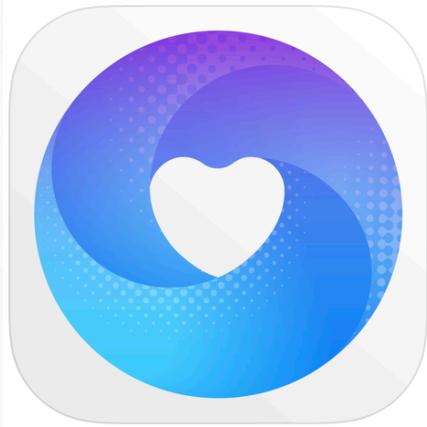


Wearables Data Feed

Mark DeLaVergne

Intro

- 10+ years in Indy software engineering
- Joined LifeOmic in 2017, Precision Health Cloud (PHC)
- Empowering culture, hackathons



LIFE Fasting Tracker

17+

Social Intermittent Fasting

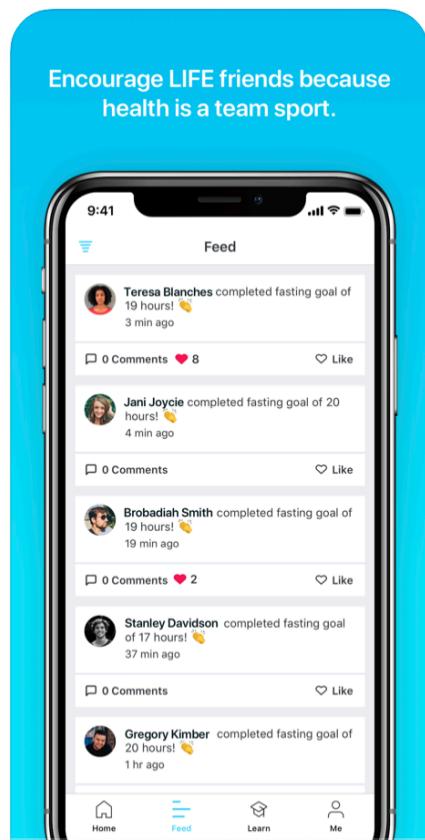
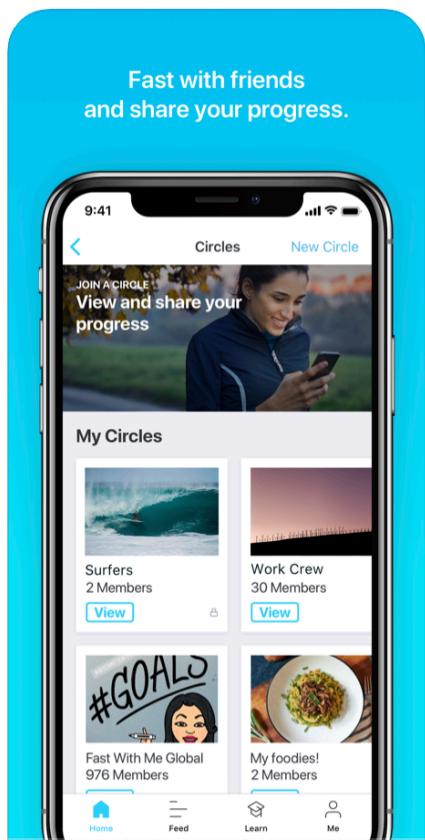
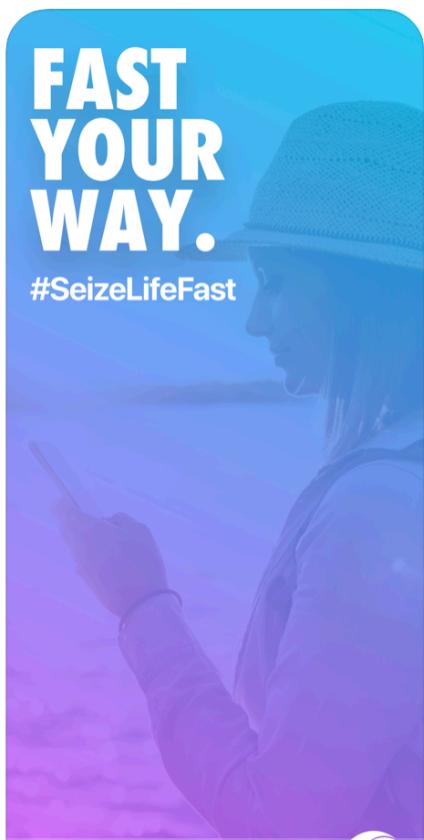
LifeOmic, Inc.

