Software Architecture

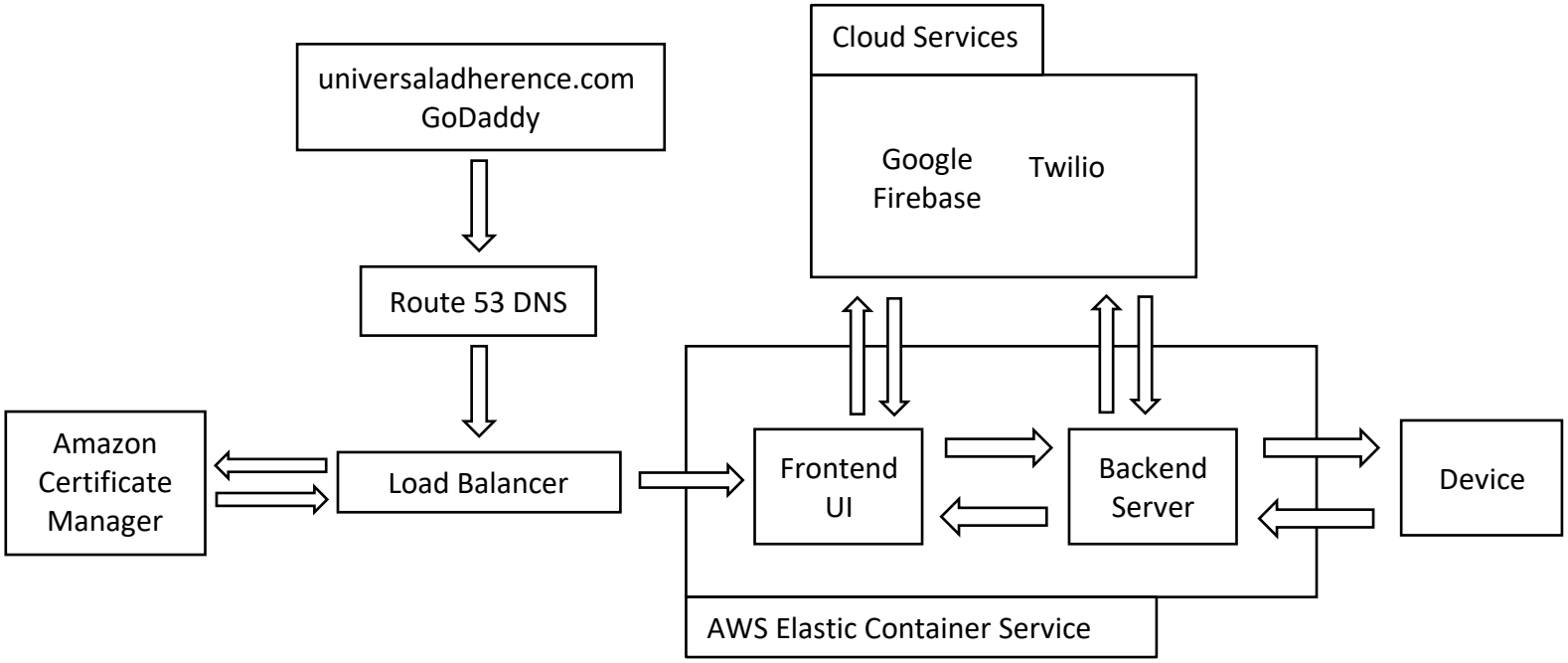

Figure 1. Visual diagram of software architecture elements and communications.

System Summary

The software system depicted in Figure 1 is aimed at providing an online application for patients and doctors to track real-time adherence of eye medication. The system is viewable on standard desktops as well as mobile devices. The application is composed of three primary modules (i.e., Main Panel, Calendar Panel, and Alarm Panel). Through these three interfaces the patients and doctors can view when patients have taken eye medication and also update the device schedule and any text messages the patients will be receiving as reminders.

The client-side content is all developed using the React framework, which is a JavaScript library created by Facebook for the creation of User Interface (UI) elements. In the backend, a Node server is used to communicate with the device and place data into the database. This application leverages Google Firebase for User Authentication and Authorization as well as their Realtime Database services. The software system is being hosted through AWS and leverages many features of AWS such as Route53 for DNS services and Elastic Container Service (ECS) for the deployment of containerized software. The following sections describe each component of the software system.

GoDaddy

There are many domain name services out there, but this project used GoDaddy to register the domain universaladherence.com. Through the GoDaddy interface four custom nameservers from a hosted zone in Route 53 (i.e., Amazons DNS solution) were added to pair the domain name with the application.

Route 53 DNS

Route 53 is Amazon's solution to manage domain names and DNS services. This project uses a hosted zone within Route 53 to manage the name servers for the domain name universaladherence.com.

Load Balancer

A load balancer can be used to effectively scale an application over many different instances, but it can also be used to listen for HTTPS traffic. A listener can be created to provide a clean

application independent implementation of HTTPS. This application uses an SSL certificate paired with the listener to provide secure connections to the application.

Amazon Certificate Manager

A certificate must be requested and issued to use HTTPS within an application. There are many providers that are free these days and Amazon Certificate Manager (ACM) is one such provider. This system used ACM to request an SSL certificate for the universaladherence.com domain name.

Amazon Elastic Container Service

Many software developers use containerization tools such as Docker to bundle applications into compact easy packages. This provides a standard environment on every machine and can simplify the deployment process. This application utilizes Docker and Amazon Elastic Container Service (ECS) to containerize the application and easily deploy it a web server within AWS. Different containers can be uploaded into a repository and utilized in deployment tasks.

Frontend UI

The user interface, or client-side view of the application, is developed with the React framework which is a JavaScript library developed by Facebook for the creation of UI elements. This library provides all the tools to structure static and dynamic content of a web page. The frontend is also utilizing Firebase authorization and authentication to provide secure login and access of content.

Backend Server

This software uses a Node backend server to communicate with the device and the Firebase database. Node or Node.js is a free open source server environment in the JavaScript programming language. The server can also receive requests from the device and frontend to send text messages.

Cloud Services

This software utilized two cloud services (i.e., Google Firebase, Twilio) to accomplish certain tasks within the application. Google Firebase is used to provide user authentication and

authorization within the site so that there is secure access to the application and also a real-time database service that stores the user and application data in a NoSQL database. Twilio provides a clean API to integrate SMS messaging into an application. This software system uses Twilio to send text message reminders to patients.

Developer Tools

Developers often use many tools when creating a software system. Below is a list, along with a short description, of the primary tools used in the development of this software:

- GitHub – Revision control used to host source code throughout development and track changes as features are expanded
- Nginx – Server that is being used to redirect http traffic coming in on port 80 to https on port 443
- Amazon Elastic Container Service (ECS) – Docker container deployment onto AWS
- Docker – Containerization software
- CircleCI - Continuous integration testing
- Twilio – API for SMS messaging
- Visual Studio Code (VSCode) – Code editor for Windows, Linux and macOS