

Team 12

Nathan's Monarchy

Client: Nathan Brockman

Advisor: Diane Rover

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Unified Butterfly Recorder Faculty Panel

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Ryan McNally, Grace Wigen, Timothy Ellis

Context

- Client: **Reiman Gardens**
- Iowa Butterfly Survey Network



What is UBR?

- A mobile application to track butterflies
- Why is it needed?
 - Research purposes
 - Pen and paper
 - Old mobile application



Current Solution: Paper

Iowa Butterfly Survey Network Field Form

Date _____ Location _____ Monitor _____

Start time _____ Stop time _____ Recorder _____

Wind (circle one) Calm Light Air Light Breeze Gentle Breeze Moderate Breeze

Sky/Cloud Cover (10% increments, 0%= Clear): _____ Temp: _____

Transect Key: A=

B=

C=

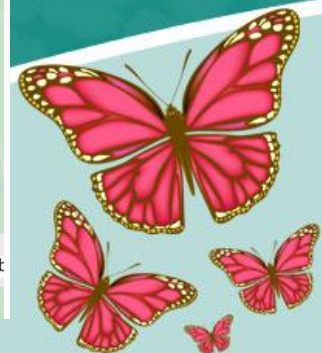
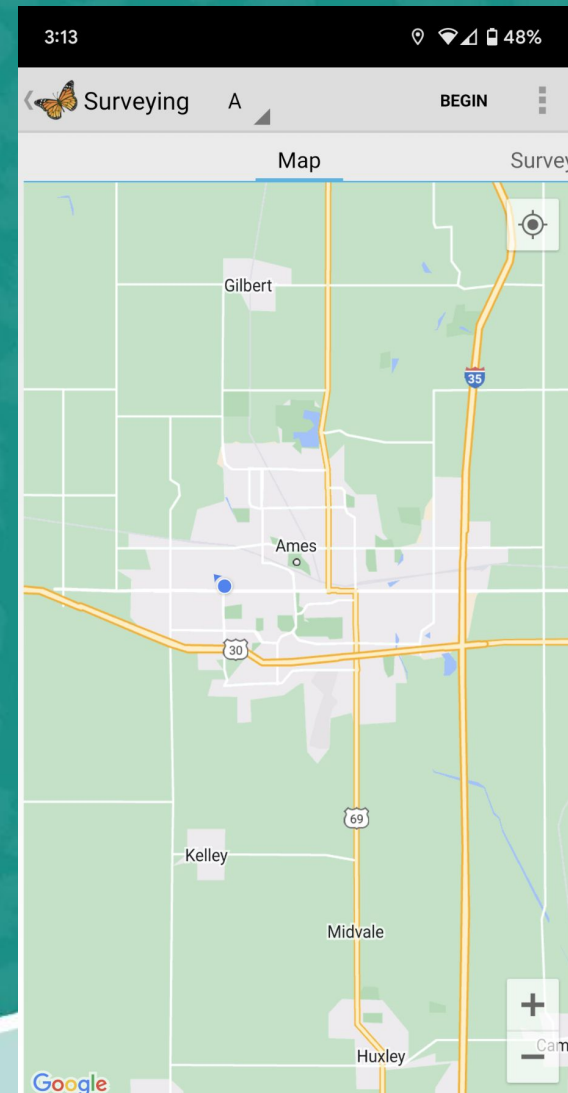
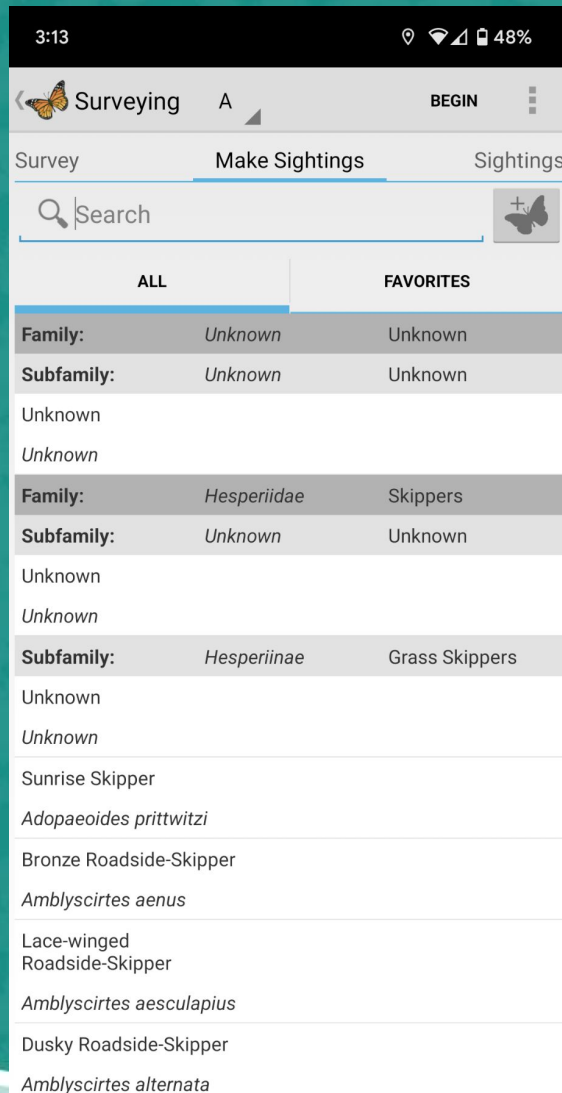
D=

E=

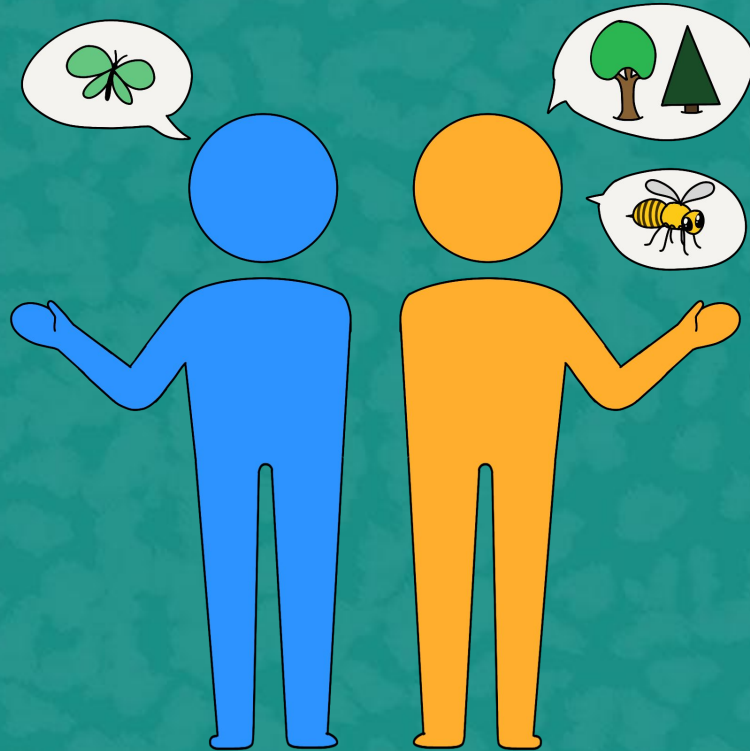
		A	B	C	D	E	Totals
Swallowtails							
Black Swallowtail	<i>Papilio polyxenes</i>						
Giant Swallowtail	<i>Papilio cresphontes</i>						
Eastern Tiger Swallowtail	<i>Papilio glaucus</i>						
Unknown:							
Additional:							
Whites and Sulphurs							
Cabbage White	<i>Pieris rapae</i>						
Clouded Sulphur	<i>Colias philodice/eurytheme</i>						
Cloudless Sulphur	<i>Phoebis sennae</i>						
Unknown:							
Additional:							
Coppers, Hairstreaks and Blues							
Gray Hairstreak	<i>Strymon melinus</i>						



Current UI: 10 Years Old



Users



Primary Users:

New trained volunteers

Returning volunteers

Secondary Users:

Hobbyists and adopters



Requirements

- FAST (faster than the paper form)
- Cross Platform
- Basic offline functionality
- Ability to upload surveys to database from app
- Build to last several years with little to no maintenance
- Easy to use
- GPS tracking and weather checks



Application Tradeoffs

Hybrid Web App

Dealbreaker:

No offline functionality and limited device features

Cross-Platform

Dealbreaker:

Longevity concerns with Play Store/App Store

iOS/Android Native

Dealbreaker:

Does not meet cross platform requirements and we do not have time/resources to develop both at once

