



FHIR Implementation Strategies and Considerations

Duncan Weatherston – CEO



Agenda



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 - b. Industry Shift
 - c. Platform Architecture and Components

- 2. Guidelines**
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 - b. Implementation Considerations

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- 6. Facade vs CDR**
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 - b. Two Models for Adopting FHIR APIs
 - c. Facade: Upsides & Downsides
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- 8. Patient Matching & Data Quality**

- 9. Subscriptions**

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Introductions



Smile CDR specializes in enterprise-grade FHIR implementations (scale & performance)

Maintainer of **HAPI FHIR**, the **open source reference implementation of the FHIR** specification since 2014. HAPI FHIR is the most widely adopted FHIR library in the world - more than **20,000 downloads monthly**. Smile CDR is the commercially supported version of HAPI FHIR.



Smile CDR is a FHIR Platform - Product + Services + Ecosystem built around FHIR Data Model & APIs

Customers – LabCorp, Fresenius, BCBSA, Centene, HSSC, & more...

Partners - TIBCO, RedHat, FHIRBall, & more

Key People: Duncan Weatherston, CEO & **James Agnew**, CTO

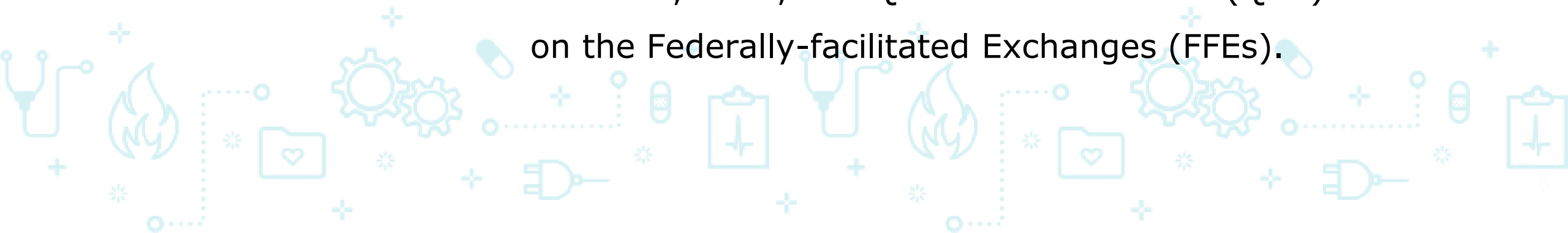




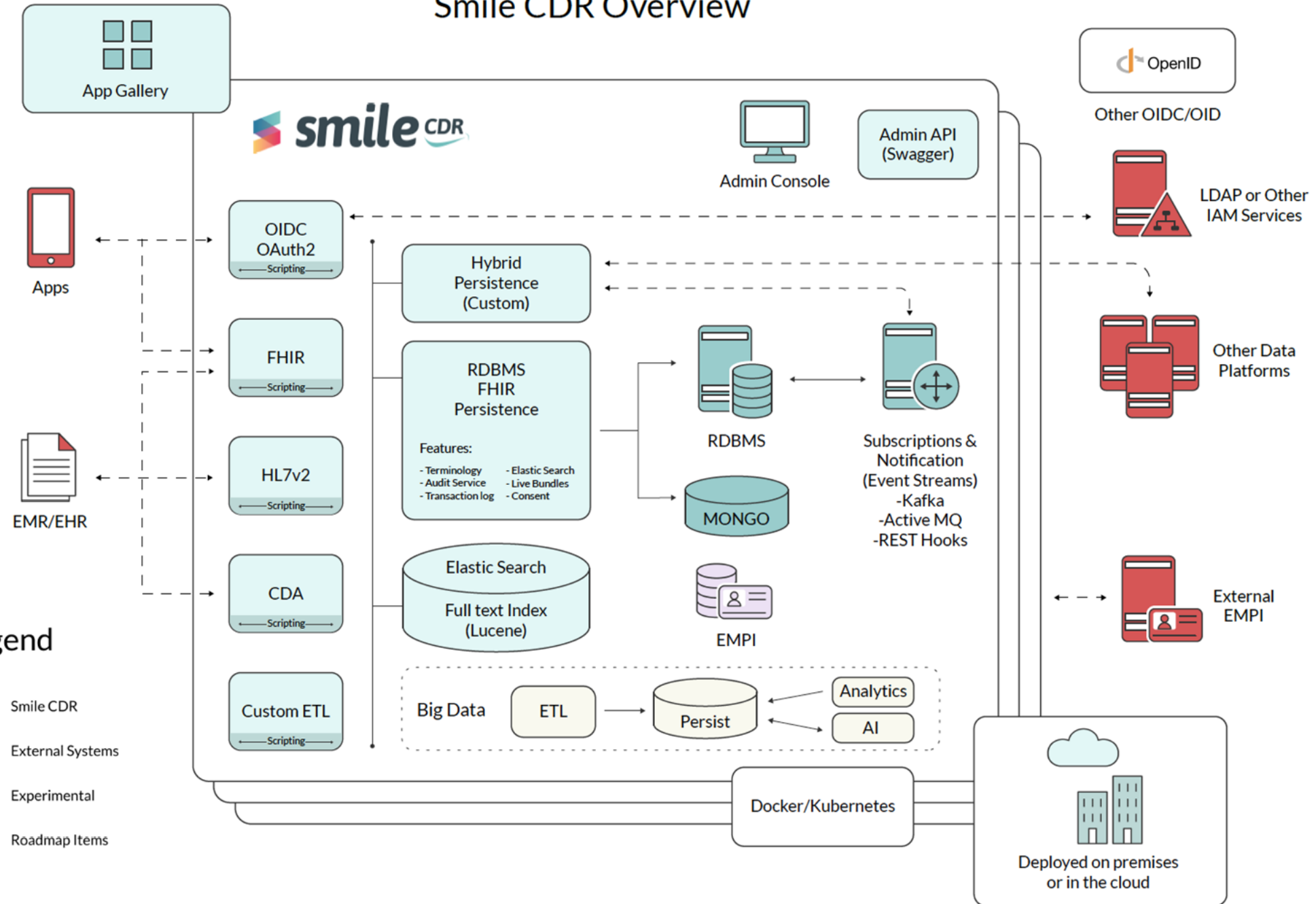
Industry Shift



- Enabling Patients to take control of their Healthcare data, through use of FHIR and other standards
- **Payers**, with their more horizontal view of data, **are responsible for providing the data to their enrollees/patients** from Medicare Advantage (MA), Medicaid, CHIP, and Qualified Health Plan (QHP) issuers on the Federally-facilitated Exchanges (FFE).