#140 in Health & Fitness

★★★★★ 4.8, 44.2K Ratings

Free

iPhone Screenshots





LIFE Extend · Healthy Living

17+

Exercise & Nutrition Tracker

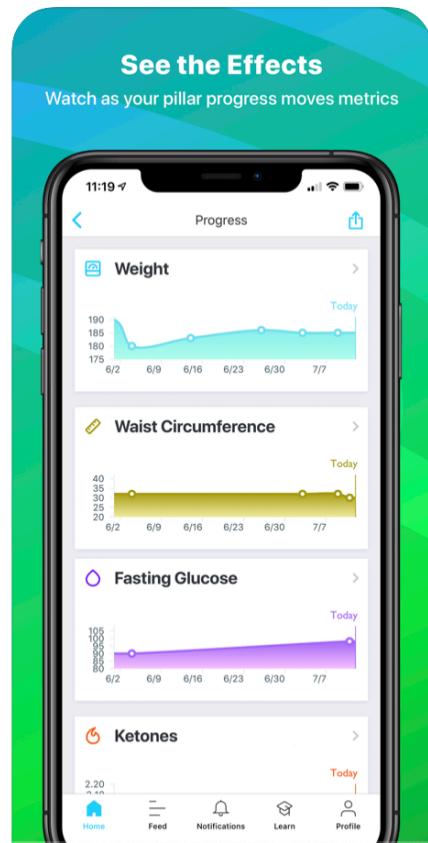
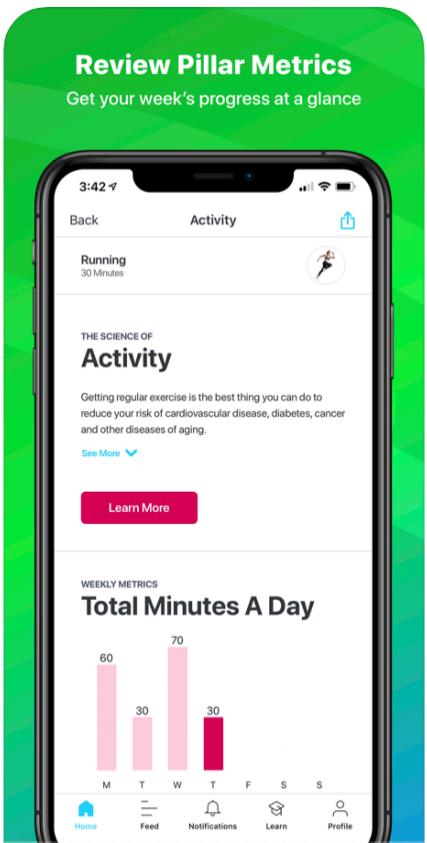
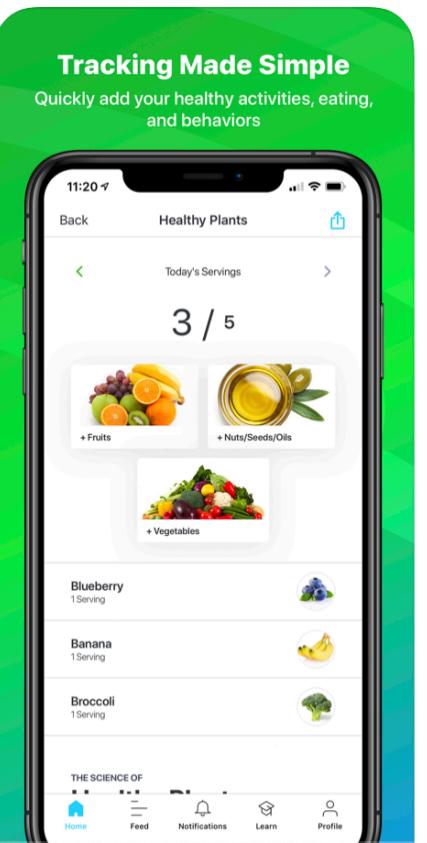
LifeOmic, Inc.

