Solution Document

for

Not Just Any Startup

Not Just Any Startup's mobile application platform enables real-time consumer - service-provider interaction. We propose migrating to AWS to help *Not Just Any Startup*:

- Scale without need to guess capacity: provision EC2 instances (virtual servers) on-demand using Amazon **Elastic Compute Cloud** (**EC2**) & Auto Scaling — Elastic
- Distribute traffic across healthy EC2 instances in multiple Availability Zones with Cross -zone load balancing option of AWS **Elastic Load Balancing (ELB)** — *High Availability*
- Plan for Disaster Recovery — *Scalability*
  - redundant instances across AZs
  - highly durable S3 storage (& protection through bucket policies) — *Secure*
  - Elastic Block Store (EBS) volume snapshots
  - RDS - multi-region - snapshots & read replicas
  - Amazon CloudFormation - templatize environment & resource stack
- Manage identities & sync user data across devices using **Cognito**
  - temp credentials avoid need for individual AWS or IAM accounts using Identity Pools & an associated IAM Role (default access Cognito Sync) — Manageability
  - local cache & service deltas sync'd over HTTPS when client is online
- Push notifications to clients using **Simple Notification Service (SNS)** topics
- Collect, visualize, understand app usage data with Amazon Mobile Analytics:
  - KPIs - *Engagement* (DAU, MAU, new users, Sticky Factor (DAU/MAU)), *Retention* (Day 1/3/7), *Sessions*, *Revenue* (ARPPDAU) etc.
- Configure a performant database layer: with Relational Database Service **(RDS)** — High Performance
  - Scale Up: Instance Class up to 32 VCPUs & 244 GB memory
  - Scale out: Read replicas to increase performance
- Leverage self-healing infrastructure: Amazon **CloudWatch** dynamically scales (out/in) instances. **CloudWatch Logs** monitors application logs and sends error notification to Amazon Simple Notification Service (SNS) when over threshold. Upon launch, new instances execute a UserData script (**bootstrap**), and auto-configure (apply IAM Roles, etc.) and install applications. — Fault-tolerant & Recoverable
- Secure data at rest and in transit
  - at rest: S3 bucket policies, IAM policies, SSE or Client Side Encryption
  - in flight: SSL API endpoints for S3
- Secure environment in face of expansion: **Identity & Access Management (IAM)** for authentication/authorization to AWS infrastructure, with Managed

Policies applied to Groups and transitively to the users in a group

- Archive/delete data: using Lifecycle rules to auto transition from S3 buckets to Amazon Glacier
- Manage & replicate environments: AWS CloudFormation templates describe resources (eg. Auto Scaling group, load balancer, database), managed as a single unit. A stack can be created in a different region for DR.