Smile CDR Overview



Solution Characteristics



Solution must be:



Flexible

- a. Rules are still evolving
- a. Standards are evolving
- a. Allow for both FHIR Façade and FHIR Repository



Extensible

Need to work with legacy systems internally and externally



Scalable

- a. Need to handle a lot more data
- a. Need to handle a lot more requests



Secure

- a. Patient-centric
- a. Able to handle complex authentication for multiple identities (HIPAA Compliance)



Reliable

Strong patient matching



Implementation Considerations



Blue Button Applications of Customer Choice

Consider dedicated delivery and receiving FHIR repositories to minimize exposure of production systems. Promote and recommend preferred Apps to customers.

Translations

Consider which translations are needed, and when/where in the processing architecture they're best implemented

Security

OAuth 2.0 & OIDC ensure HIPAA compliance, but plan for the impact of inefficient SMART on FHIR apps or malicious actors. Firewall placement is crucial.

Scalability

Cluster with Docker, Kubernetes. Master node design for scaling

Enrollee/ Patient Matching

Sending mismatching data is a HIPAA violation. Set up strong EMPI solutions matching claims/EOB Blue Button data to correct incoming clinical information/USCDI

Performance

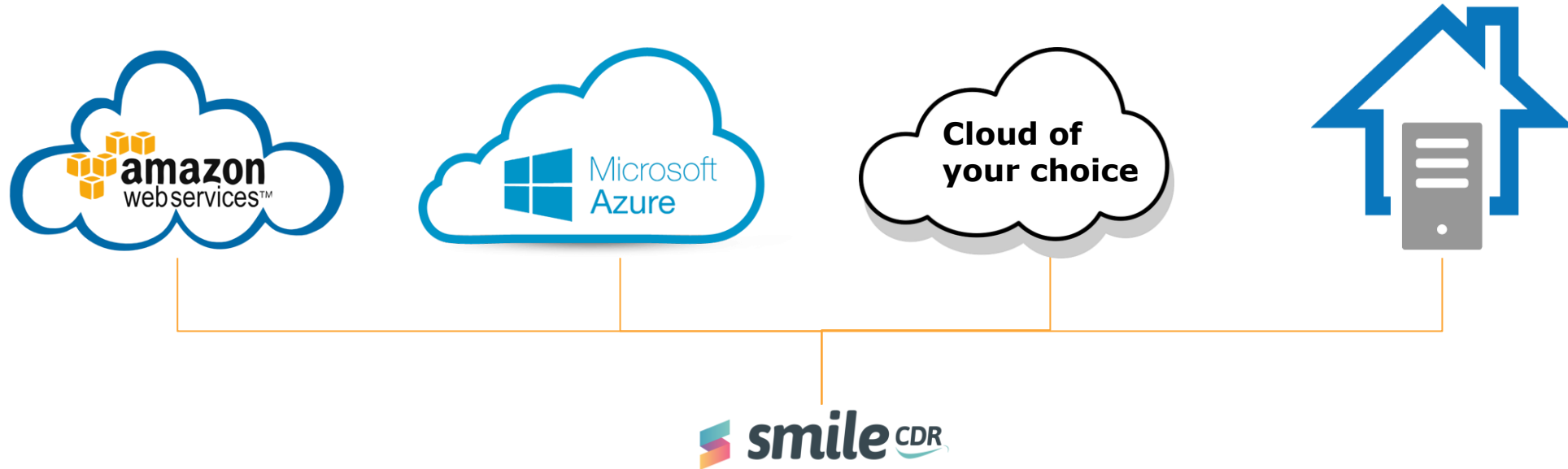
- Concurrency
- Mongo DB
- Efficiencies-subscriptions

API Management

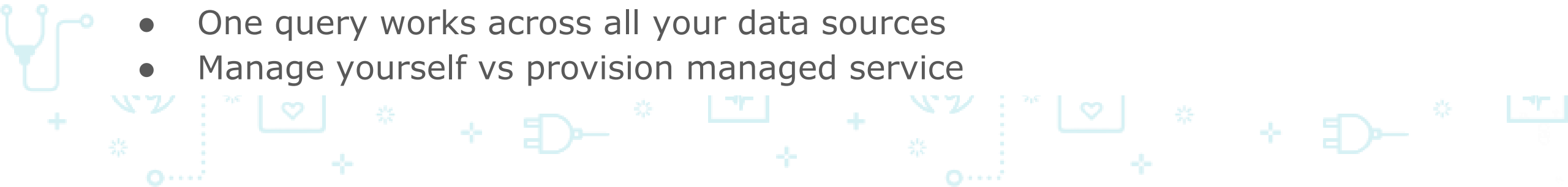
Securely publish FHIR-based APIs, visualize API analytics and use a single system of traffic management for your API gateway.