Progressive Web App (PWA)

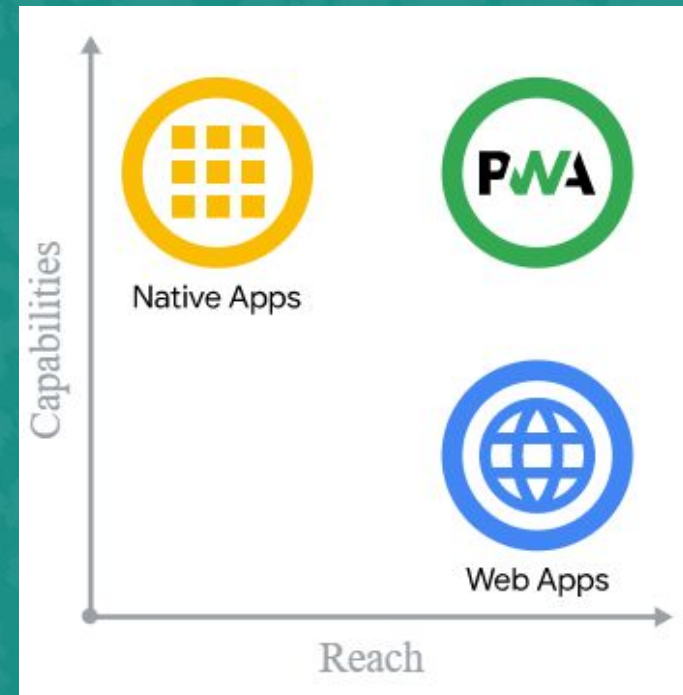
Negative:

Limited offline features



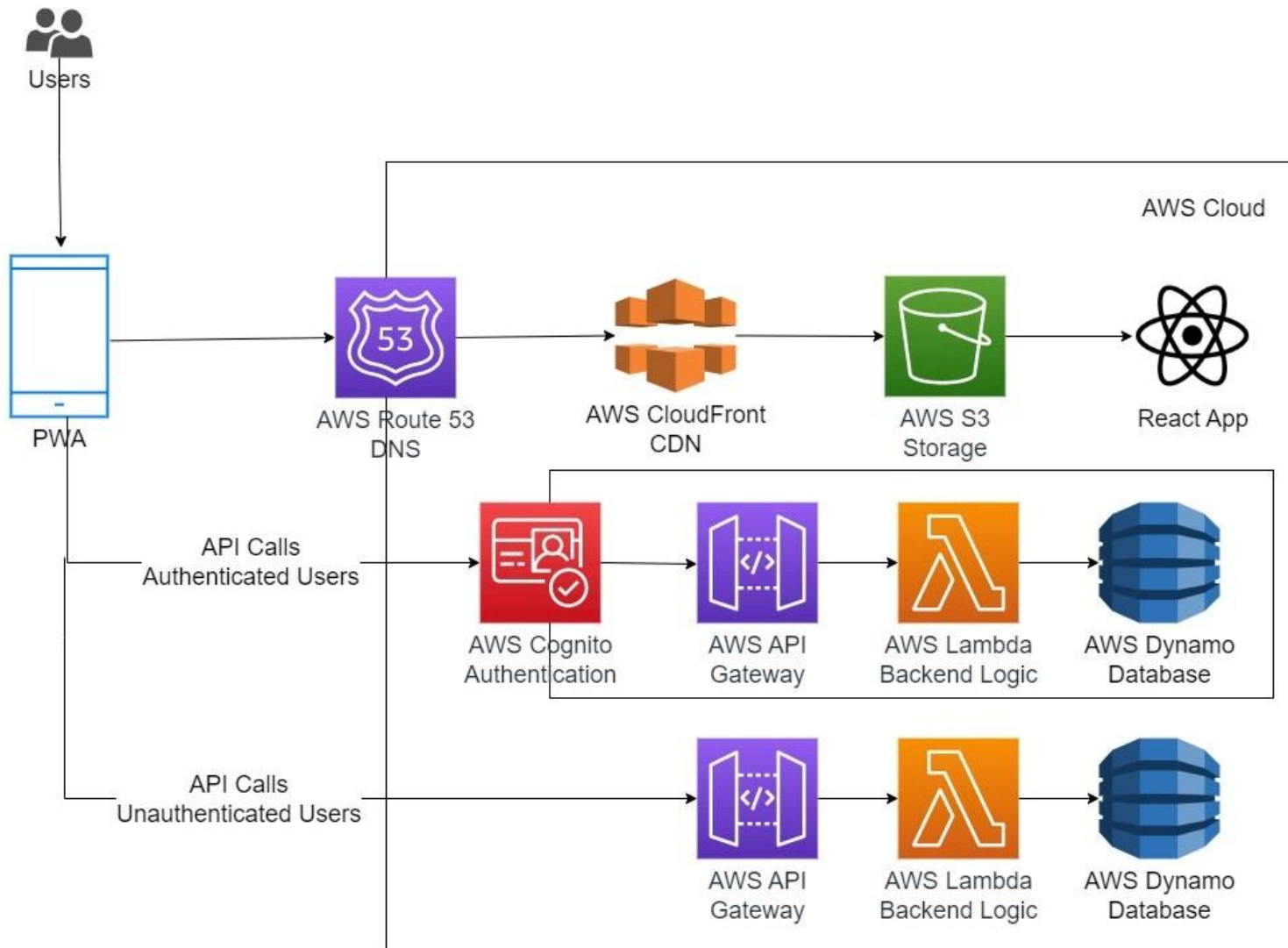
Proposed Solution

- New Infrastructure as Code
 - Defined using the AWS Cloud Development Kit
- Progressive Web Application (PWA)
 - Mobile application
 - React front-end
 - Serverless back-end (AWS)



