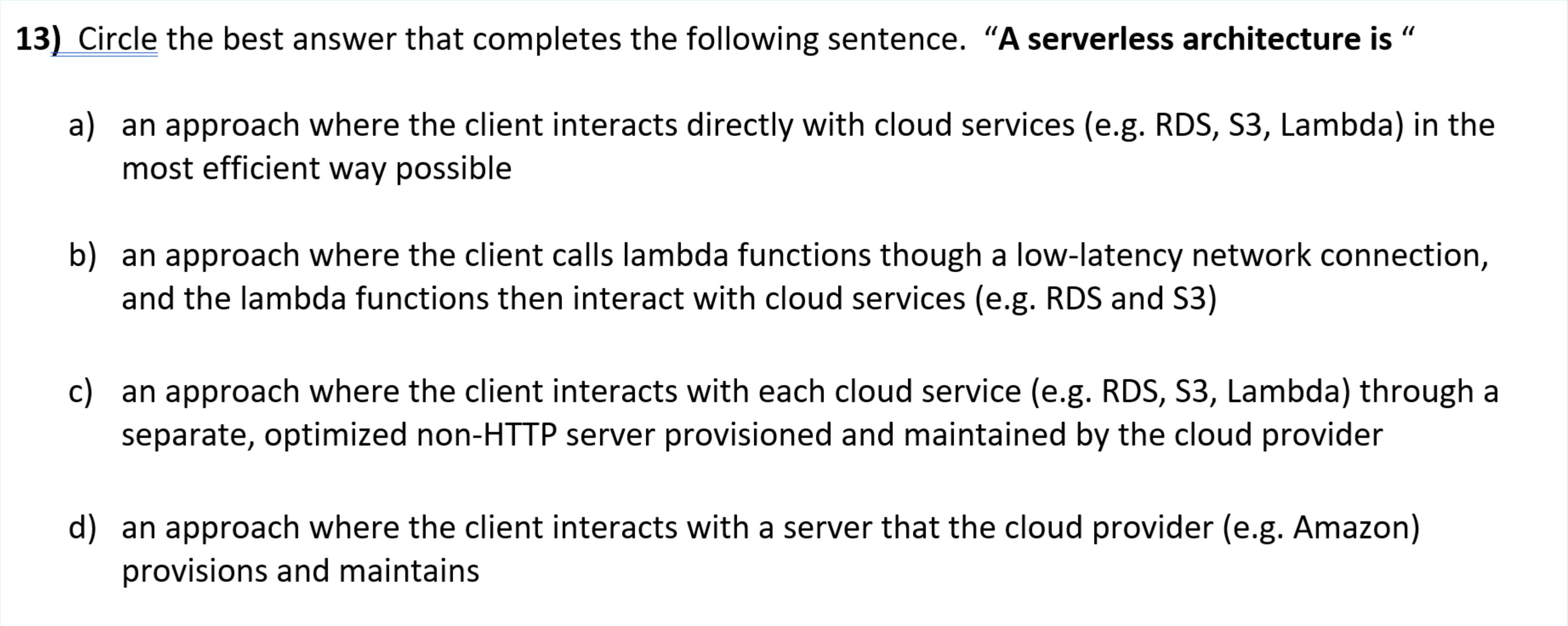
TIME FOR
REVIEW

Serverless



13) Circle the best answer that completes the following sentence. “**A serverless architecture is** “

a) an approach where the client interacts directly with cloud services (e.g. RDS, S3, Lambda) in the most efficient way possible

b) an approach where the client calls lambda functions though a low-latency network connection, and the lambda functions then interact with cloud services (e.g. RDS and S3)

c) an approach where the client interacts with each cloud service (e.g. RDS, S3, Lambda) through a separate, optimized non-HTTP server provisioned and maintained by the cloud provider

d) an approach where the client interacts with a server that the cloud provider (e.g. Amazon) provisions and maintains

Answer here: https://tinyurl.com/cs310-multi

API Design

12) In project 03, a call to **GET /results** may yield a response with a status code of 480 and the message 'uploaded'. Status codes of the form 4xx generally implies an error of some sort, so what is the best explanation for the occurrence of this status code in project 03? Circle the best answer: [5 points]

a) According to the CAP theorem, computers may fail and this denotes a server failure

b) Project 03's API is an example of an asynchronous API, and this means the results are not yet available