Hosting: Cloud, On-Premise, or Both



- Support Client's data independence
- Support hybrid approach (some data on-premise or in the Cloud)
- One query works across all your data sources
- Manage yourself vs provision managed service





Availability and Scalability

- Capacity planning: how do you I know if I have the right size?
- Clustering with Kubernetes & Docker
- Multiple data centers





Operations

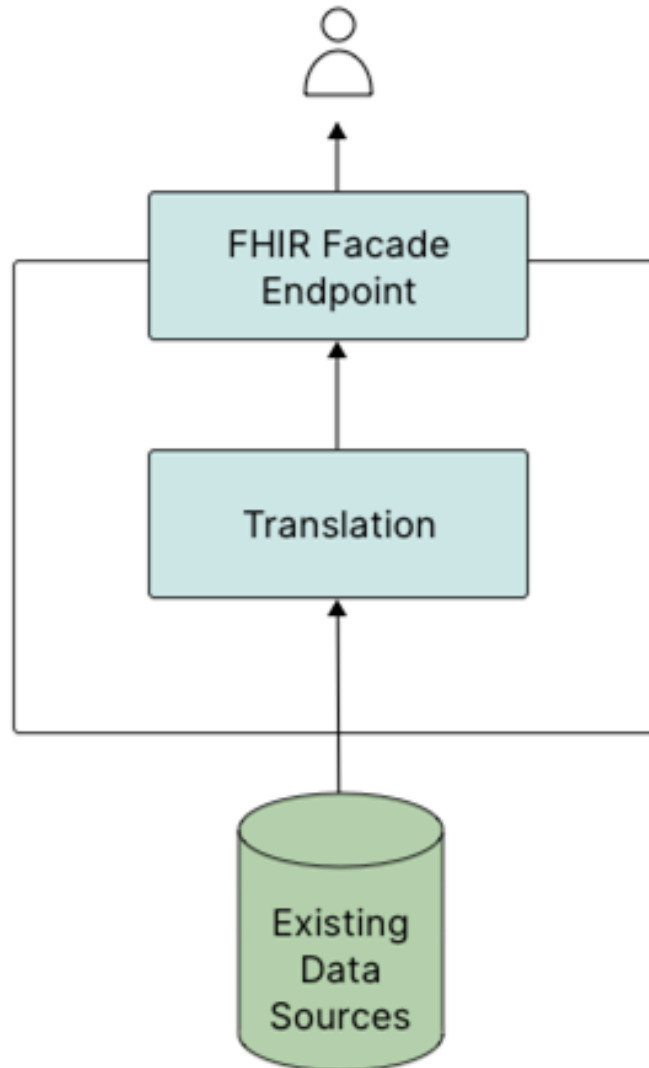
- Data quality
- Service management and monitoring
- Partner data flows
- Queue management
- Incident management
 - Security



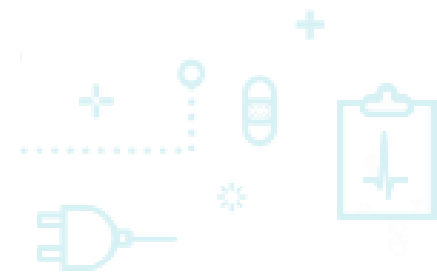
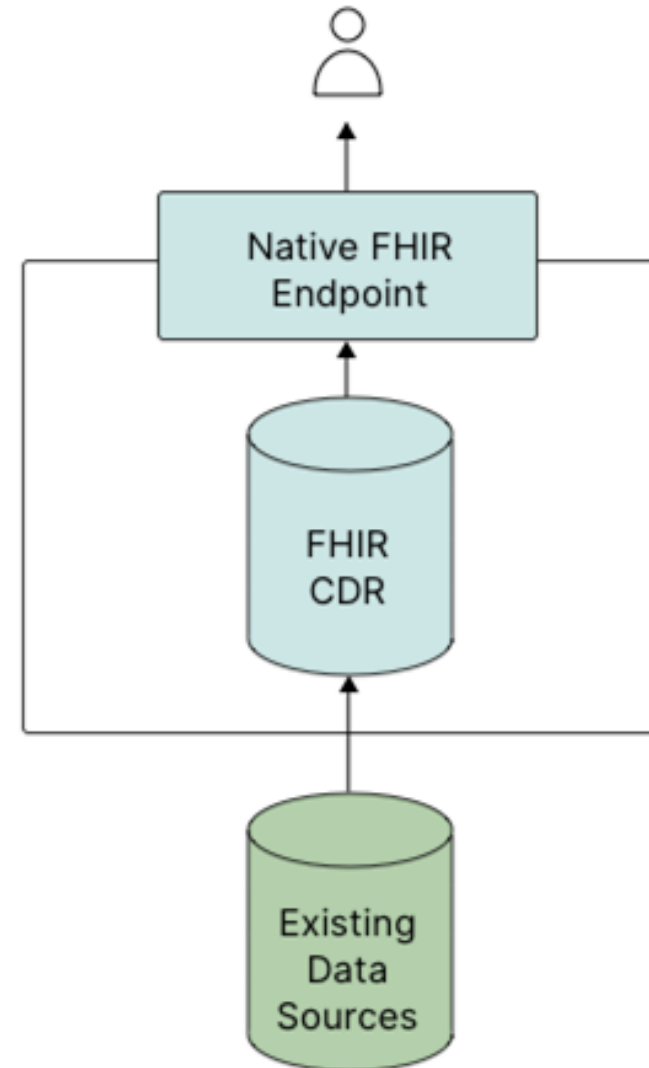
Deployment Models



