Supercharge FHIR search with Large Language Models(LLMs)

Who am I?

- Ruchika Kharwar

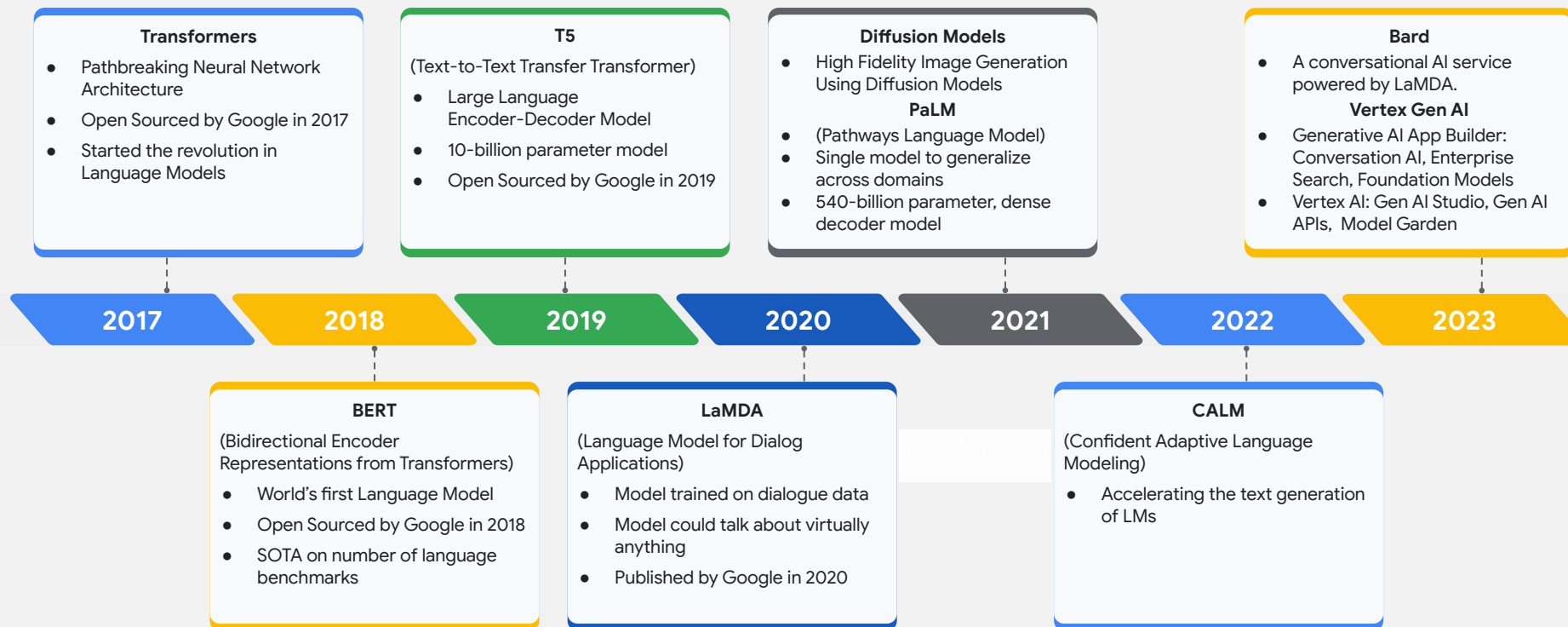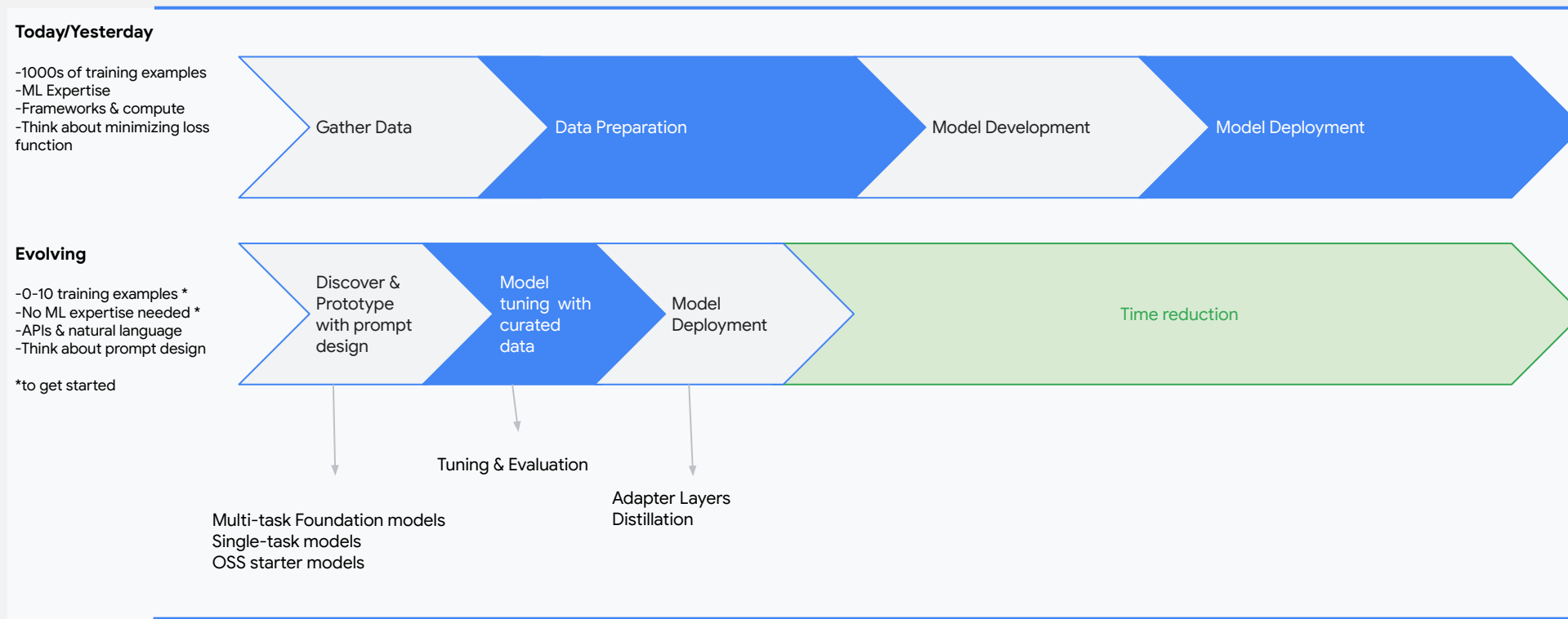- Customer Engineer (Google Cloud Platform - Healthcare and Life Sciences)