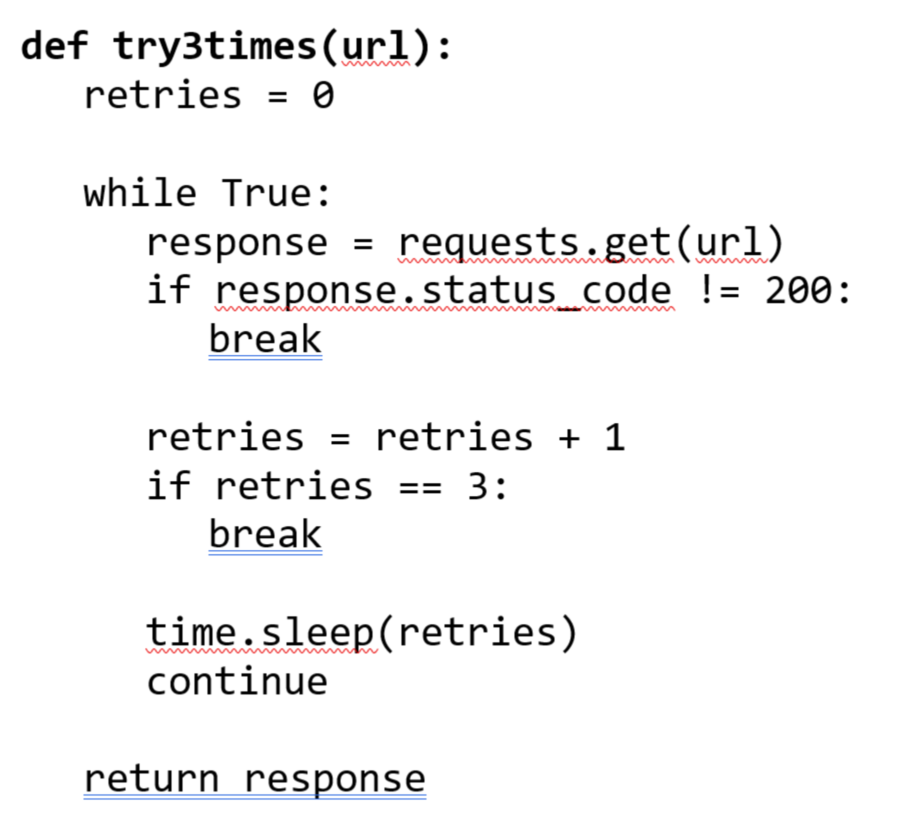
c) Project 03 is based on a serverless architecture, and upload failures are unfortunately a side-effect of serverless architectures

d) This denotes a programming error in the server-side **POST /pdf** function, because this should never happen in a correct version of project 03

Answer here: https://tinyurl.com/cs310-multi

Polling

This function retries GET requests at most 3 times, returning the response. It doesn't work. How would you fix the code?



```
def try3times(url):
   retries = 0

   while True:
      response = requests.get(url)
      if response.status_code != 200:
         break

      retries = retries + 1
      if retries == 3:
         break

      time.sleep(retries)
      continue

   return response
```