FACADE



REPOSITORY





Two Models for Adopting FHIR APIs

The Facade

- Data is served from its existing location
- Mappings to FHIR are employed at query time
- Names:
 - HAPI FHIR: *Plain Server*
 - Smile CDR: *Hybrid Providers*

The Repository

- Data is copied to a purpose-built repository in real-time or on a schedule
- Data is then queried from this repository
- Names:
 - HAPI FHIR: *JPA Server*
 - Smile CDR: *CDR*

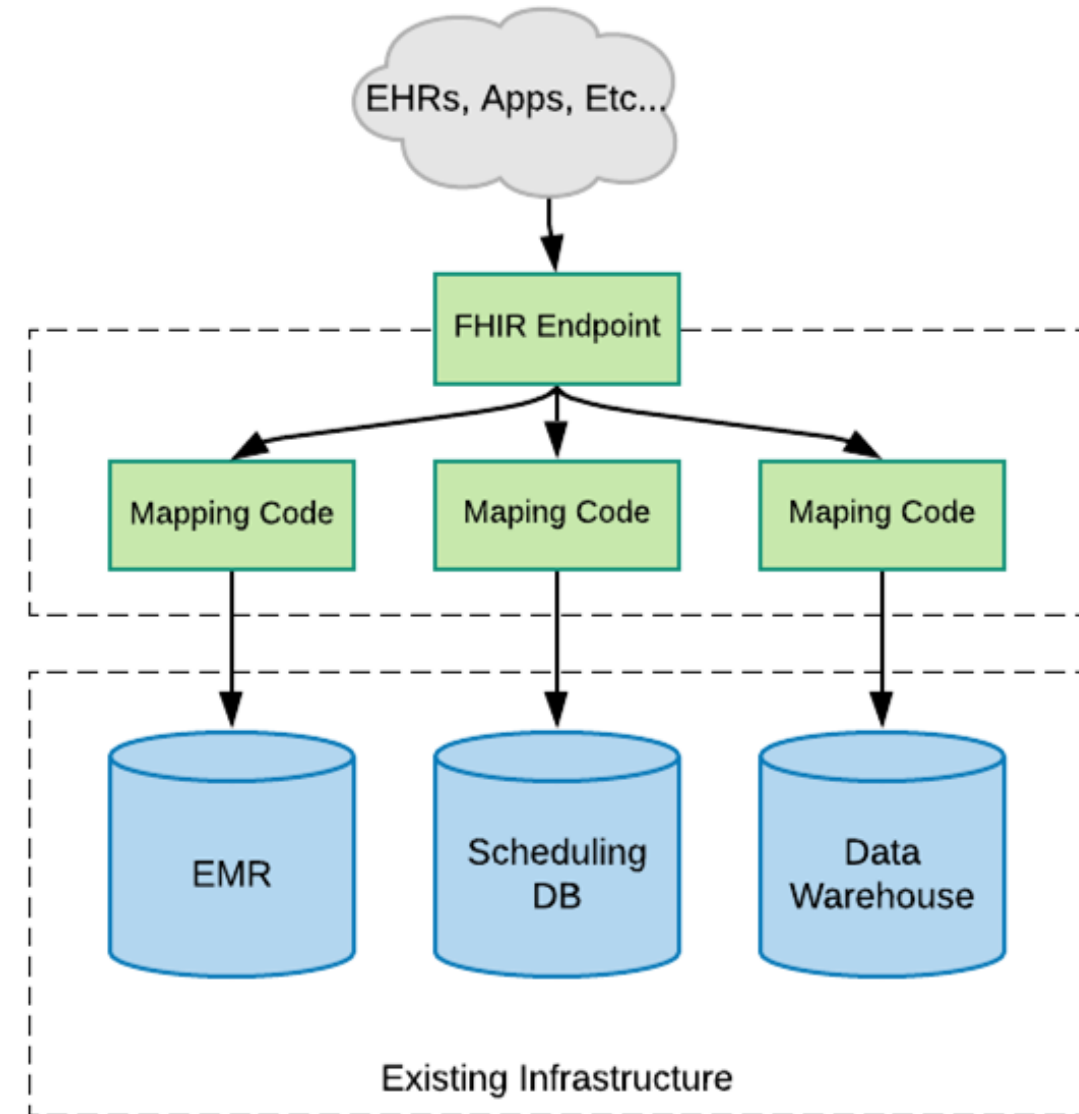


Facade

Leaving Data In-Place

Most FHIR Frameworks provide support for a "Facade Mode". This has ups and downs.