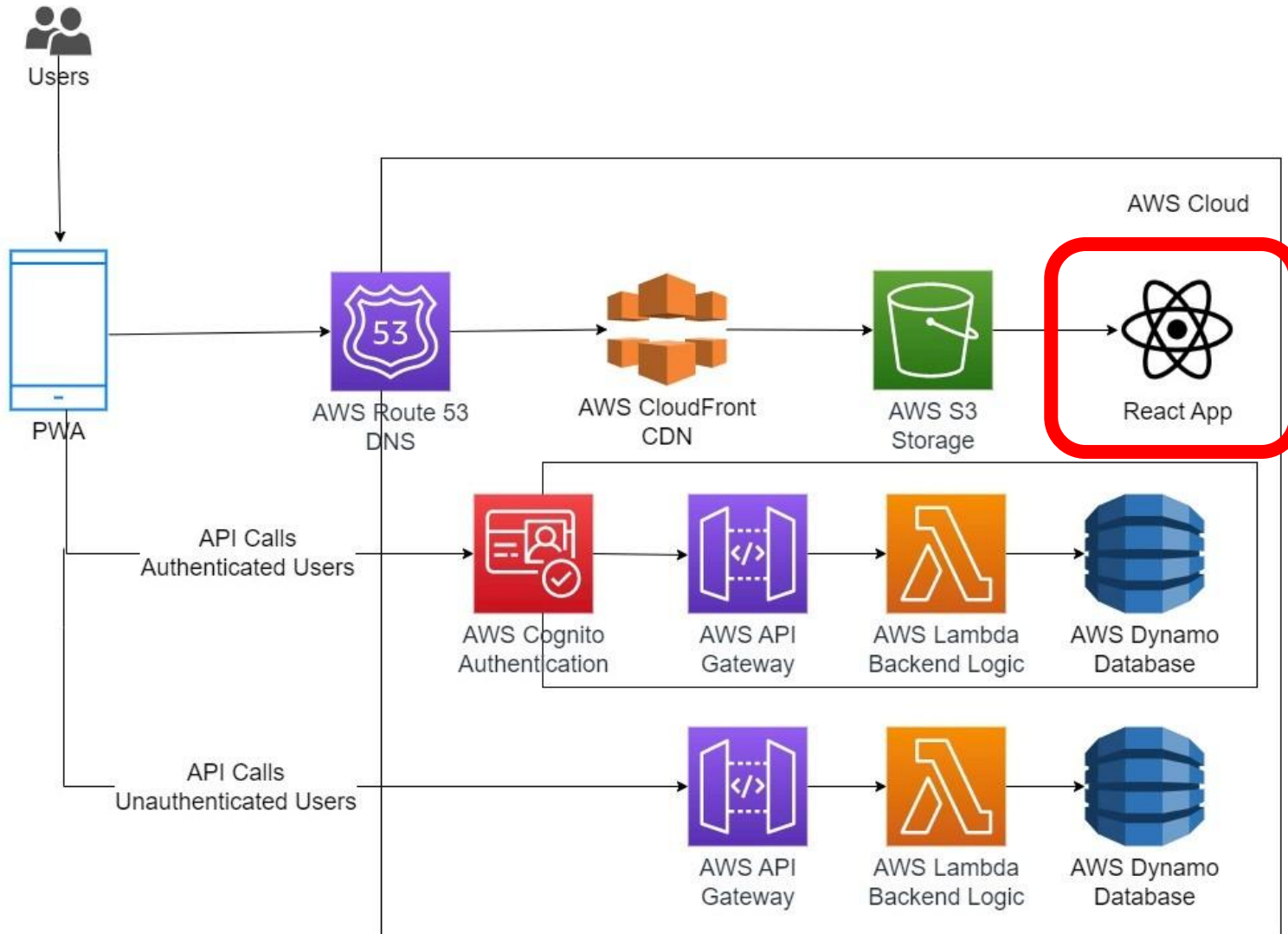
Design Overview

Unified Butterfly Recorder Application



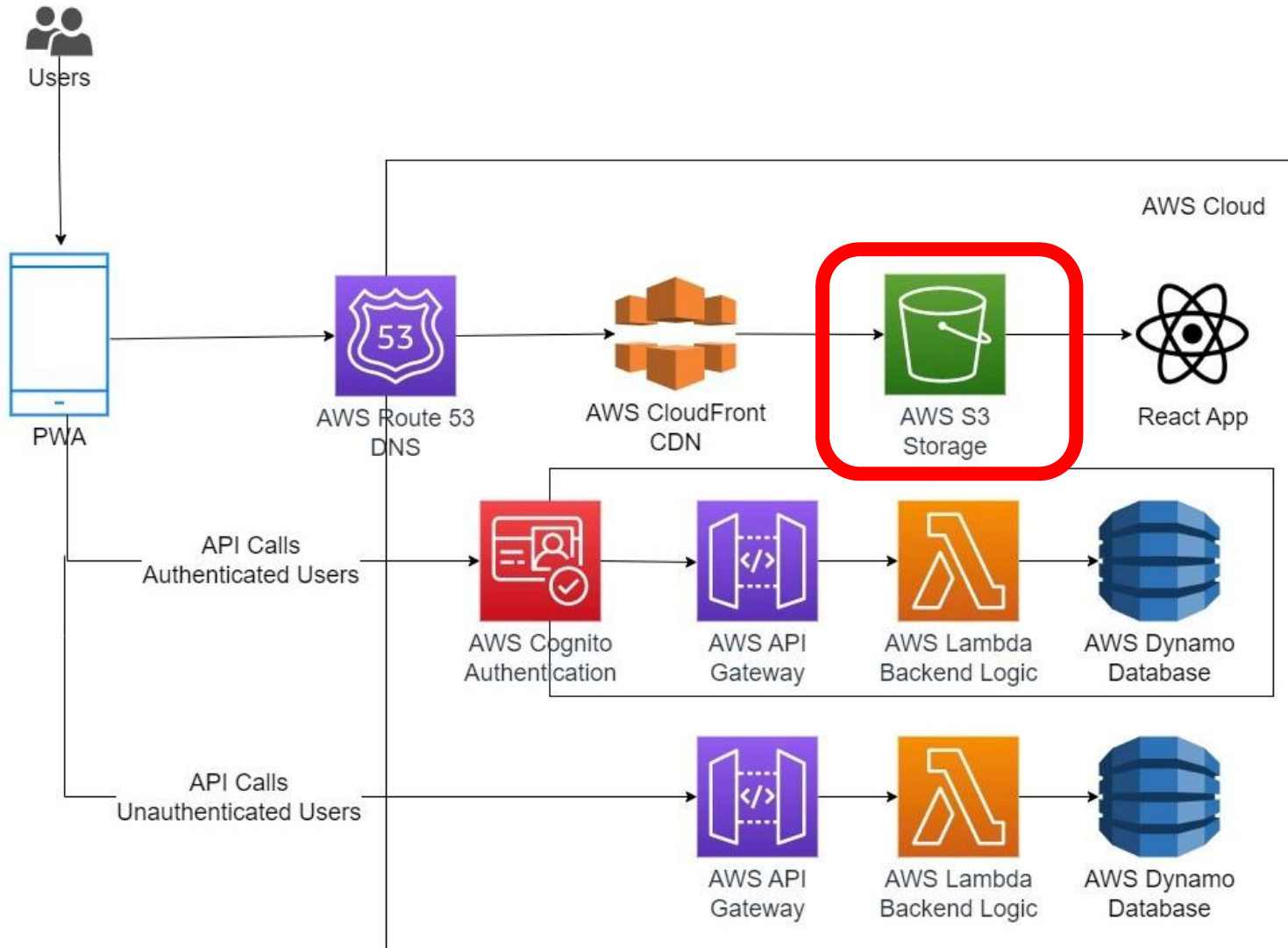
Design Overview - React App

Unified Butterfly Recorder Application



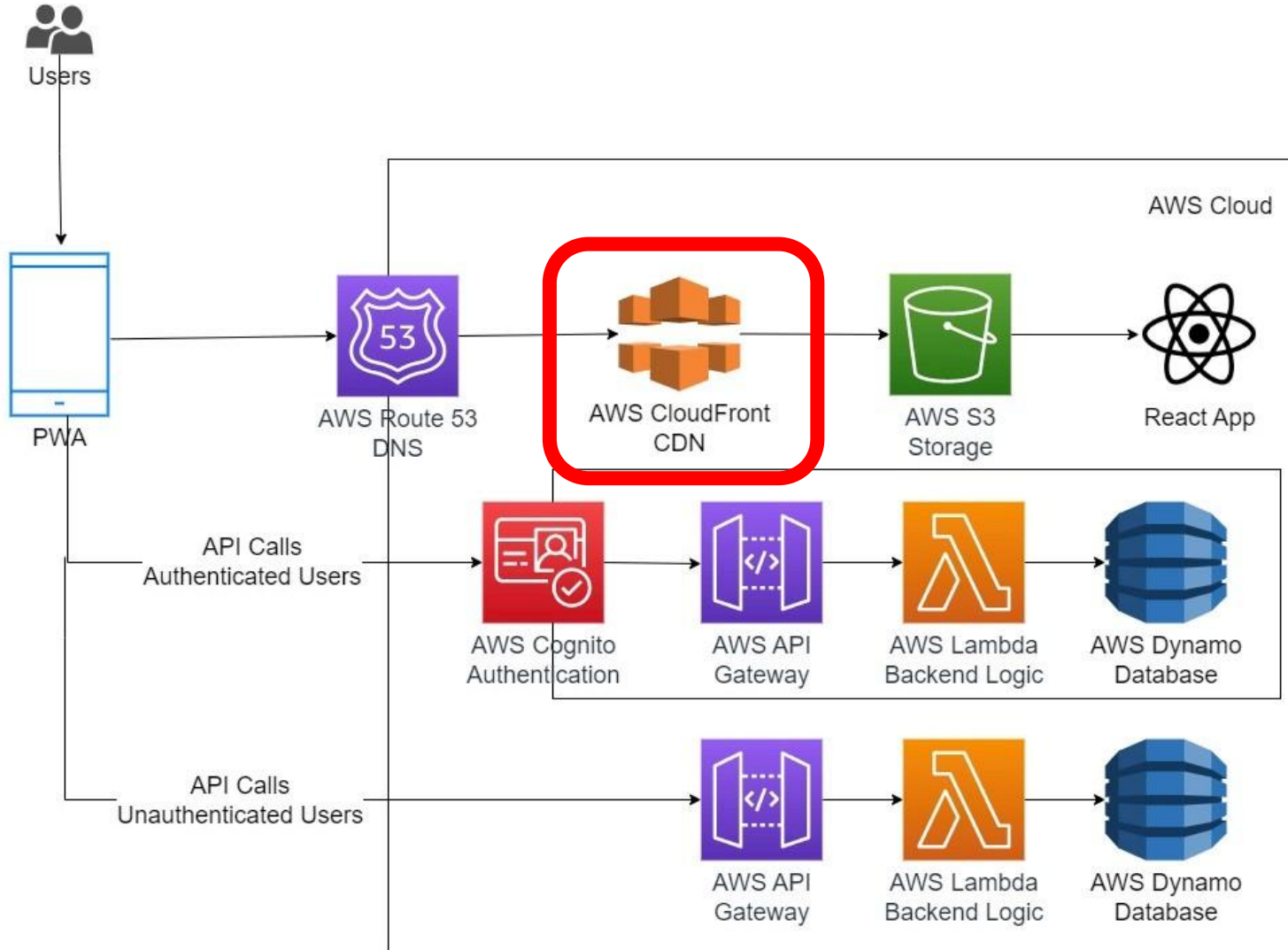
Design Overview - S3 Storage