Answer here: https://tinyurl.com/cs310-short

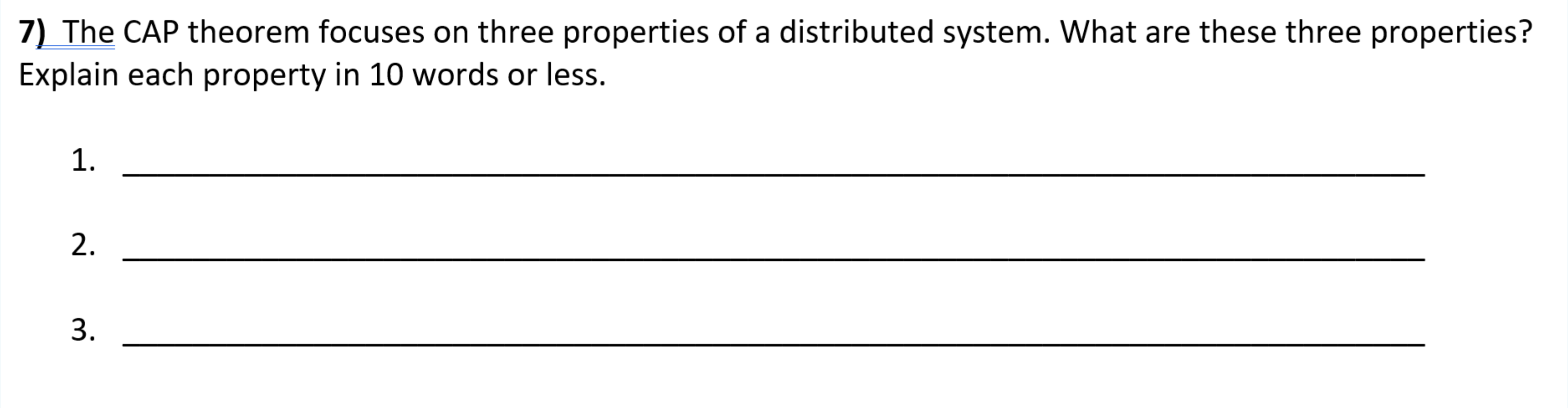
Lambda functions

- *With our web service written in JavaScript + Node.js, we understood that the code ran on a single-thread. Async programming allowed our web service to handle requests from multiple users in a timely way.*

- *When we rewrote our web service using API Gateway + Lambda functions, the lambda functions were configured to run on the same virtual HW as Node.js --- simple 2-core virtual CPUs. From the perspective of supporting execution requests from multiple users in a timely way, should we have programmed our Lambda functions in an async manner? Why or why not?*

Answer here: https://tinyurl.com/cs310-short

CAP Theorem



7) The CAP theorem focuses on three properties of a distributed system. What are these three properties? Explain each property in 10 words or less.

1. ____

2. ____

3. ____

Which systems are the most common: CA, CP, or AP?

Answer here: https://tinyurl.com/cs310-short

S3 design

4) Amazon's S3, when first released, was an example of a system that was eventually consistent. What did this mean in terms of building a system using S3? Circle the best answer:

a) S3 was not fault tolerant, and may occasionally fail to respond.

b) S3 was fault tolerant, but if a client updated a bucket in S3, that update would be limited to just one of the sites in the region.

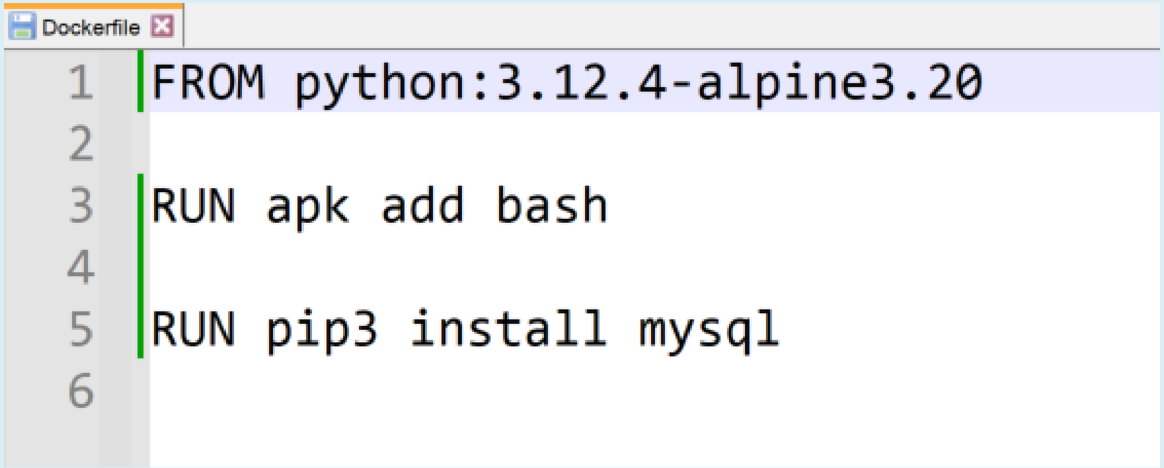
c) S3 was fault tolerant, and updates were replicated across all sites in a region, but the timing of these updates was unpredictable.

d) S3 was fault tolerant, updates were replicated across all sites in a region, and the timing of the updates was invisible to the client.