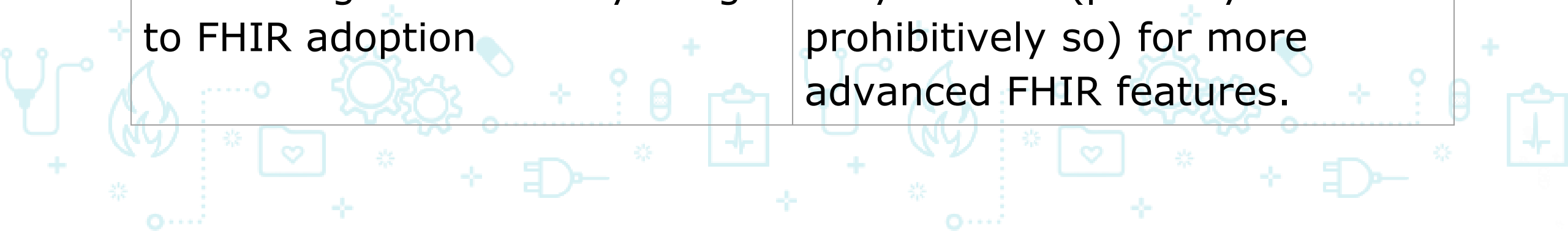
- Much easier to build generally
- Typically requires constrained FHIR abilities
- Data is typically converted at runtime to FHIR





Facade

Upside	Downside
One single source of truth for data	Performance: Often times existing sources are not (and can not be) tuned for arbitrary online transactions
Leverages existing investments in SOA / Microservice	Can be hard to support "bare minimum" FHIR features
Can be a good "Gateway Drug" to FHIR adoption	Very difficult (possibly prohibitively so) for more advanced FHIR features.



Repository



Upside	Downside
<p>Native FHIR repositories support most FHIR features out of the box</p> <ul style="list-style-type: none">◦ E.g. new search parameters, includes, chaining, etc.	<p>Converting data up-front can take lots of effort as it has a higher threshold for "getting it right the first time"</p>
<p>A FHIR repository often instantly becomes a valuable enterprise asset</p> <ul style="list-style-type: none">◦ (instant flexible access to normalized data is something your customers didn't know they needed!)	<p>Duplicating large volumes of data has storage implications</p>



Multitenancy



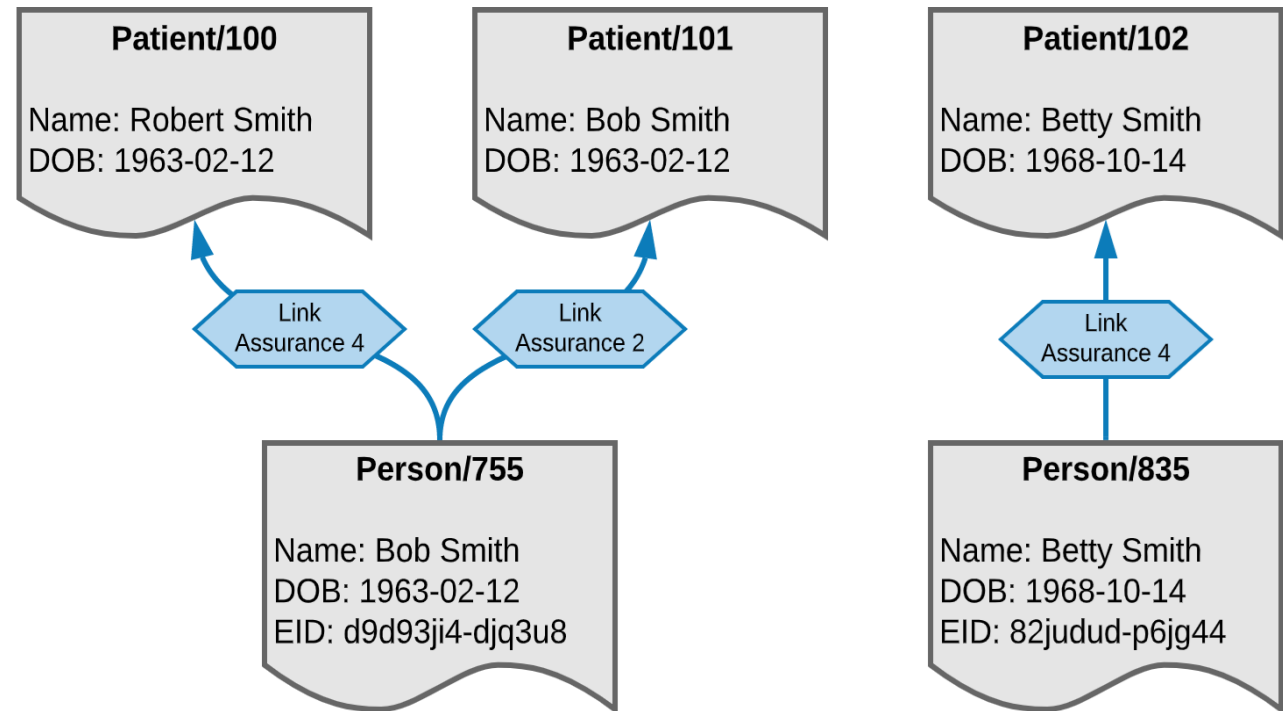
- You can allocate particular infrastructure for particular tenants
- Isolating tenants from each other on common infrastructure and common components
- **Use of partitions for retention management for your data stores if you have high growth**



