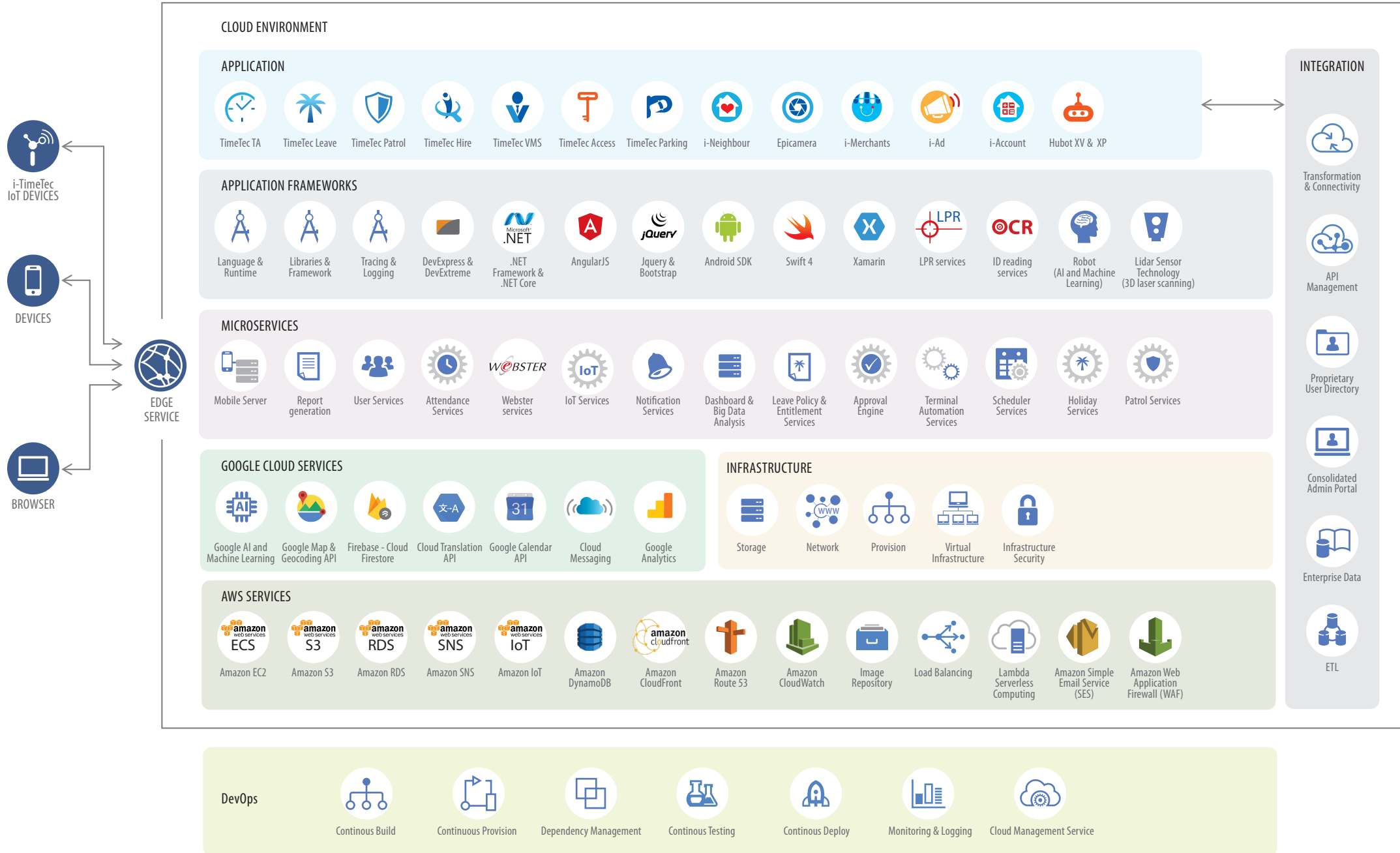


TIMETEC CLOUD TECHNOLOGY ARCHITECTURE





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TimeTec Cloud major components consist of the Application, Application Frameworks, Microservices, Integration, Google Cloud Services, Infrastructure, AWS services and DevOps Process. That said, most of the components are integrated closely to achieve high performance and efficiency.