#187 in Health & Fitness

★★★★★ 4.3, 183 Ratings

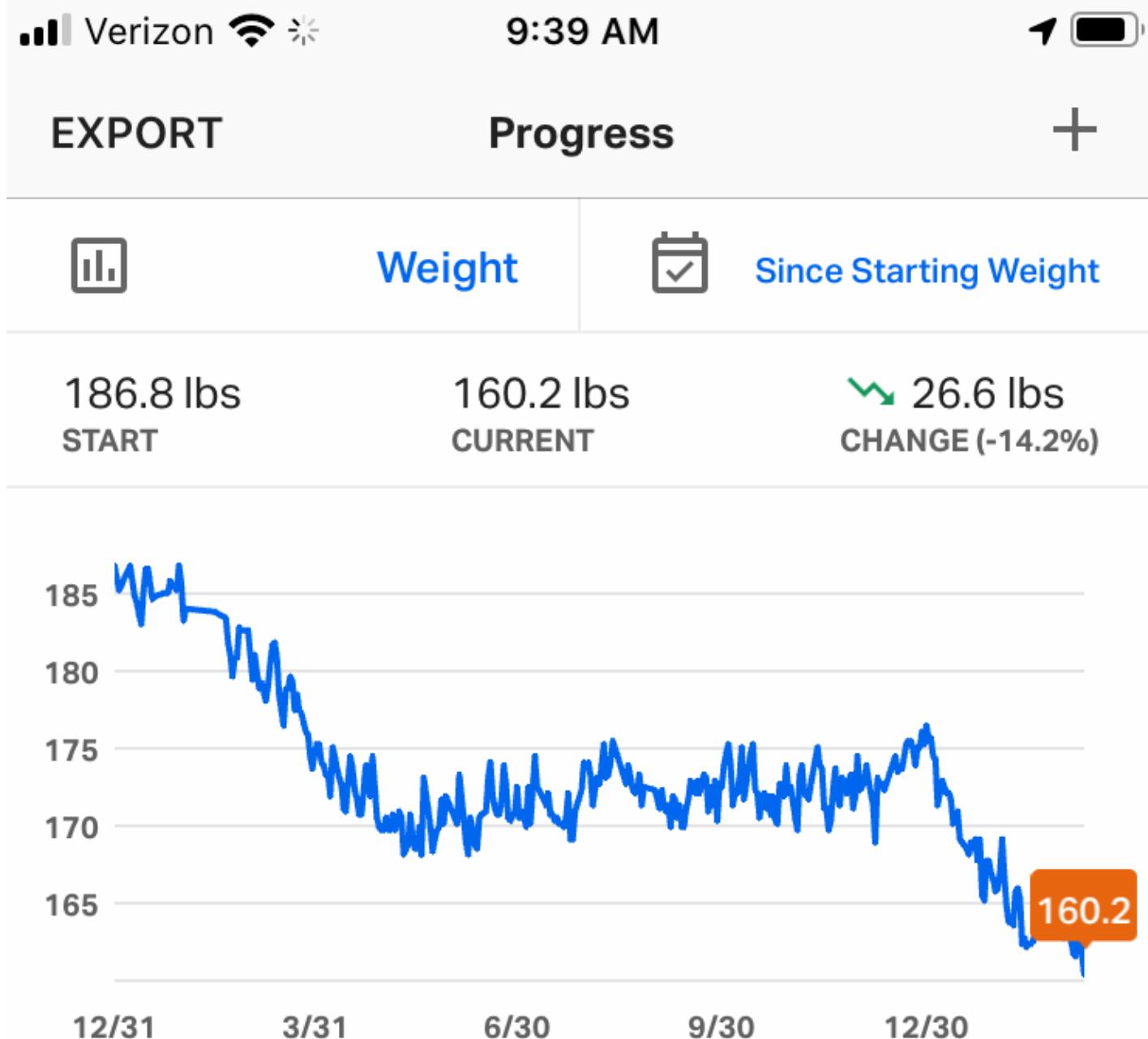
Free

iPhone Screenshots

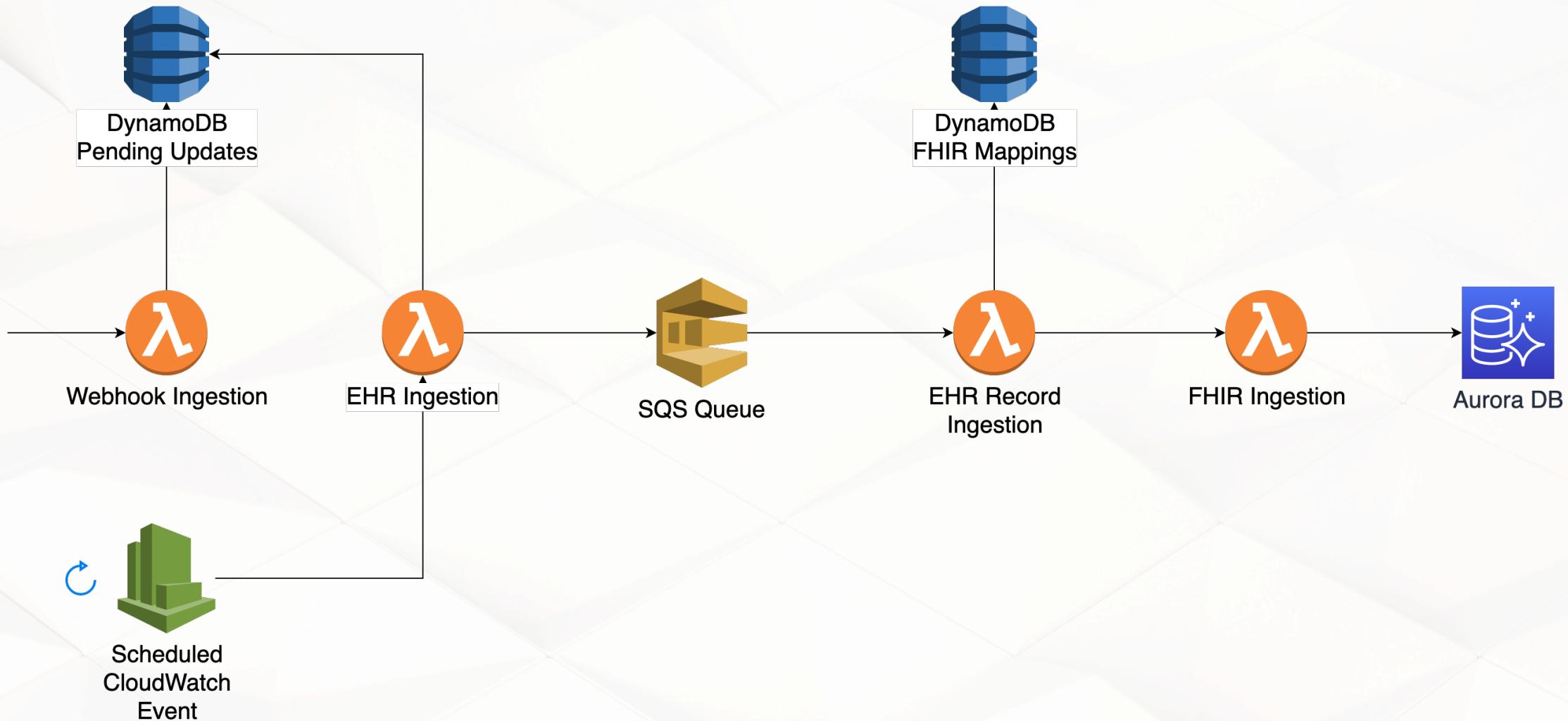


Now is the time

- Personal weight loss journey, data driven
- Incredible amount of data in Apple Health
- Hackathon
- Pitched to CEO and a few others