Patient Matching and Data Quality



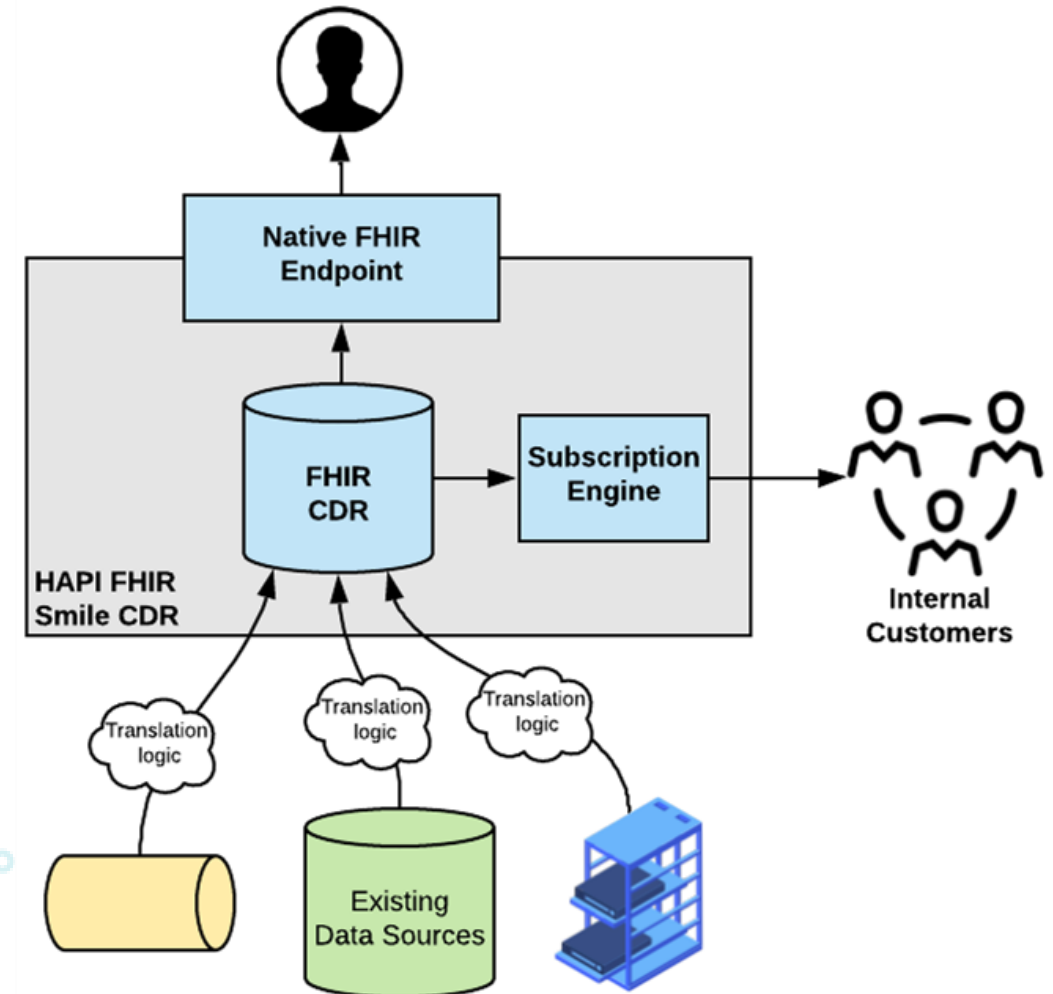
- How do you know the data belongs to the right patients?
- The Smile CDR **EMPI** is itself a FHIR repository, using the FHIR data model to represent roles and links.
- These links are used to indicate that different Patient/Practitioner resources are known or believed to refer to the same actual (real world) person.



Subscriptions

Enterprise Notification System

- FHIR Subscriptions can power many internal customers
- Internal innovative ideas are particularly likely to benefit from **real-time access to focused data feeds** and a **canonical enterprise data model**



Thank you!



Questions?

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Appendix





What is Smile CDR?

Smile is a FHIR Platform

- Product + Services + Ecosystem
- Core building block of any connected system leveraging FHIR data model, APIs
- Data unification is our goal