APPLICATION

The applications running within TimeTec Cloud are as follows: TimeTec TA, TimeTec Leave, TimeTec Patrol, TimeTec Hire, TimeTec VMS, TimeTec Access, TimeTec Parking, i-Neighbour, Epicamera, i-Merchants, i-Ad, i-Account, Hubot XV & XP. Discover more information regarding the applications at their respective websites.

APPLICATION FRAMEWORKS

Application Framework provides necessary support for our Cloud Development. This includes every aspect that a developer requires to build and run the application.



Language & Runtime: Applications are written in different programming languages such as .NET, PHP, Java and etc. TimeTec uses native runtime environment supported by its programming language.



Library & Framework: DevExpress & DevExtreme, AngularJS, etc, are the JavaScript library used for our front-end user interface. TimeTec uses JUnit, PHP Unit as our Unit test framework.



Tracing & Logging: To enable internal troubleshooting, TimeTec uses LogRocket to better understand the customer's behaviour and problem. We also use Crashlytics to collect the crash report for our mobile application.



DevExpress & DevExtreme: TimeTec uses DevExpress & DevExtreme library in the web platform. DevExtreme is a HTML5 Javascript Component Suite for Responsive Web Development, which provides us with extensive controls on Data Grid, Mapping, Charting, UI Widget as well as Integration.



.NET Framework & .NET Core: TimeTec uses Visual Studio C# for the majority of our TimeTec Cloud applications. We are using .Net Framework and the latest .NET Core technology to provide better performance and scalable system in the long run.



AngularJS, JQuery & Bootstrap: AngularJS is an open source front end web framework maintained by Google. JQuery is another Javascript library that works with Bootstrap as well as acts as our front-end framework. We are using that to extend our HTML capabilities and convey the application components effortlessly in addition to simplifying the front-end development experience.



Android SDK: TimeTec uses Android studio to develop most of our Mobile Apps. Since we need to communicate with low level hardware and system level control, it is thus best to develop using Native Android SDK for such development.



Swift 4: TimeTec also uses Swift 4 to develop our Mobile Apps for better communication with low level hardware and system level control.



Xamarin: To speed up the Mobile App development, TimeTec uses hybrid app development platform such as Xamarin for cross platform development to provide deployment on both Android and IOS platform, i.e. TimeTec Leave.



LPR Services & ID Reading Services: In expanding our cognitive technology, TimeTec has developed the in-house license plate recognition and Identification card reading services using our proprietary OCR method.



Robot (AI & Machine Learning): This is our newly ventured and developing technology. The Robot system will be equipped with AI & Machine Learning capabilities to perform tasks such as patrolling or in-door delivery.



Lidar Sensor Technology: This is the main component for our Robot system. Lidar is a surveying method that measures distance to a target by illuminating the target with a pulsed laser light. This aspect helps the Robot in moving around the area.

MICROSERVICES

A microservices architecture provides a set of capabilities that enable better communication within the system. Example of capabilities that are available between our Cloud platform are as follow:



Mobile Server: It is used as a communication method for TimeTec Mobile App. Mobile Server will accept the request from the mobile app and return the feedback accordingly. It is also closely integrated with GPS Location and Notification services.



IoT Services: TimeTec IoT Services is built on top of AWS IoT platform to offer high availability. All of the messages are sent via MQTT and stored in the NoSQL database such as Amazon DynamoDB.



Approval Engine: Apply to Overtime, Edit Attendance and Out of Area request. Request will be treated as Expired if the approvers did not complete the approval process within the given validity period. It also supports sequential approval, random approval and any approval mechanism.



Report Generation: Provides a variety of reports such as TA: Report comprising of users clocking activities, i.e. calculated work time, breaks, overtime and work hour shortage in a chosen date range. The report also contains a summary of attendance, tardiness and leave taken by the selected users.



Notification Services: Dedicated notification services to manage the communication message sent to TimeTec Cloud Mobile App and Web. Integrated with clocking monitoring, this service allows users to monitor the attendance and tardiness for staffs under users' supervision as per defined by the Hierarchy Chart based on the time set.



Terminal Automation Services: Automate the process of downloading and uploading new users in FingerTec Terminal to TimeTec TA and vice versa. Set the time to trigger the process, select your terminals and enable Auto-create User Profile to add the user in TimeTec TA automatically.