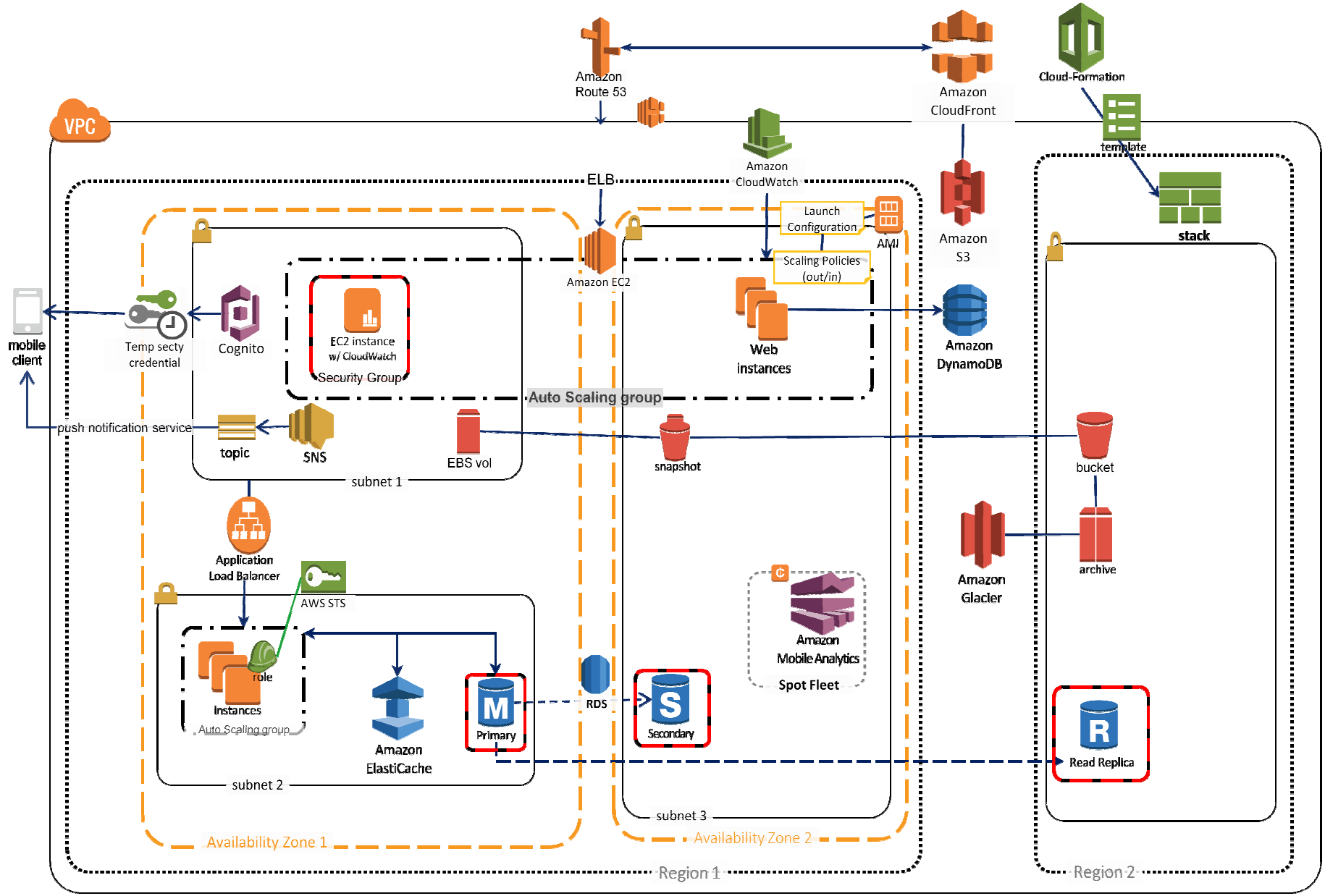
Flow

- the public **ELB** has a HTTPS listener for encrypted connections (uses SSL certificate from AWS Certificate Manager), and distributes traffic across healthy instances in both AZs.
- Instances are launched within VPC **subnets** (identified by CIDR blocks).
- **CloudWatch** will execute an Auto Scaling Policy (max, min, desired) when a parameter threshold is crossed. **Auto Scaling** service will scale out/in EC2 instances in the Auto Scaling group.
- an internal load balancer routes traffic to the private subnet
- **Security groups** (stateful, virtual firewalls with in/out rules) are set up at the instance-level to control traffic based on port, protocol, source/destination. For example, { port: 80, protocol: http, source: all incoming}, {port: 22, protocol: SSH, source: <your IP>}
- **Endpoints** (route to service url) will connect instances to S3 without requiring NAT or IGW
- **Roles/Temporary Security Tokens** enable the application to authenticate against AWS APIs. Actors assume a role and receive a temp token associated with the policies of the role. For eg:
    - IAM role granting access to S3 bucket assigned to EC2 instance
    - app running on instance assumes instance role when invoking S3 API, obtains temporary token from **AWS Security Token Service (STS)**, allowing it to authenticate with S3
- authorization to AWS resources happens through Policies, eg:
    - **Effect**: 'Allow', **Action**: ['s3:GetObject', 's3:ListBucket'], **Condition**: { 'IpAddress': {'aws:SourceIp': '192.168.0.2'}}, **Resource**: ['arn:aws:s3:::mybucket/*']
    - Policies will be assigned to Groups to simplify managing permissions
        - eg: create 'IAM_Administrators' group, assign 'IAMFullAccess' managed policy, create 'Administrator' user and add it to the 'IAM_Administrators' group
- **Multi-AZ RDS DB cluster** uses synchronous replication between Primary & Secondary across AZs
    - provides fast-failover, minimizing RTO to minutes (Recovery Time Objective -- max downtime to resume in a failure)
    - daily Automated Backups (during maintenance window) in conjunction with transaction logs minimize Recovery Point Objective (RPO) to as little as last five minutes
- **Cross-Region Read Replicas** (async copy) offload read queries from Primary for performance
- a **push notification service** such as Amazon Device Messaging (ADM) or Google Cloud Messaging for Android (GCM) serves as an Amazon **SNS** endpoint
- user session state for web layer maintained in **Dynamo DB** for highly scalable architecture
- ElastiCache (Redis) used to cache frequently queried user data for performance at DB layer