Unified Butterfly Recorder Application



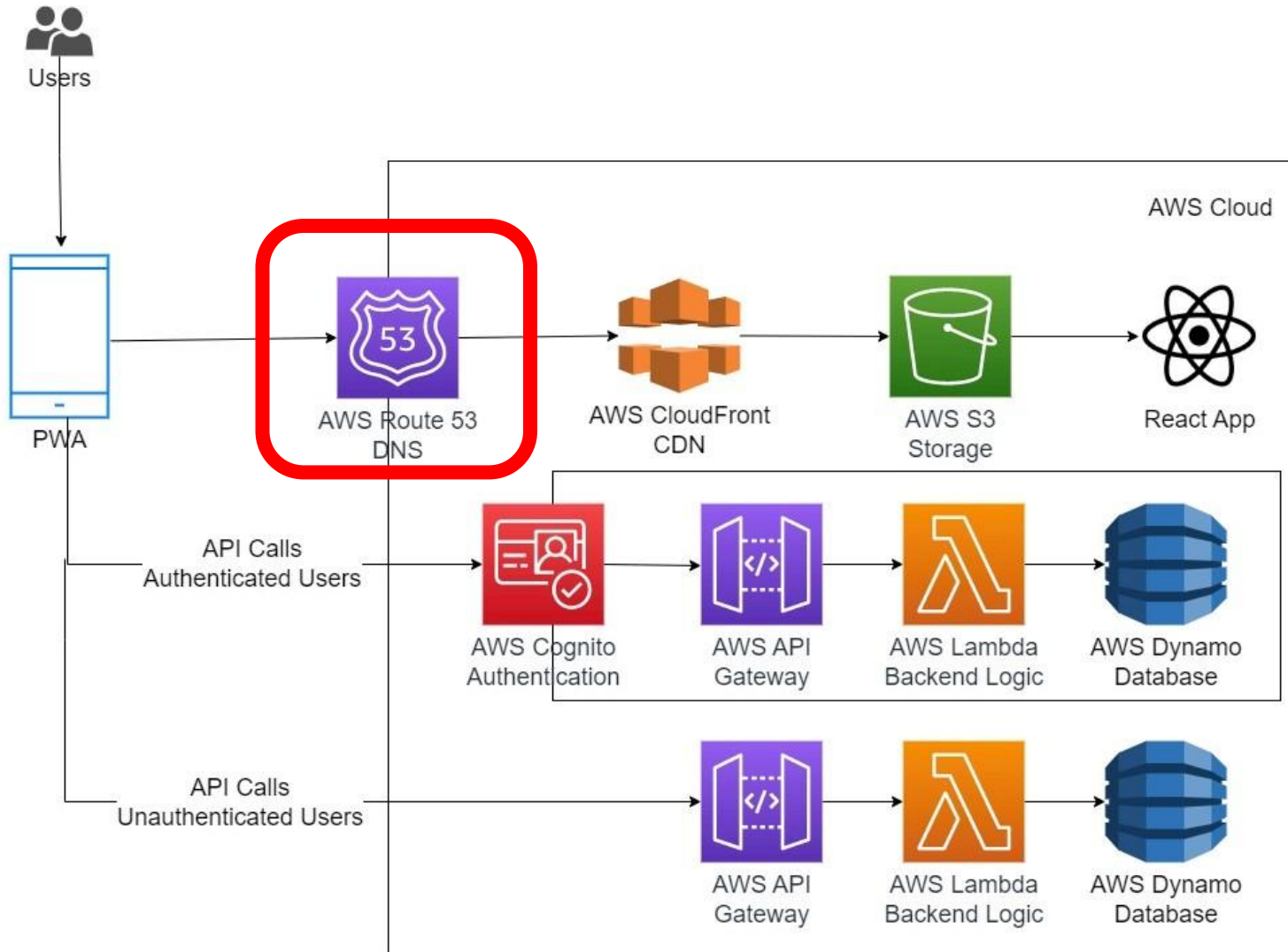
Design Overview - CloudFront Content Delivery Network

Unified Butterfly Recorder Application



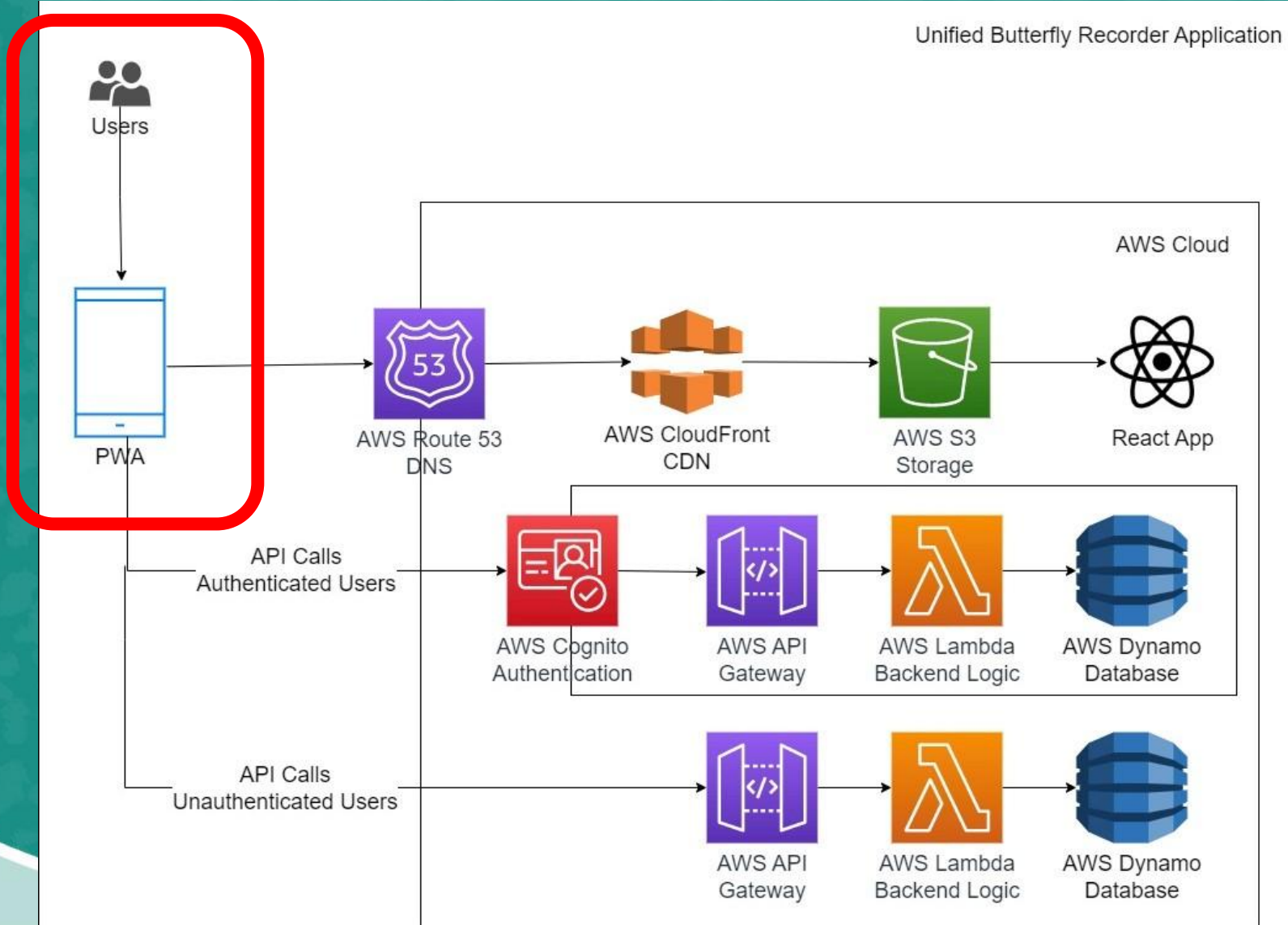
Design Overview - Route53 Domain Name Service