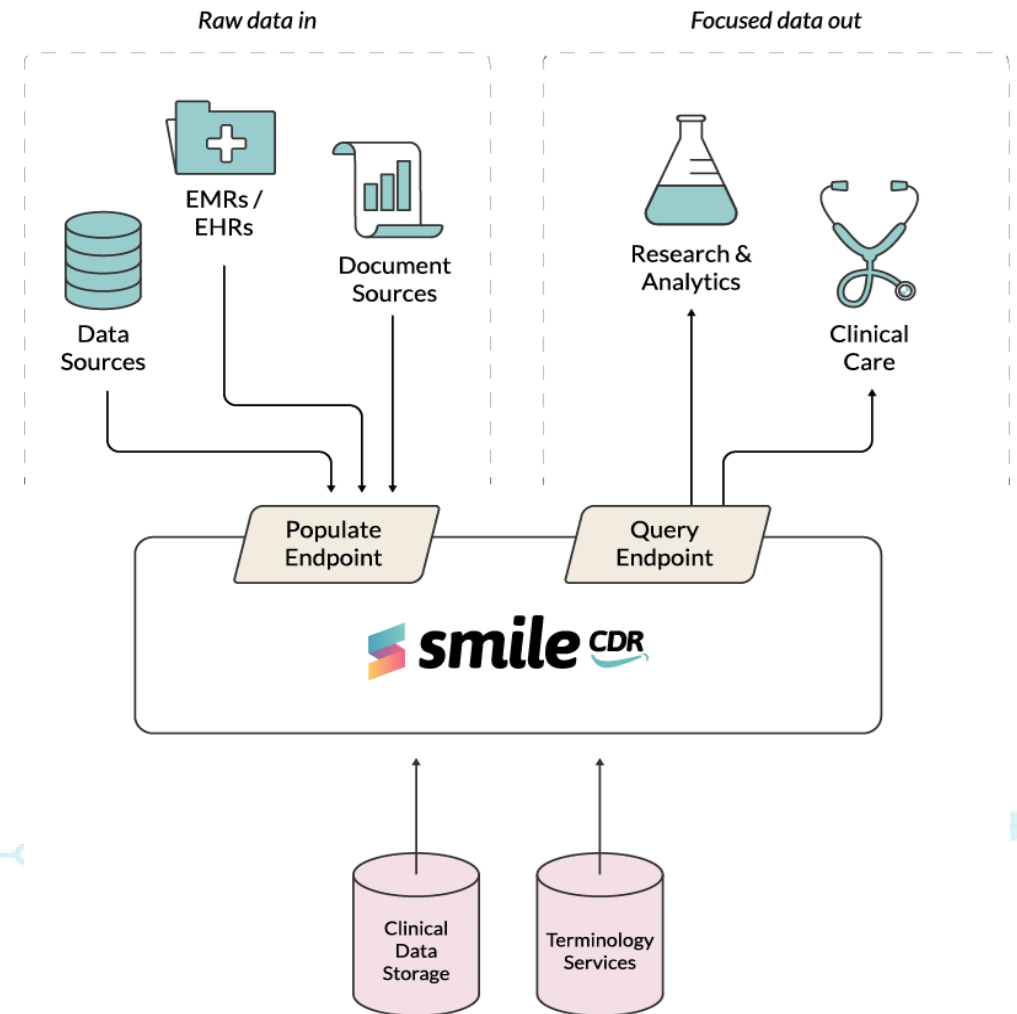
Smile is Enterprise-grade

- Out-of-the box configuration and management tools
- Built for scale and performance
- Most complete and up-to-date FHIR specifications in industry
- Multiple connectors - FHIR, HL7 v2x, CDA, ETL, LDAP and other IAM services, etc
- Enabling future initiatives - Big data (BI, AI), next gen eMPI

Transforming how health data is managed...



- Smile CDR
 - Based on open standards
 - Data stored in standardized FHIR format
 - Access data via open standard FHIR APIs
 - No vendor lock-in
 - Low upfront investment cost
 - Maximizes organization's control of their data