Leave: Report comprising of detailed and summarized information on users' Allowances, Balances, Approved/Pending/Rejected and Cancelled Requests in a calendar year..



Dashboard & Big Data Analysis: All TimeTec cloud applications come with a comprehensive dashboard and data analysis. It is also in our pipeline to build a more comprehensive and consolidated big data analysis platform to provide customers with more insight for improvement.



Scheduler Services: A clocking schedule can be set up with rules for calculating clocking activities. Managing Clocking Schedules is crucial in finding the balance for business demands and company's workforce resources. To achieve efficiency, clocking schedules need to be adjusted time and again. Edit details of your company's clocking schedules in this tab. Automate report generation by setting up the schedule settings, generation interval and recipients of the report.



Patrol: Report comprising of guards patrol activities including detailed and summarized information on guards' tardiness, incident reported, job order received during a patrol.



Leave Policy & Entitlement Services: This includes the calendar renewal, service accrual, balance accrual and reminder module:



Holiday Services: Each working year has numerous fixed holidays and leaves such as Christmas, Eid, Hannukah, Labor Day and so on, for different country and region. The holiday services will extract the information using Google Holiday API and import it to the respective TimeTec TA account annually.



User Services: Centralizes all employees' profiles and data for syncing between other TimeTec solutions. Customize profile field to control the admins and users viewing rights in user profile. Provide several privileges to maintain security; the highest authority being System Administrator (only account creator has this privilege). Likewise, System Administrator can choose which users to be given the administrator privilege(s).

Calendar Renewal: Automate user's leave renewal annually.

Service Accrual: Automatically increase your user's allowance/balance once they have reached a certain number of months/years of service within your company. For example, if a user has served the company for more than 5 years, 3 days annual leave will be added to their leave allowance/balance.



Patrol Services: Process patrolling data based on route and schedule setting. Route setting allows users to set checkpoints that are required for patrol operation according to sequence or random. On the other hand, schedule setting allows scheduling for patrol routes on certain days and times to the security guards.



Attendance Services: Transaction log from terminal, mobile app, web will be consolidated and processed by our attendance services based on the schedule defined via a comprehensive attendance conversion algorithm.

Balance Accrual: User's leave balance accrued based on accrual interval setting

Reminder: For employees regarding approved leaves prior to leave dates. Reminders can be sent to the administrators/managers/users or any email addresses.



Webster Services: Access raw time attendance data from FingerTec hardware remotely. The real-time user info, transaction log and terminal data can be transmitted and synchronized to Webster Services via Internet connection.

INTEGRATION

Microservice-based applications must communicate with internal/external system via different clouds or networks. The types of method that have been used to invoke these systems are as below:



Transformation & Connectivity: Secure connection for external and internal enterprise system. This setup often operates with Virtual Private Network (VPN) or under Hyper Text Transfer Protocol Secure (HTTPS).



API Management: To integrate between third party or internal system, API is the medium for communication. TimeTec uses both REST and SOAP Web API services for data communication using API.



Proprietary User Directory & Consolidated Admin Portal: To store and manage all users, resellers as well as distributors via admin portal.



Enterprise Data & ETL: To obtain insight and analysis from the current enterprise data, the enterprise data will need to be transformed via our internal Extract-Transform-Load (ETL) tools.



Edge Services: These are the infrastructure tools needed by Cloud services such as Content Delivery Network (CDN)

INFRASTRUCTURE

Infrastructure services provide the underlying cloud compute, network and storage capabilities that TimeTec Cloud requires to function. It also includes provisioning the virtual infrastructure storage and network accordingly on top of the AWS Services platform.

GOOGLE CLOUD SERVICES

Google provides a very comprehensive cloud platform for facilitating TimeTec development in web application.



Google AI and Machine Learning: Under our R&D process, TimeTec is working on Google AI such as Google Vision API to extract the information and insight of the attendance photo.



Google Map & Geocoding: To geocode the GPS location in mobile app and web platform, TimeTec is using the Google Map API services.



Firebase – Cloud Firestore is a platform to store and sync data between users and devices - at a global scale - using a cloud-hosted, NoSQL database. It is used to keep track and monitor our real time patrolling record via mobile app.



Cloud Translation API: To minimize and speed up our software localization process, TimeTec has adopted the Google Cloud Translation API for machine translation in terms of all our software's text and wording.