Unified Butterfly Recorder Application



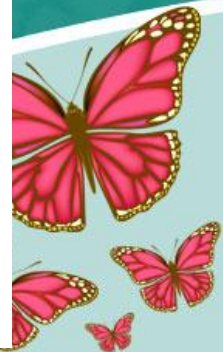
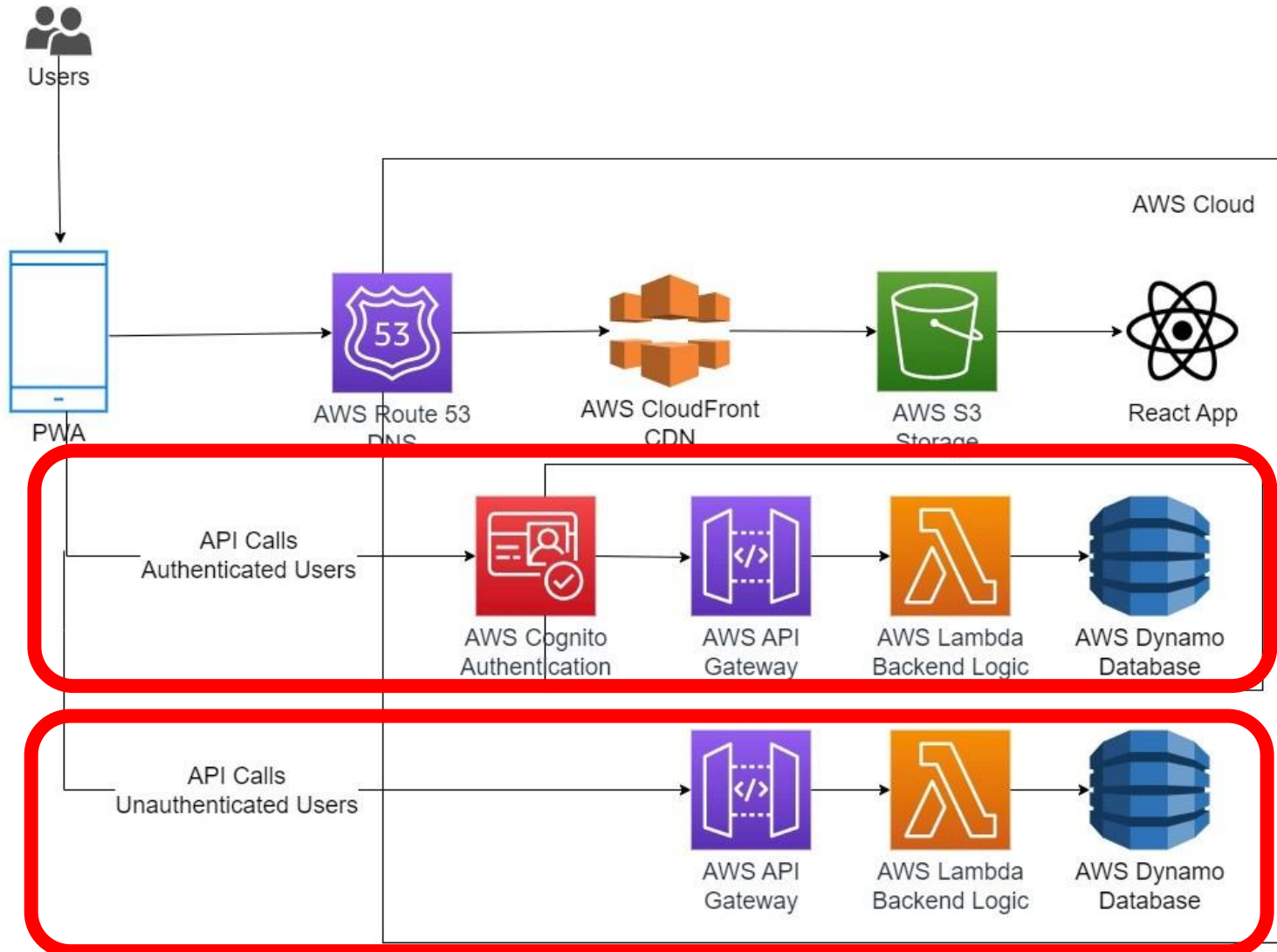
Design Overview - Users Access PWA