Agenda

Supercharge FHIR search with Large Language Models(LLMs)

- Large Language Models(LLMs)
- Approaches
- Common Use Cases
- Examples illustrating Google's Large Language Models on FHIR data
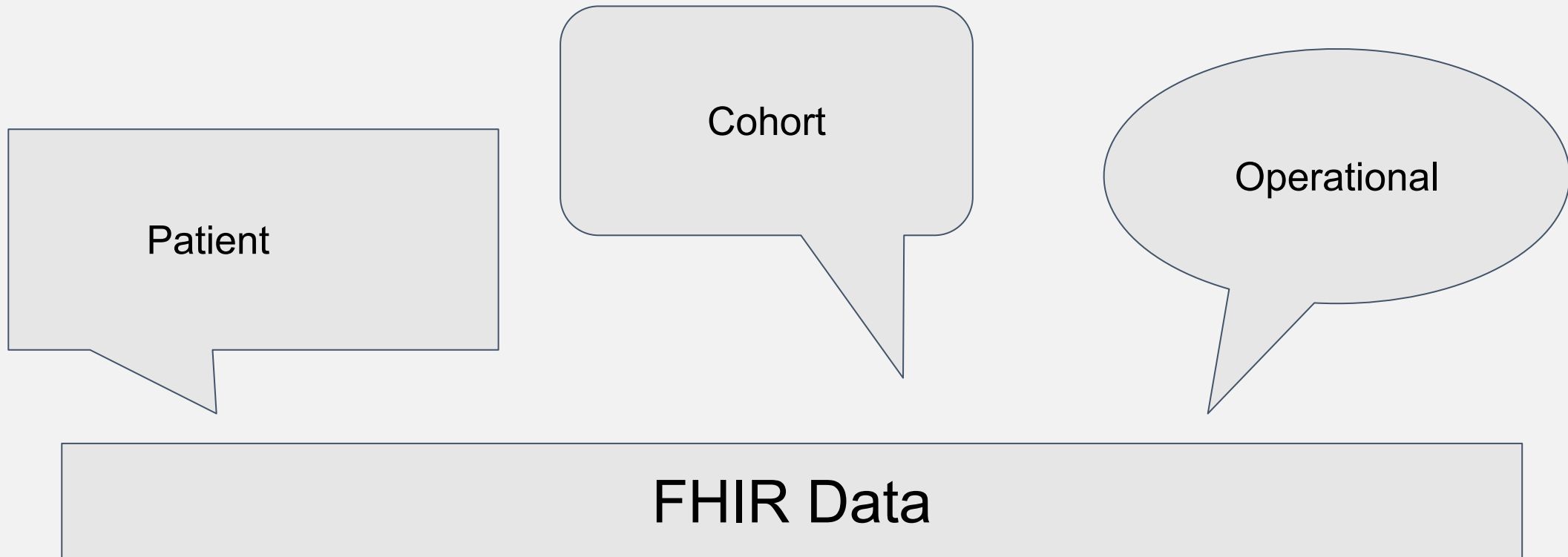- It's just the beginning