Google Calendar API: Integrated with Google Calendar to retrieve all of the Holiday information from every country effortlessly. The data can then be imported to TimeTec TA company calendar.



Cloud Messaging: Used to send data from TimeTec TA into users' devices. The Firebase Cloud Messaging will help handle all aspects of queuing in messages as well as delivery to the client mobile application.



Google Analytics: Google Analytics is a premium web analytics service offered by Google that tracks and reports website traffic. TimeTec is using the tools to understand the customer web traffic pattern as well as the customer visitor data, which will then be used for online marketing purpose.

AWS SERVICES

TimeTec Cloud is running on AWS services to speed up the entire new technology adoption and infrastructure design of our cloud platform. Services used are not limited to the following:



Amazon EC2: Web and Application will be hosted as Amazon EC2 server instances. All EC2 instances will be behind Amazon ELB to support high availability.



Amazon S3: AMI's, Logs, Snapshots, Backups and static assets can be maintained in Amazon S3. It is used to store all TimeTec reports, images, user photo and etc, as well as designed to provide 99.999999999% durability of objects over a given year.



Amazon RDS: Managed MYSQL database services and with Multi-AZ as well as Read Replica configuration to ensure high availability of service. Amazon SNS: Notifications, Alerts triggered from CloudWatch will be published to the System administrators via SNS.



Amazon IoT: A managed platform for IoT hardware to connect, communicate and control. It is used by our access control hardware with multi-layered security and proven at scale.



Amazon Dynamo: A NOSQL database to store our log transaction as it provides a better and more reliable support when compared to relational database. It is a key-value database that delivers single-digit millisecond performance at any scale.



Amazon CloudFront: A cloud distributed content delivery system to securely push web content into the nearest edge server. It is used to speed up the entire website loading time and reduce the network latency.



Amazon Route53: A managed DNS services which can be scaled based on demand. It operates with redundant DNS server to offer high availability on the domain name services.



Amazon CloudWatch: Components of Amazon Web Services such as EC2, EBS, etc, will be monitored using AWS CloudWatch. CloudWatch comes with an alarm alert feature, which can be customized based on your monitoring activities.



Amazon Elastic Load balancers: Software Load balancers HAProxy/Nginx/Amazon ELB will be used for load balancing. It will distribute the web traffic to the designated web server for us to scale out our application accordingly.



Lambda Serverless Computing: A new programming concept to write our new application and service without provisioning any new instances or servers.



Amazon SES: A managed email services to enable communication between the system and all of the subscribers. It is a reliable, cost-effective service for TimeTec applications to contact our subscribers.



Amazon WAF: To ensure our cloud service is protected by DDOS attack and serve as the front layer to filter unauthorized and malicious web traffic. It is very efficient in blocking common attack patterns, such as SQL injection or cross-site scripting as well as rules that are designed with TimeTec applications.

DevOps

DevOps is essential for a successful cloud application development. It is a very important concept for cloud development as well as cloud operation. TimeTec uses Jenkins server to help manage our software pipeline for continuous integration/continuous development (CI/CD). Below covers the following capabilities in our DevOps architecture:



Continuous provision: Instrumenting and automating underlying cloud virtualization such as creating cloud cluster using cloud formation.



Continuous build: Continuous building deployment DLL or files required for new features and requirements. The build is automated and triggered once the source code has been committed to our source code control platform.



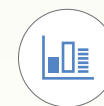
Dependency management: Tools to automatically pull in dependencies during build process, e.g. visual studio .net library. It also includes the Android SDK and Apple IOS SDK dependency for TimeTec mobile app pipeline.



Continuous testing: Automation for invocation of unit tests case using selenium with Visual C#. It is integrated to all different types of development pipeline and project to reduce the repetitive work required during the testing process.



Continuous deployment: Ability to deploy individual files and DLL files into the server. TimeTec has a 2 weeks deployment cycle for our web platform and at least 1-month deployment cycle for our mobile app.



Monitoring and logging: A comprehensive monitoring and logging ecosystem is required to debug and monitor the resources used and root causes of the problem. TimeTec mainly uses AWS console for our daily monitoring activities.



Cloud management services: Cloud management includes many different tools such as Event Management tool, notification tools, configuration tools in the AWS console.