HTTP-based EMR Ingestion



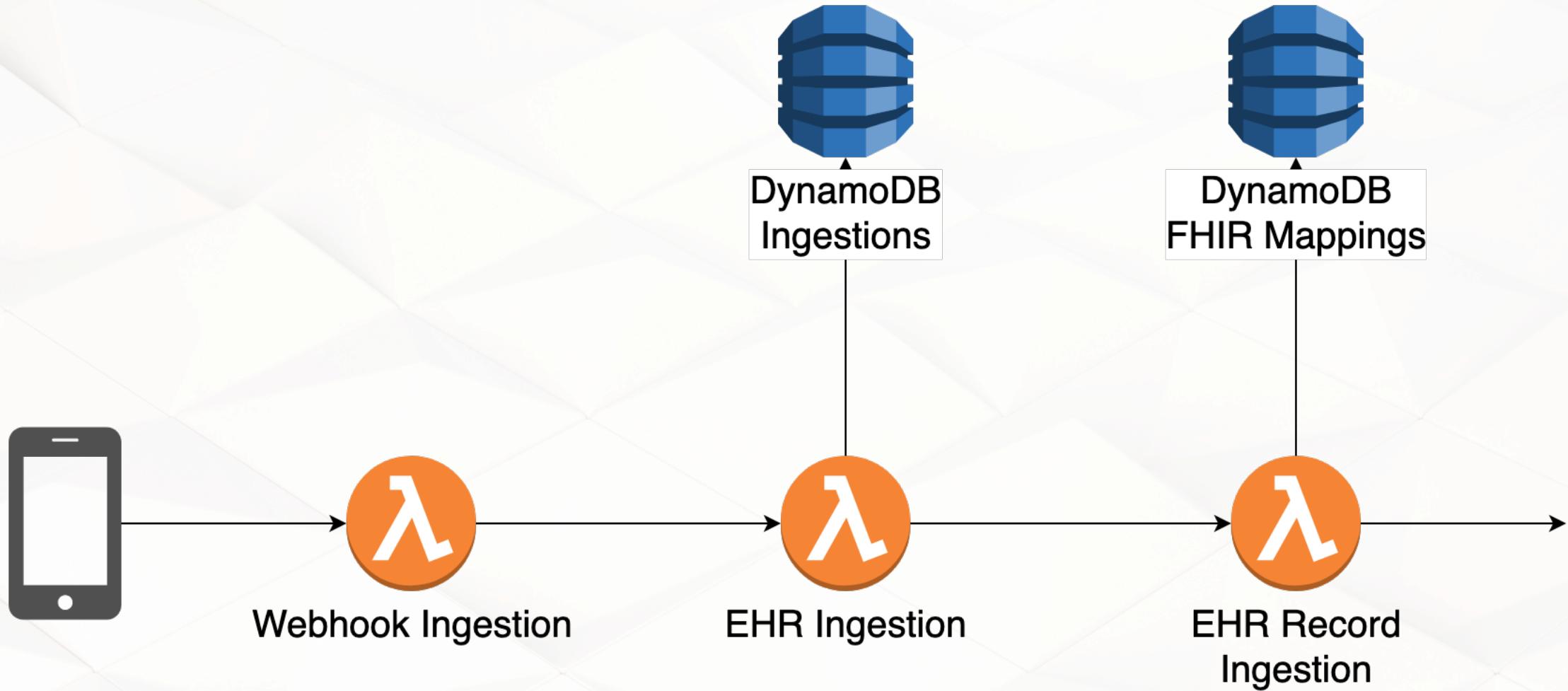
“EHR” ingest recipe

Step	Lambda TypeScript Interface Methods
Webhook ingestion	- handleWebhookIngestion (optional)
EHR ingestion	- prepareForIngestion - startIngestion
EHR record ingestion	- prepare - transform - upload