The beginnings of the Generative AI revolution

Transformers
- Pathbreaking Neural Network Architecture
- Open Sourced by Google in 2017
- Started the revolution in Language Models

T5
(Text-to-Text Transfer Transformer)
- Large Language Encoder-Decoder Model
- 10-billion parameter model
- Open Sourced by Google in 2019

Diffusion Models
- High Fidelity Image Generation Using Diffusion Models

PaLM
- (Pathways Language Model)
- Single model to generalize across domains
- 540-billion parameter, dense decoder model

Bard
- A conversational AI service powered by LaMDA.

Vertex Gen AI
- Generative AI App Builder: Conversation AI, Enterprise Search, Foundation Models
- Vertex AI: Gen AI Studio, Gen AI APIs, Model Garden

2017	2018	2019	2020	2021	2022	2023

BERT
(Bidirectional Encoder Representations from Transformers)
- World's first Language Model
- Open Sourced by Google in 2018
- SOTA on number of language benchmarks

LaMDA
(Language Model for Dialog Applications)
- Model trained on dialogue data
- Model could talk about virtually anything
- Published by Google in 2020

CALM
(Confident Adaptive Language Modeling)
- Accelerating the text generation of LMs

The approach to Machine learning has drastically changed.

Today/Yesterday

-1000s of training examples
-ML Expertise
-Frameworks & compute
-Think about minimizing loss function

Gather Data → Data Preparation → Model Development → Model Deployment

Evolving

-0-10 training examples *
-No ML expertise needed *
-APIs & natural language
-Think about prompt design

*to get started

Discover & Prototype with prompt design → Model tuning with curated data → Model Deployment → Time reduction

Multi-task Foundation models
Single-task models
OSS starter models

Tuning & Evaluation

Adapter Layers
Distillation

Applying Large Language Models to FHIR data

Fundamental approaches ..
(1)FHIR data wrangle through LLM

Data eg. FHIR Bundles

LLM

- Summarization of a Patient Record
- Extractive Q & A eg. "When was the last time this patient hospitalized?"

Challenges with pushing FHIR Data through LLMs (Security)

"I am concerned about security sending PHI/PII data"

"Is the vendor LLM going to use my data to train their model"

"How do I manage data security concerns?"

"If I de-identify my data, will the LLM results still be useful ?"

Fundamental approaches ..
(2)Use LLM for Operational functions

Expressions in "*Natural Language*"

LLM

- Generation of FHIR Search String (Operational Queries)
- Generation of SQL on FHIR (Data Analytics Queries)