Unified Butterfly Recorder Application



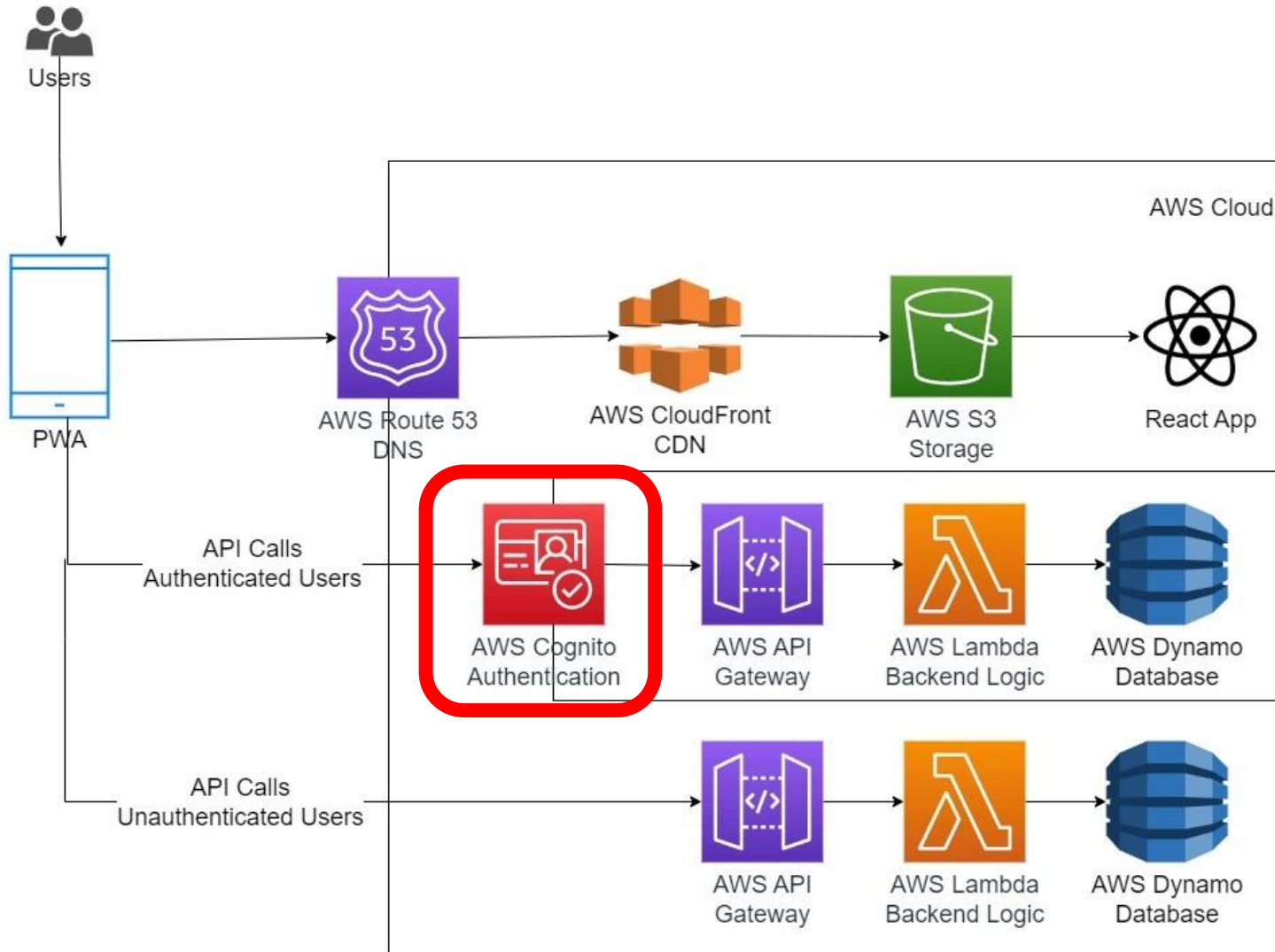
Design Overview - API Routes

Unified Butterfly Recorder Application



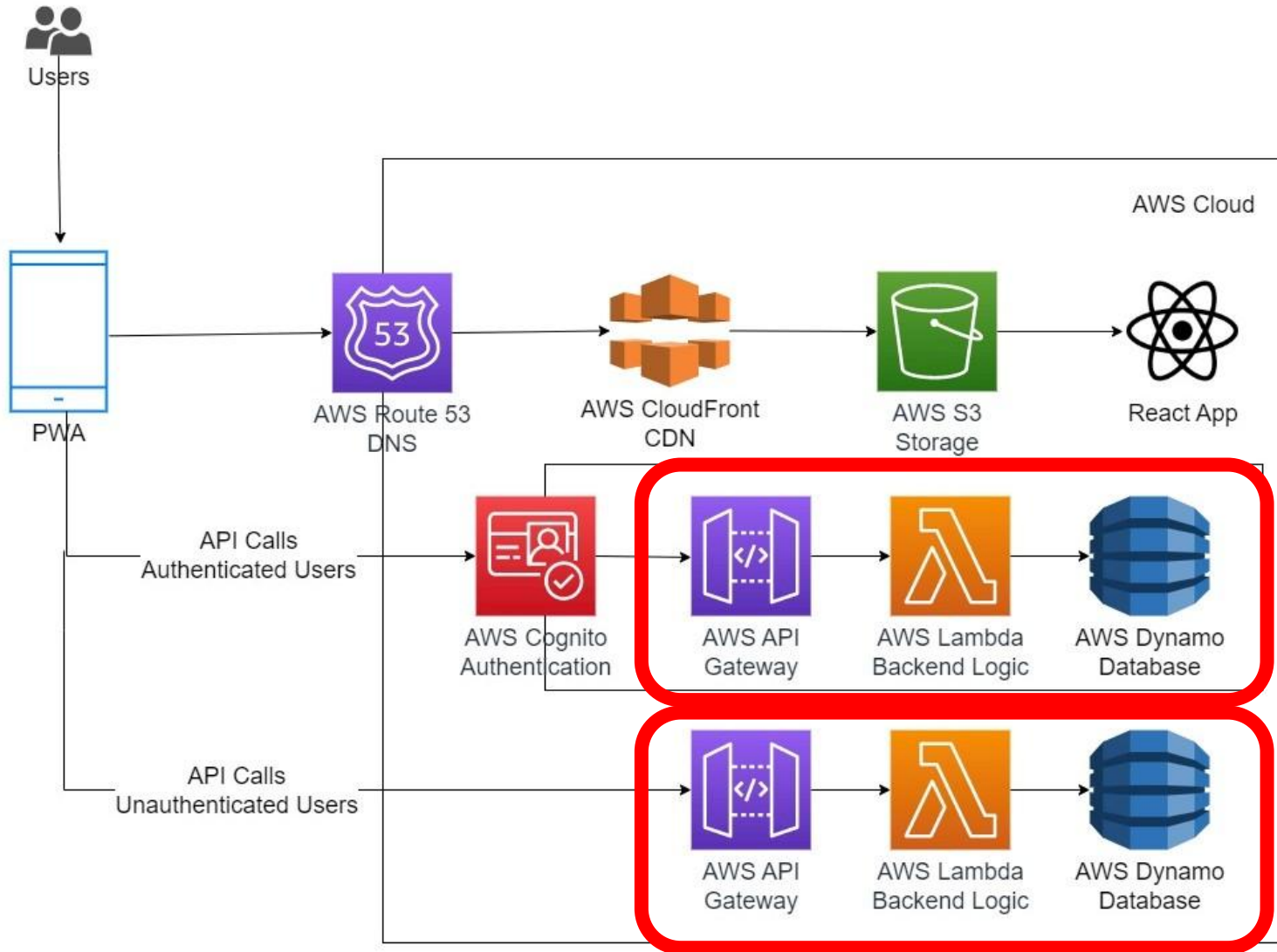
Design Overview - Authentication

Unified Butterfly Recorder Application



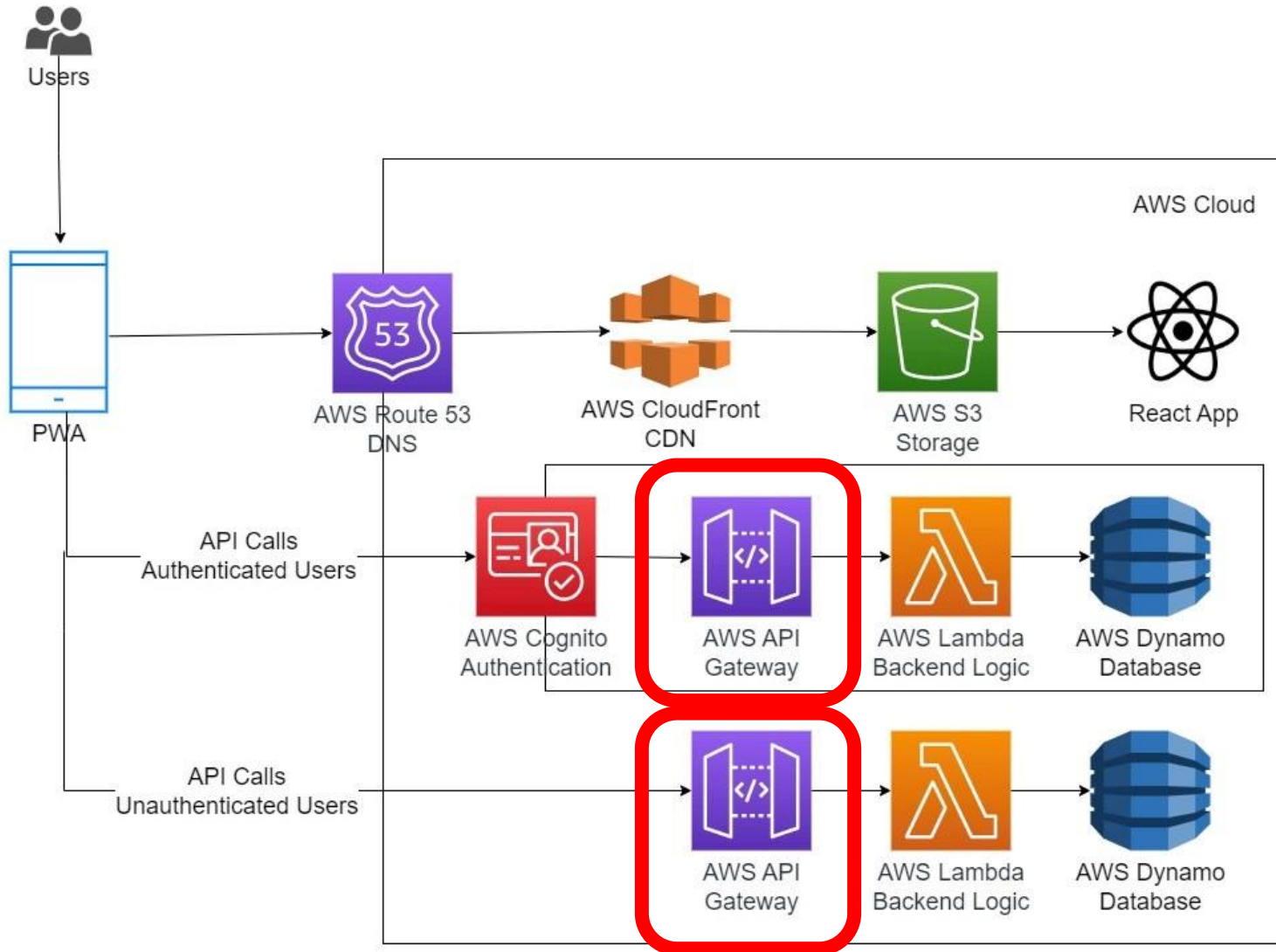