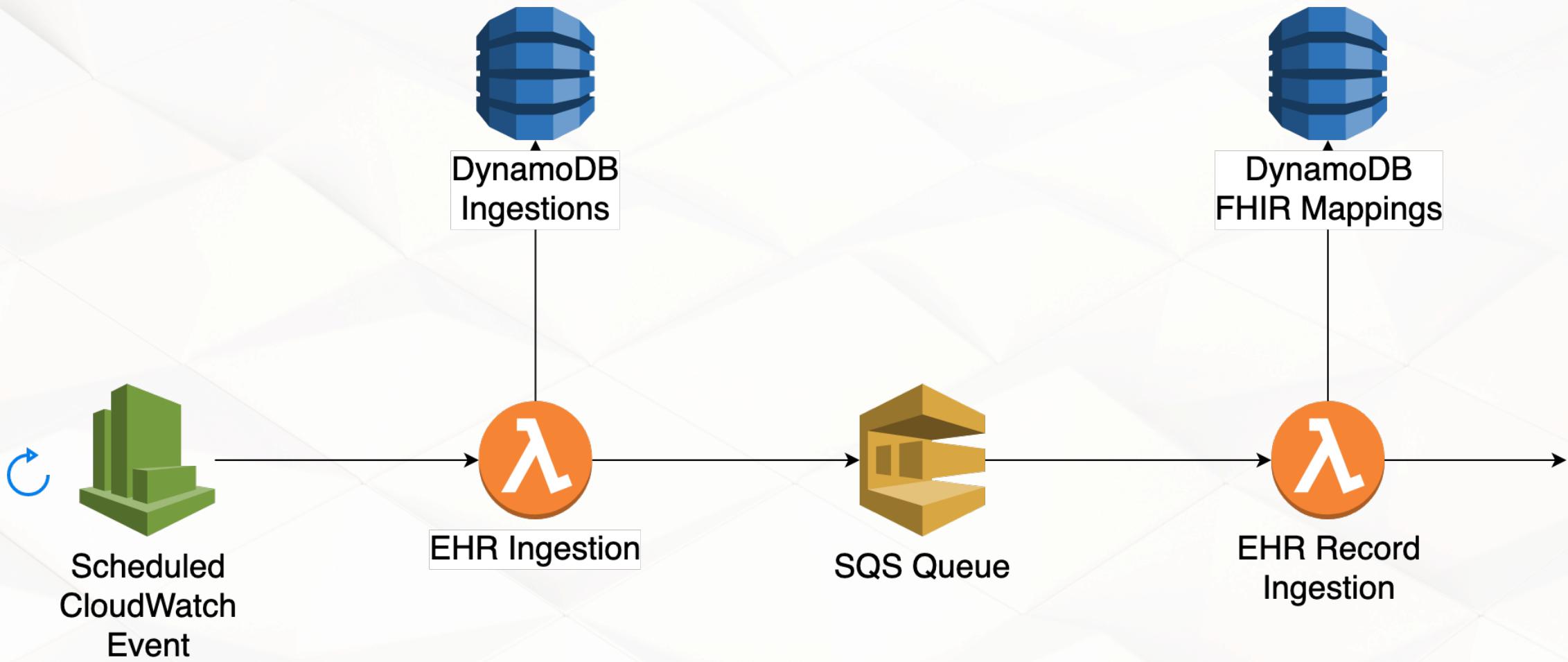
Two examples

Step	HTTP-based EMR	Apple Health
Webhook ingestion	Receive notifications of patients needing to be synced - store in DynamoDB	Single user's batch of data synced via HealthKit
EHR ingestion	Retrieve patients needing to be synced and enqueue each as a separate SQS message	Enqueue batch of records (whatever was synced client-side for this user)
EHR record ingestion	Fetch patient data from EMR, then transform and ingest as FHIR	Transform each record and ingest as FHIR