Less PII/PHI concerns

Q & A on FHIR Bundles

- What are the active prescribed medications
- When was the last time the patient visited the ER ?
- Who was the last doctor the patient saw ?
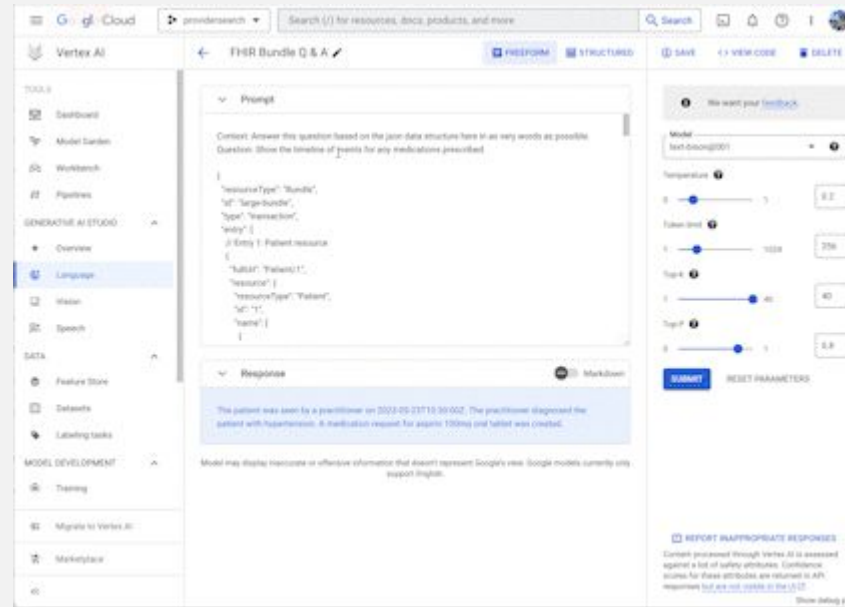
Summarization of FHIR Bundle