ASSUMPTIONS

The IT organization will define the following parameters:

- standards (production, dev) for instance types (vCPU, memory, storage, network) & AMIs
- the presentation tier subnet be made private by removing the Routing Table rule ('Destination CIDR ->Target') that directs traffic to Amazon VPCs IGW. The IGW does NAT for Internet traffic.
- configure the ELB for sticky-session binding to simplify application development
- archival frequency & time-window -- for taking EBS delta snapshots on EC2 & RDS instances
    - an EBS volume is auto-replicated within an AZ. But volume snapshots (saved in S3) are replicated across AZs in a region and this is deemed sufficient for DR
    - Snapshots will be used to create recovery / expansion volumes only in the region where they are created -- otherwise will need to copy snapshot to required region.
- encrypt EBS volumes using AWS KMS for key mgmt (AES-256) where data at rest to be secured
- consider balance of reserved (save up to 75% over hourly rates, but commit up to 3 years, and pay upfront), on-demand (for peak loads) and spot **instances** (non-critical workloads)
- cost-effective **Instance stores** (ephemeral, block-level) used for run/scratch-data areas
- **General Purpose SSD EBS volumes** providing upto 10k IOPS sufficient for small databases, dev and test environments. **Provisioned IOPS SSD** required for IO-intensive loads in production.
- **Network Access Control Lists (ACLs)** or stateless firewalls at subnet level for added security.
- Application and Database tier in private subnets, with a NAT Gateway for Internet access. NAT Gateway is a high-availability instance for NAT and forwarding traffic to Amazon VPC's IGW.
- Amazon **CloudWatch Logs agent** installed on server instances
- Route 53 DNS failover routing policy provides higher availability in instance or AZ failures
- for managing operations, a set of principals with IAM administrative privileges will be tasked with managing access to AWS resources and roles.
- The Amazon RDS DB Instance class (compute & memory) will change as the need for vertical scaling arises (upto 32 vCPUs and 244 GB memory)
- For higher throughput, we can place an Amazon Simple Queue Service (SQS) messaging cluster between the presentation and application layers coupled with Long Polling (WaitTimeSeconds) for querying from the queue.


Amazon Route 53
Amazon CloudFront
Cloud-Formation
VPC
template
Amazon CloudWatch
ELB
Launch Configuration
AMI
stack
Amazon S3
Scaling Policies (out/in)
Amazon EC2
mobile client
Temp secty credential
Cognito
EC2 instance w/ CloudWatch
Security Group
Web instances
Amazon DynamoDB
Auto Scaling group
push notification service
topic
SNS
EBS vol
snapshot
bucket
subnet 1
Application Load Balancer
AWS STS
Amazon Glacier
archive
Amazon Mobile Analytics
Spot Fleet
role
Instances
Auto Scaling group
Amazon ElastiCache
Primary
RDS
Secondary
Read Replica
subnet 2
subnet 3
Availability Zone 1
Availability Zone 2
Region 1
Region 2