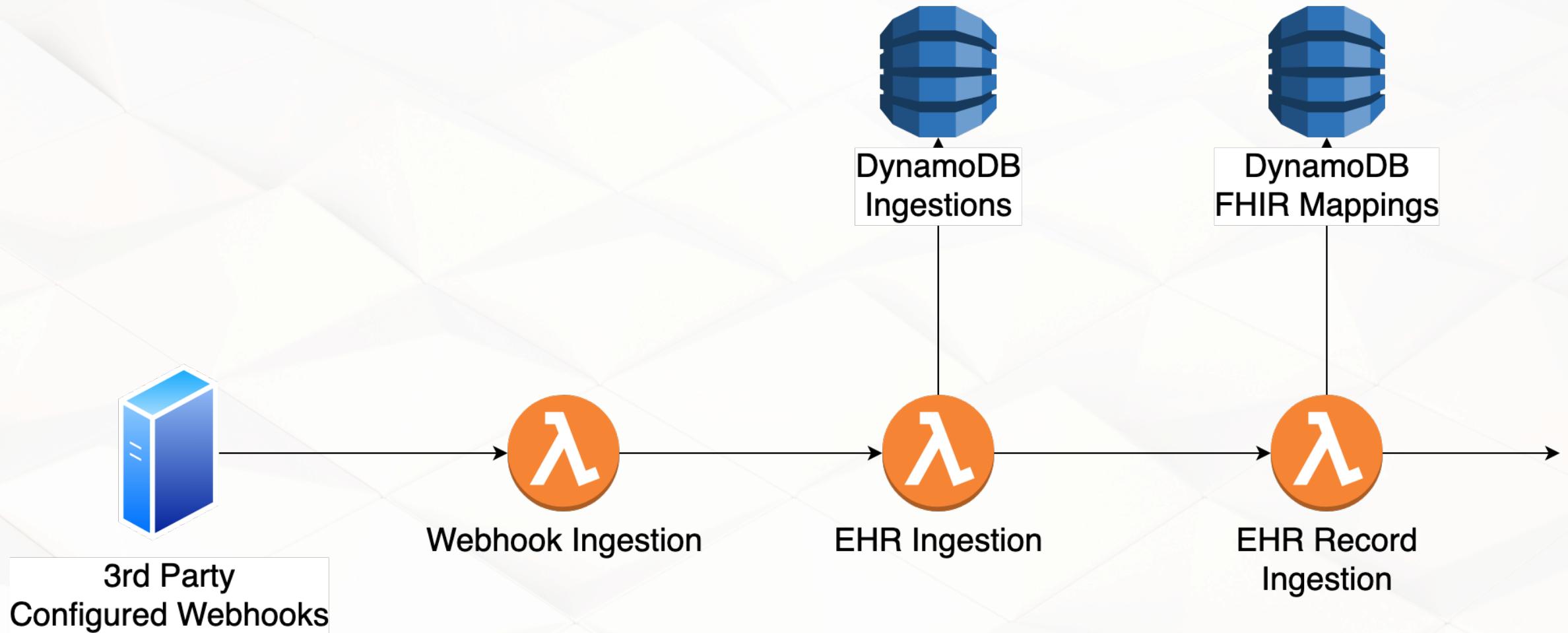
Apple Health Ingestion



Scheduled OAuth Ingestion



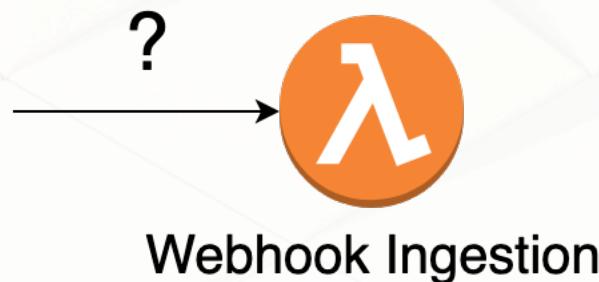
OAuth Subscription Ingestion



Decisions

Webhook payloads

Ingestion type	Webhook payload description
HTTP-based EMR	Notifications of patients needing to be synced
Apple Health	Batch of new HealthKit records for one person
OAuth subscription model	Batch of new records, potentially for multiple people



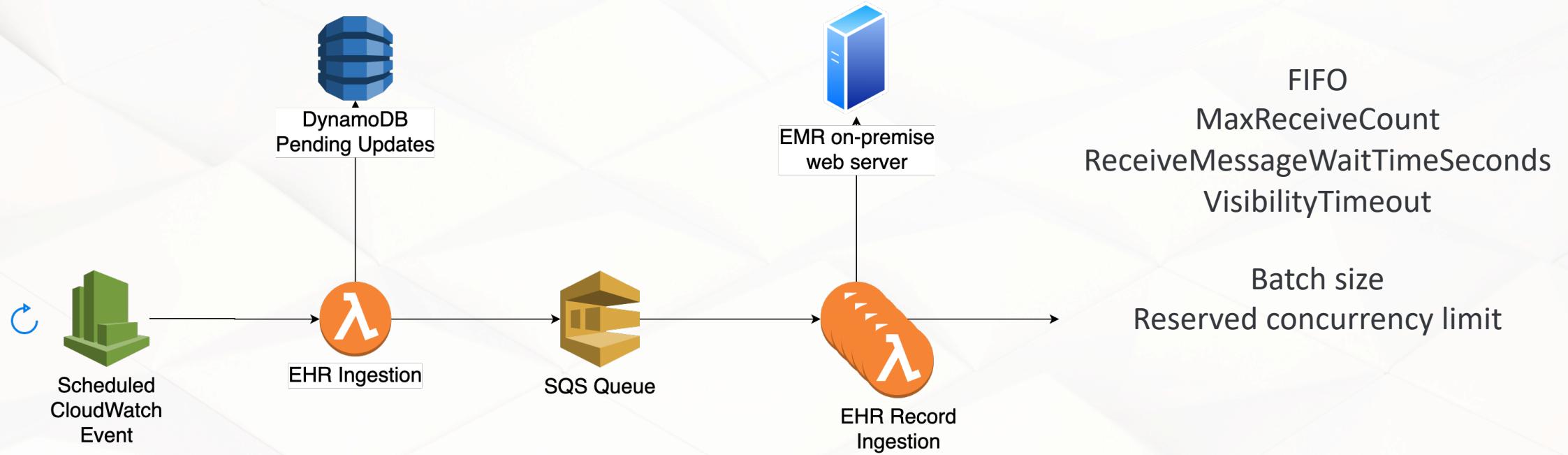
<https://api.us.lifeomic.com/ehrs/<ehrId>/webhook-updates>