- Extremely common use case
- Show timeline of events
- Summarize the patient's LPR
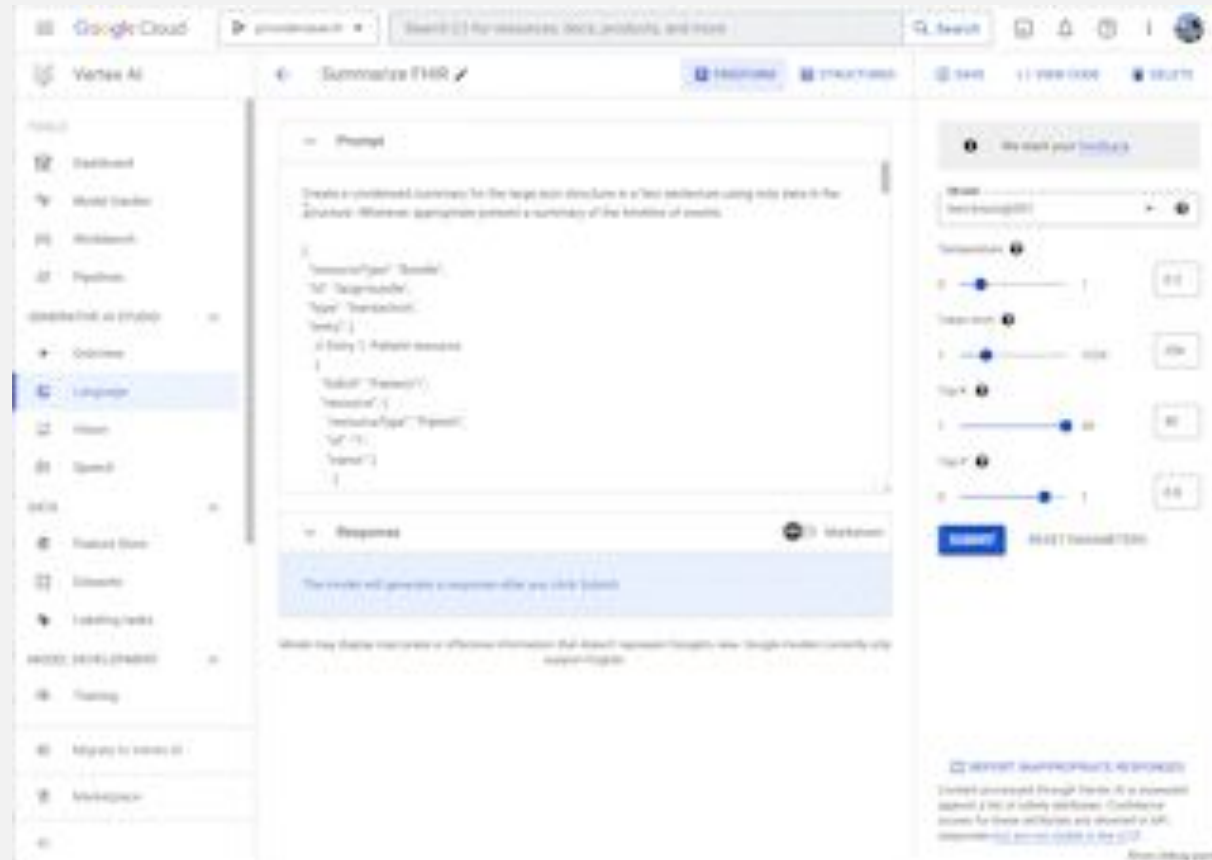
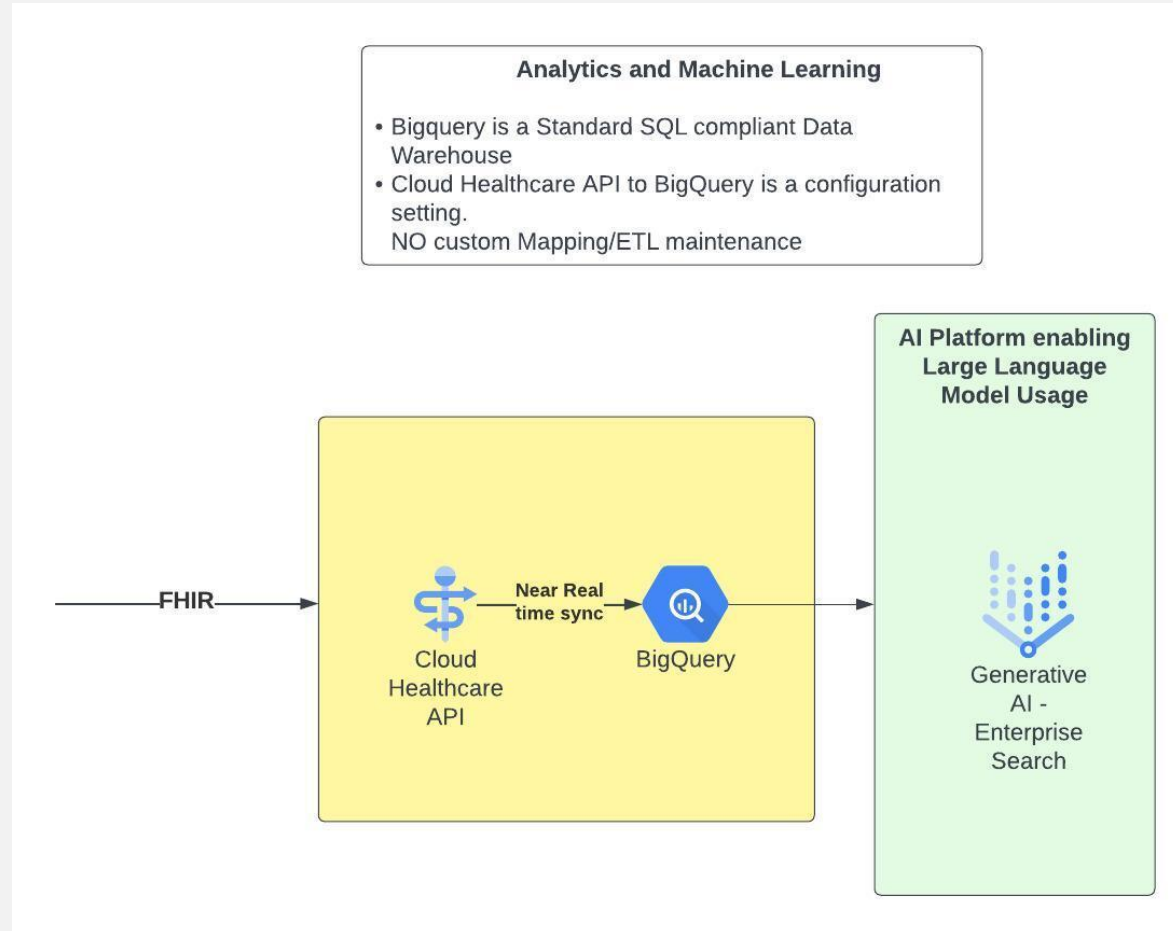# Generation of FHIR Search Queries