Design Overview - API Routes

Unified Butterfly Recorder Application



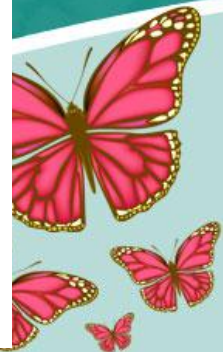
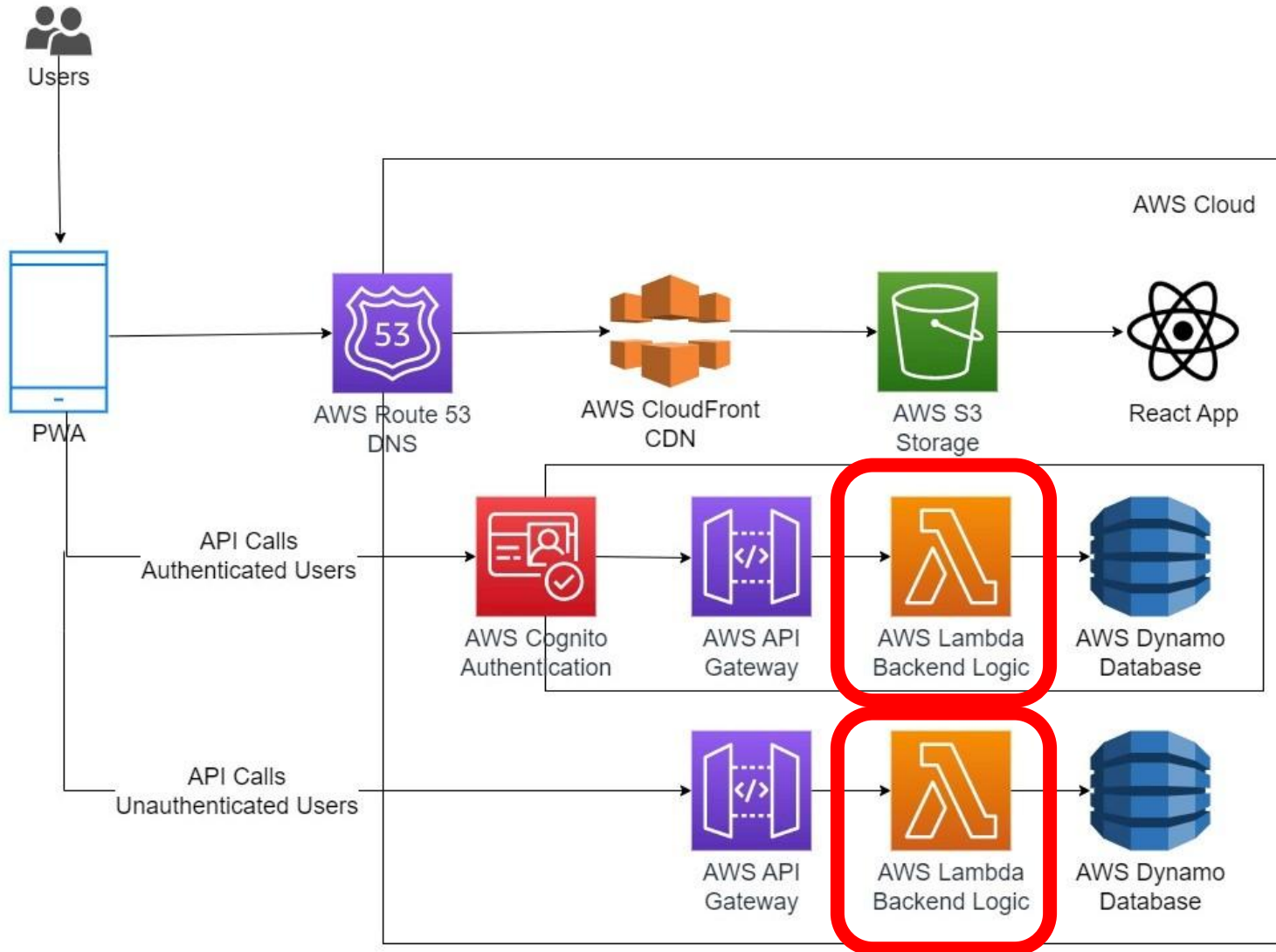
Design Overview - API Gateway

Unified Butterfly Recorder Application



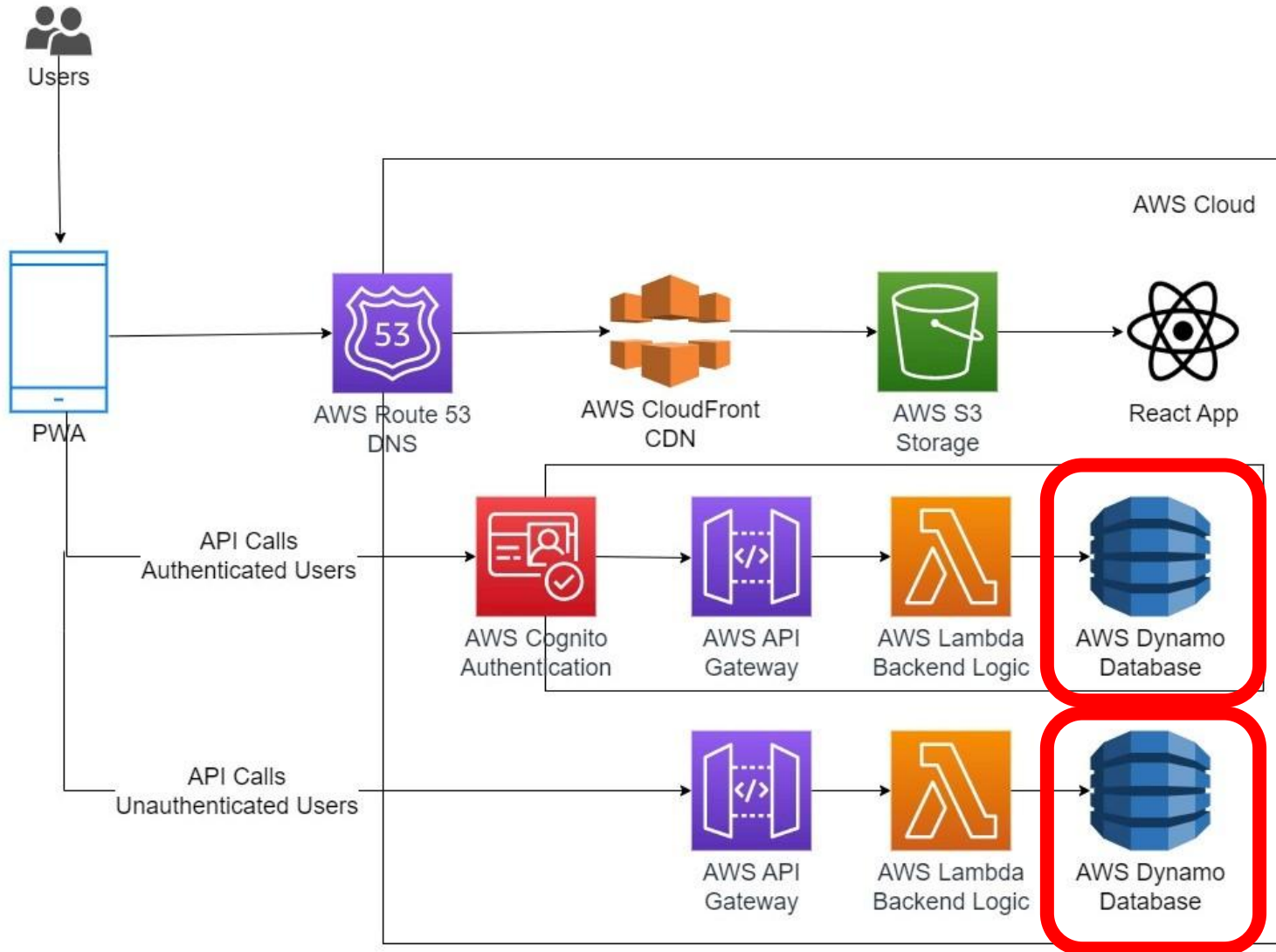
Design Overview - Lambda (Logic)