Data Duplication

- Each FHIR resource is ingested with one or more codes (e.g. SNOMED)
- Our mobile apps use a code-based FHIR query for records to display
- One wearable integration syncing at a time - soon to be one per data type
- Each integration owns the cleanup of its data *before* ingestion

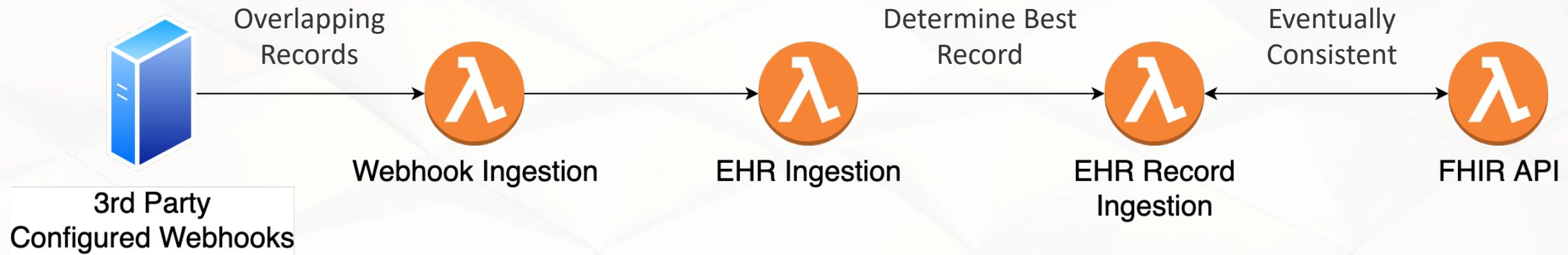
Challenges

Throttling



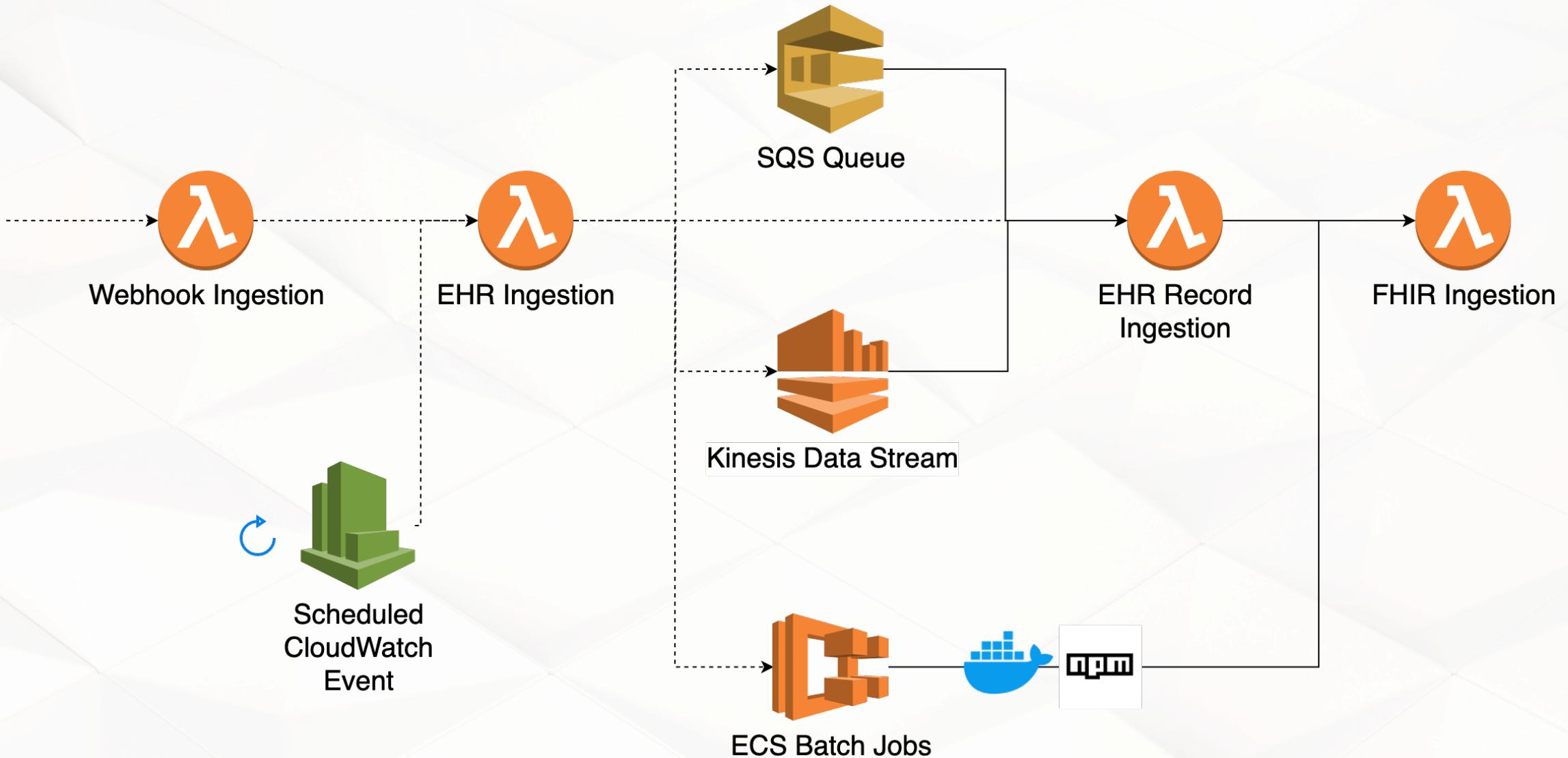
Solution: ECS Batch Job

Race condition

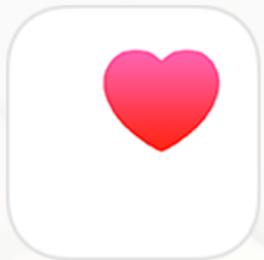


Solution: Kinesis Stream

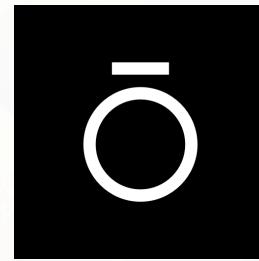
Ingestion Vehicle Options



Current Offerings



Apple Health



Oura



Stats

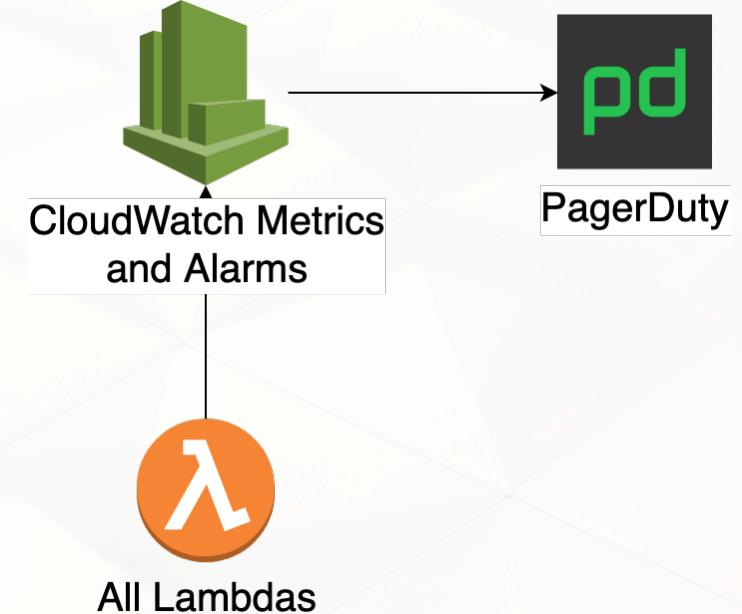
- Lambda
 - 10 lambdas
 - ~20 million invocations per month
 - Avg 500ms invocation duration
 - ~20k FHIR bundles uploaded / day
- DynamoDB
 - 8 tables
 - ~3 GB indexed storage
- SQS
 - ~1.5 million requests per month
- Kinesis
 - 1 shard
 - < 10 million PUTs of 100k / month
- S3
 - 1 bucket
 - < 1 GB

Estimated Costs

AWS Service	Estimated Cost per Month
Lambda	Compute: \$167 Requests: \$4
DynamoDB	< \$10
SQS	< \$10
Kinesis	< \$10
S3	< \$10

Monitoring

- CloudWatch metric-based alarms on errors, duration, kinesis iterator age, etc.
- Integration with PagerDuty
- Monitor lambda which ingests a sleep record using a test user account every 15 minutes



Thanks for listening

@markdelavergne