- "FHIR Search String" creation offloaded to LLM
- The user can say things like
  - *Search for all observations with a BMI of 21*
  - *Search query for observations with diastolic blood pressure greater than 90 OR systolic blood pressure greater than 140*
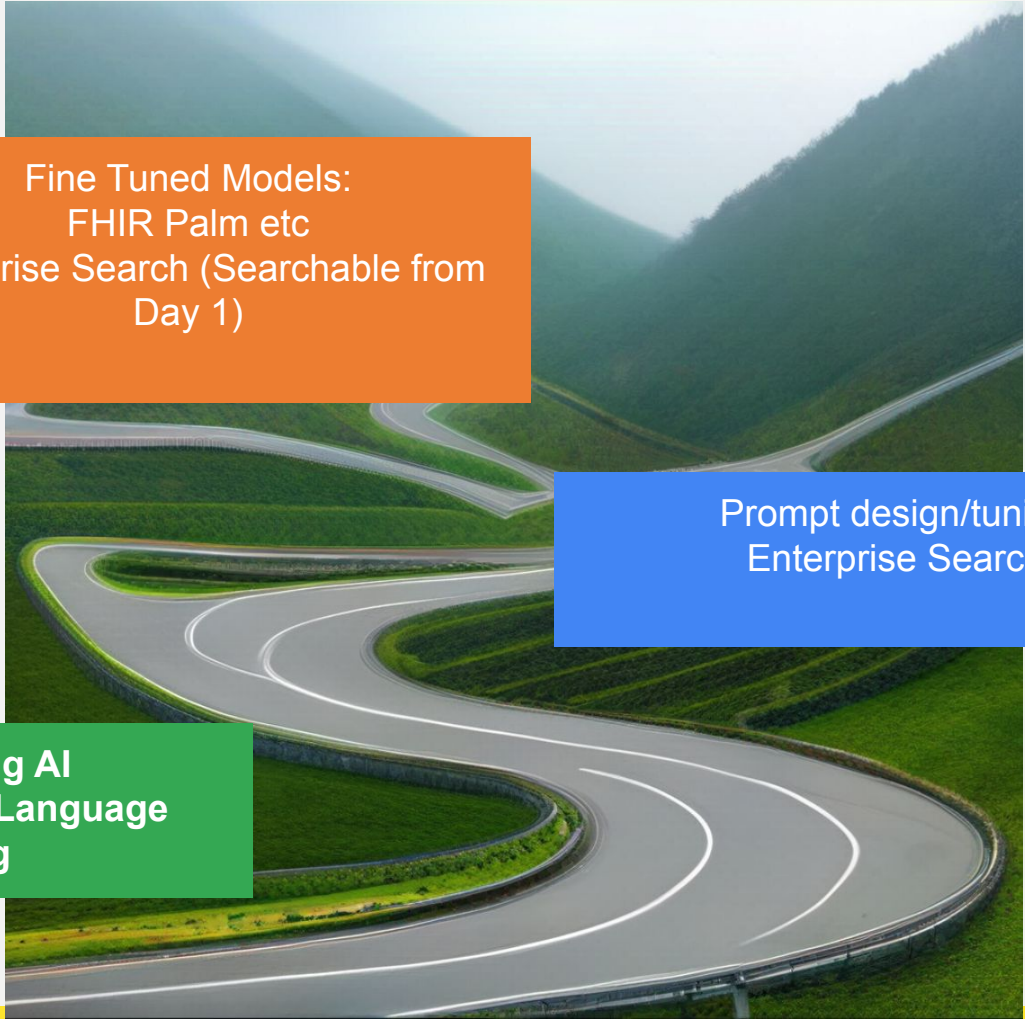
Generation of SQL Queries

Possibilities on the Horizon
Healthcare Data searchable from Day 1 (On Google Cloud Platform)

Analytics and Machine Learning

- Bigquery is a Standard SQL compliant Data Warehouse
- Cloud Healthcare API to BigQuery is a configuration setting.
NO custom Mapping/ETL maintenance

AI Platform enabling Large Language Model Usage

FHIR

Cloud Healthcare API

Near Real time sync

BigQuery

Generative AI - Enterprise Search

It's a journey and not a destination

Fine Tuned Models:
FHIR Palm etc
Enterprise Search (Searchable from Day 1)

Prompt design/tuning
Enterprise Search

**Medical Coding AI
Healthcare Natural Language Processing**

Special Thanks

- Kalyan Pamarthy
- Scott Penberthy
- Will Rosenfeld
- Will Morris
- Reshma Kapadia

Contact

- During DevDays, you can find / reach me here:
  - Via Whova App – Speaker's Gallery
  - rkharwar@google.com
  - Twitter
  - https://www.linkedin.com/in/rkharwar/

Q&A

ORGANIZED BY