Answer here: https://tinyurl.com/cs310-multi

Docker

A Dockerfile is used to create a Docker image. Explain each line of this Dockerfile.



```
FROM python:3.12.4-alpine3.20

RUN apk add bash

RUN pip3 install mysql

```

VMs

- **Why are Virtual Machine images so much larger than Docker images?**

Answer here: https://tinyurl.com/cs310-short

Lambda layers

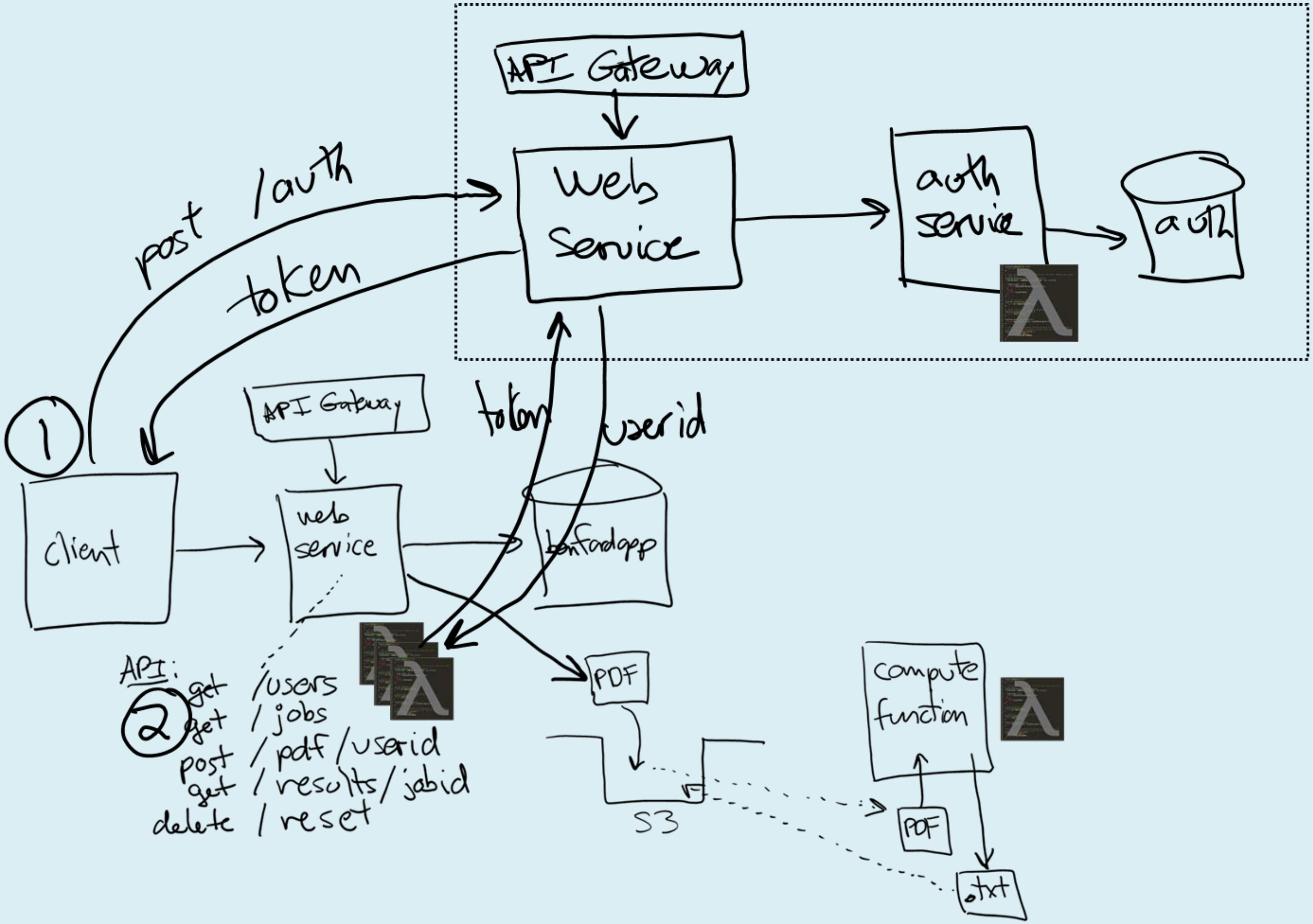
- **Why are Lambda layers so much smaller than Docker images?**

Answer here: https://tinyurl.com/cs310-short

That's it, thank you!

Project 04

- **Project 04 adds authentication (users & pwds)**


API Gateway
Web Service
auth service
auth
post /auth
token
1
client
API Gateway
web service
benfordapp
token
userid
PDF
S3
compute function
PDF
.txt
API:
get /users
2 get /jobs
post /pdf/userid
get /results/jobid
delete /reset