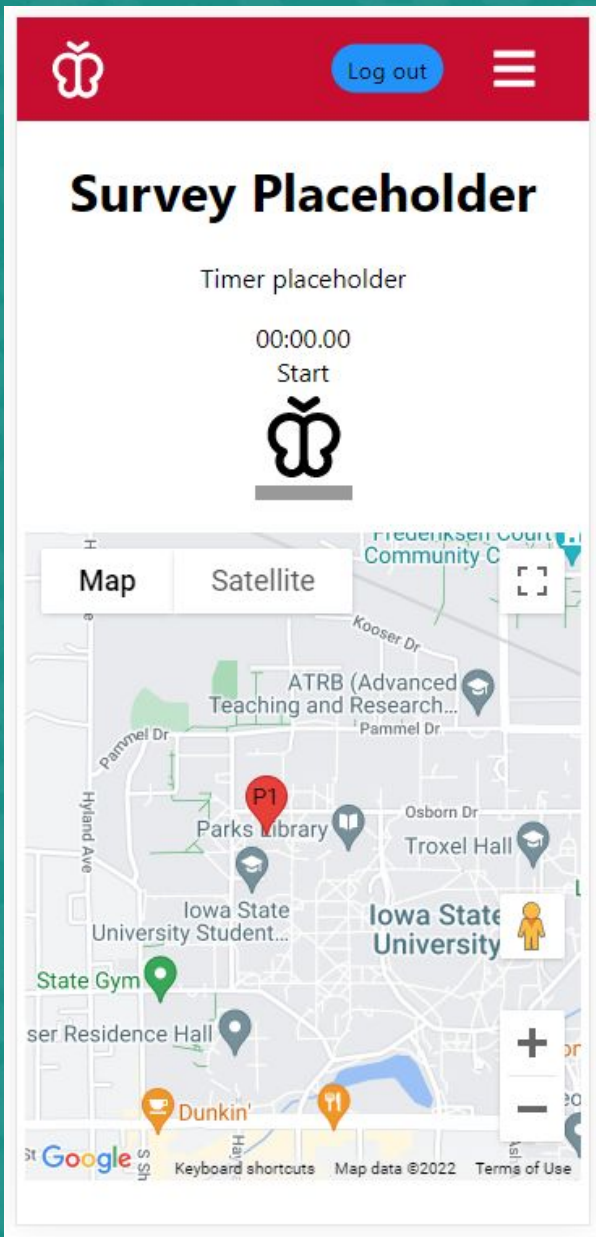
Unified Butterfly Recorder Application



Design Overview - Database

Unified Butterfly Recorder Application



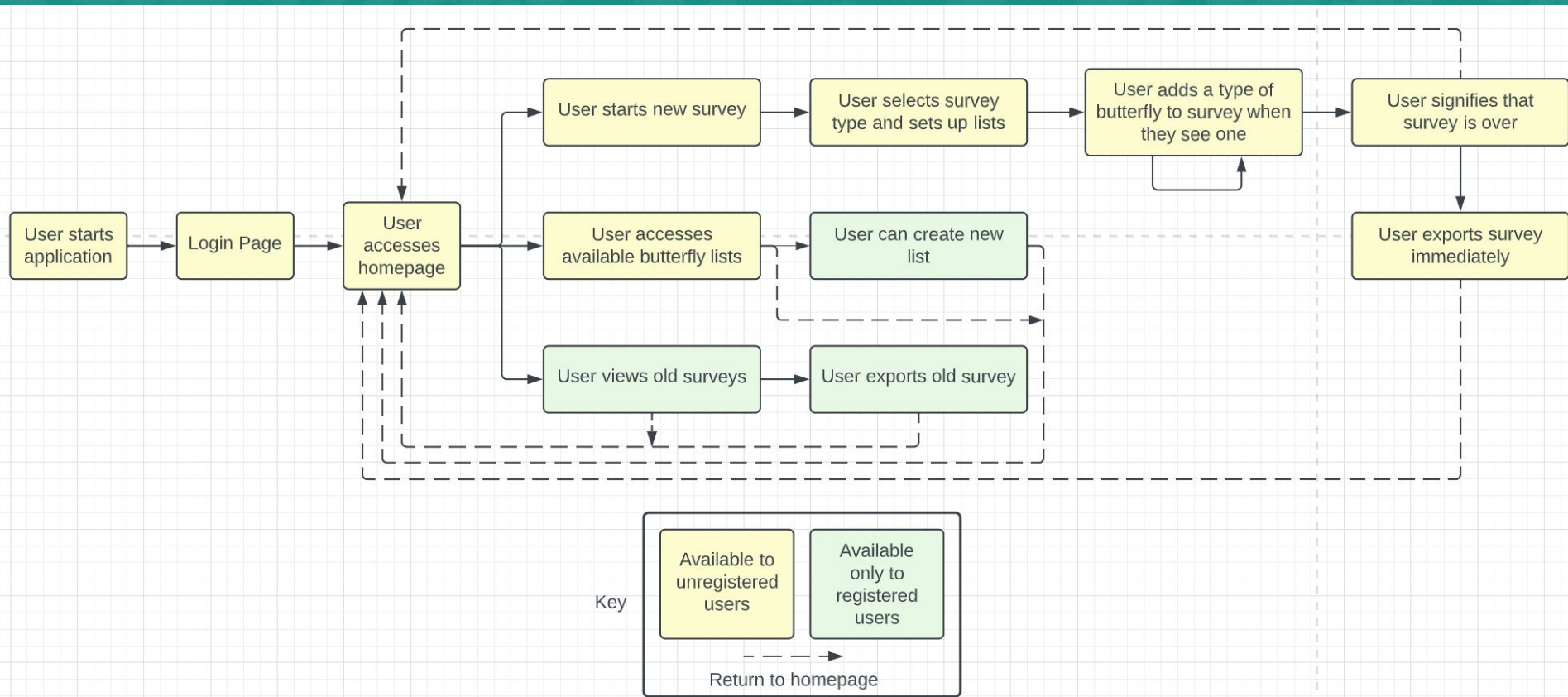


Prototype

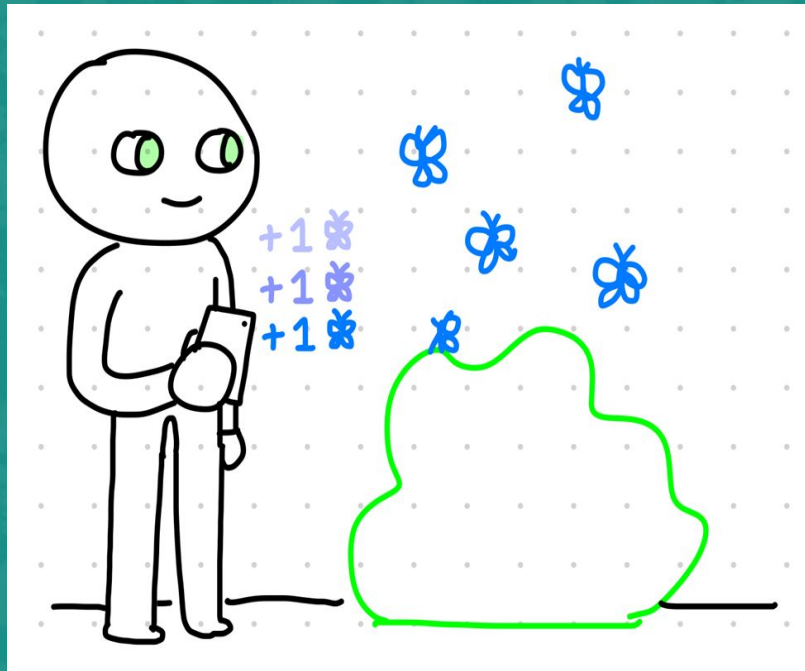
- Functional PWA
- Proof of concept
- Demonstrates feasibility
- Implements core functionality of application
 - Users press butterfly button
 - Coordinates recorded
 - Butterfly sightings tallied
 - Weather information acquired
- Authentication operational



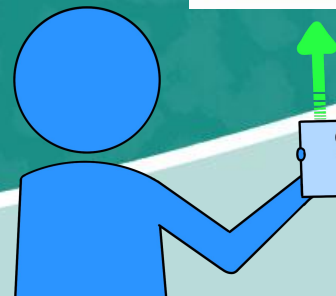
UI Flowchart



How Does It Work?



1. Install app
2. Create new survey
3. Walk a route, tapping the photo of any butterfly species the surveyor encounters
4. Each screen tap records quantities, coordinates, weather and timing



Testing

- GitLab CI/CD for Regression Testing
- Unit Testing
 - React Components
 - Function Testing
- Cloud Resources
 - Backend Lambda Functions
 - Independent AWS component testing
- User Testing & Requirements Validation
- High-Level System Testing
- Research Needed



CI/CD



Project Timeline

Task	Pre-492	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Define cloud architecture as IaC	█															
Prototype UI (Figma, etc)	█															
Determine API routes required	█															
Determine Database fields	█															
Determine Desired Sensors	█															
Define database fields in code		█	█													
Define UI as code in React		█	█	█	█	█	█	█	█							
Build API's				█	█	█	█	█	█							
Build Lambda's							█	█	█	█	█					
Map integration								█	█	█	█	█	█			
CSV import/export										█	█	█	█	█		
Testing															█	█

Note: "Define cloud architecture as IaC" includes defining the frontend, backend, authentication and storage.



Challenges & Feedback

- PollardBase (North America research database)
 - Integration challenges due to API development timeline
- Cellular connection required for PWA GPS calls



Conclusion and Overview



- Unified Butterfly Recorder will replace an outdated app
- UBR will help volunteers easily survey butterfly populations
- This survey data will help researchers be able to draw more accurate conclusions about butterfly populations



Thank you for your time!