Smile CDR Value Proposition

New Kind of Healthcare Data Management

- Enable easy access to client data

Single Platform

- Reduce support complexity and costs

Extensible and Open

- Total client control over the information

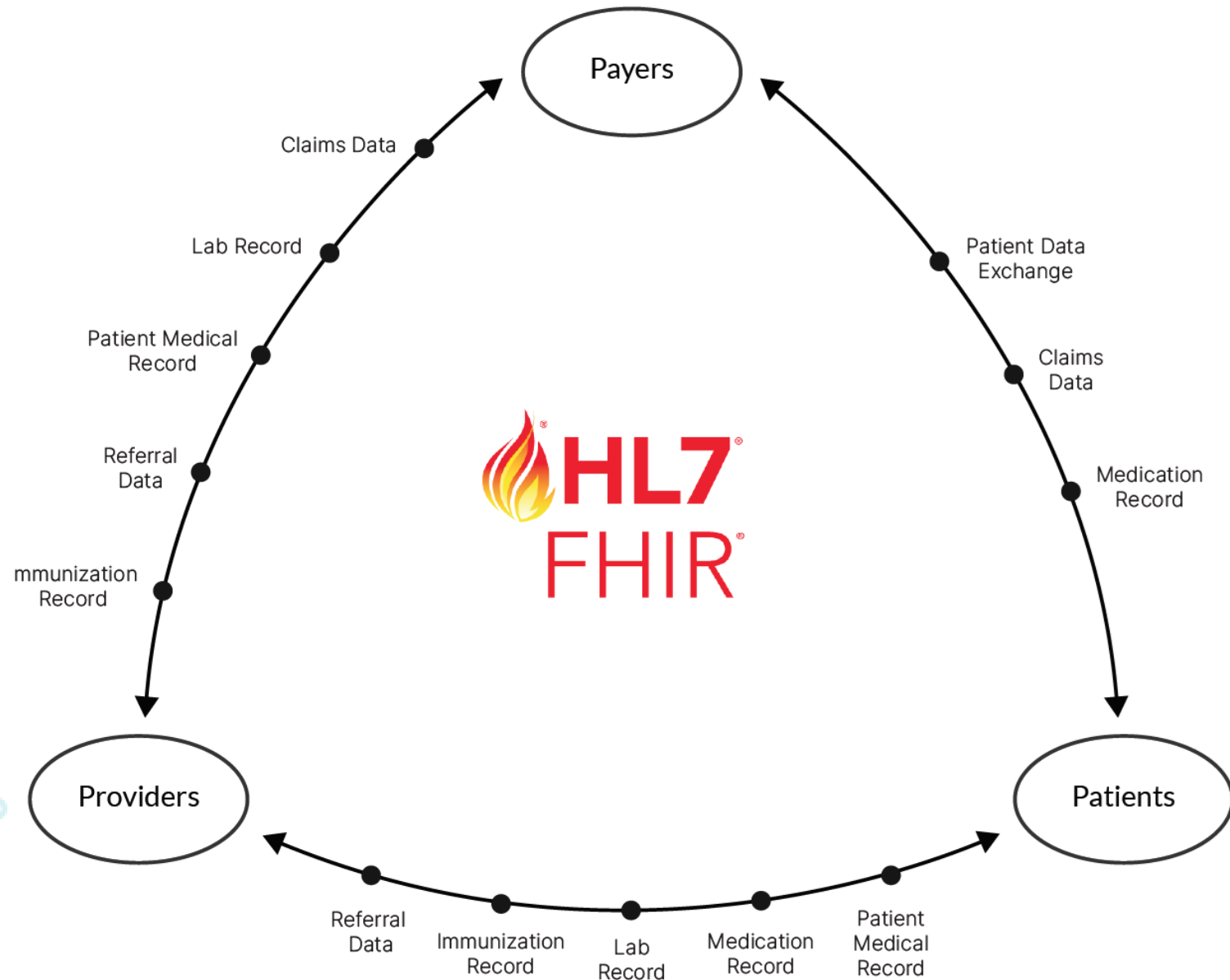
SMART on FHIR

- Enable innovative technologies to access data

Reduce Total Cost
of Ownership
(TCO) for
accessing and
maintaining highly
important data

Full Support for the FHIR Ecosystem

As the most complete FHIR server supporting the full spectrum of FHIR resources, Smile is flexible enough to accommodate the entire FHIR ecosystem for sharing health data to meet **current and future needs**



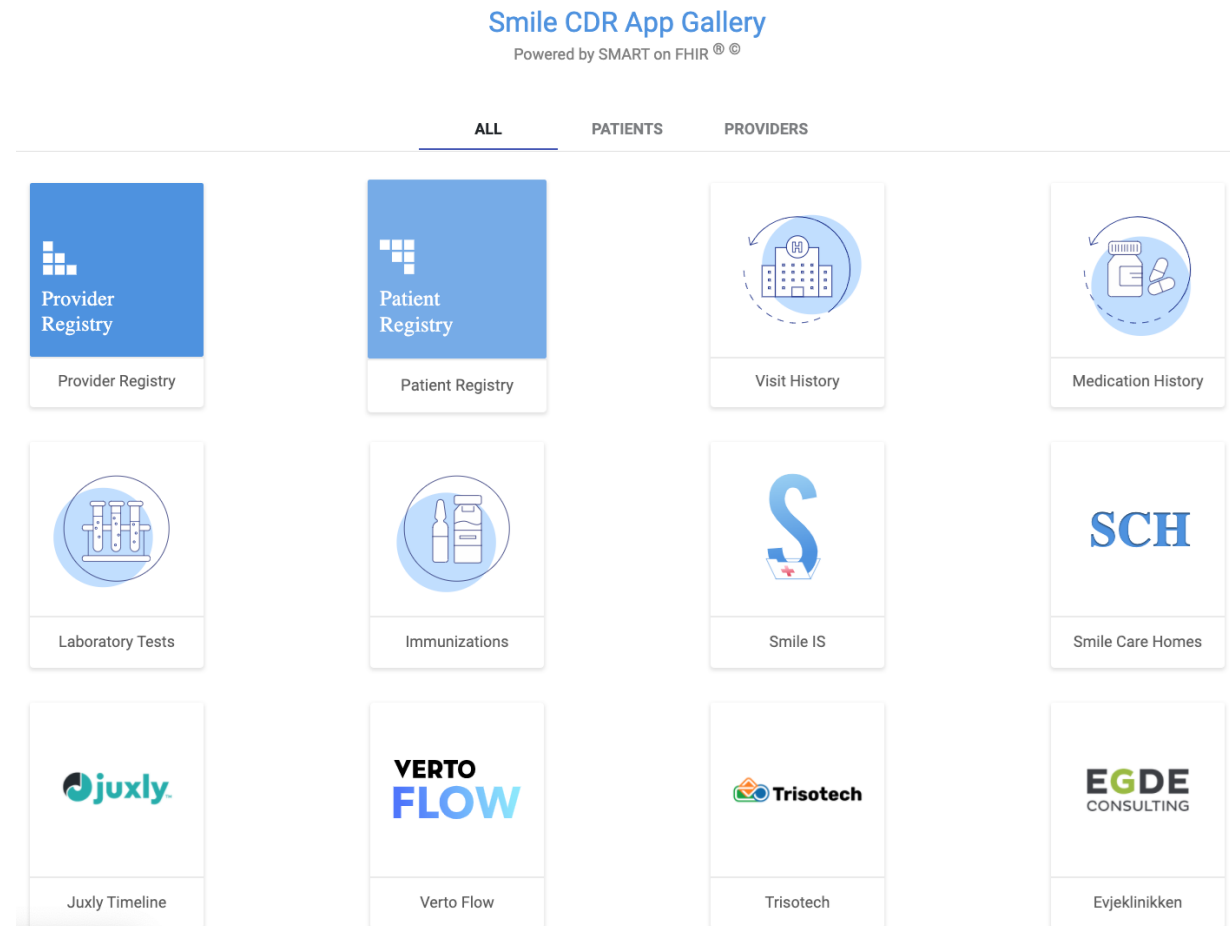
Enabling better healthcare delivery models and innovation



Leveraging a common data model and Smile CDR, organizations can provide unlimited applications for all their stakeholders that are:

- Safe and secure
- Adaptable to future needs
- Easy to build and maintain
- No data blocking or vendor lock in

App store for everyone in the healthcare continuum!



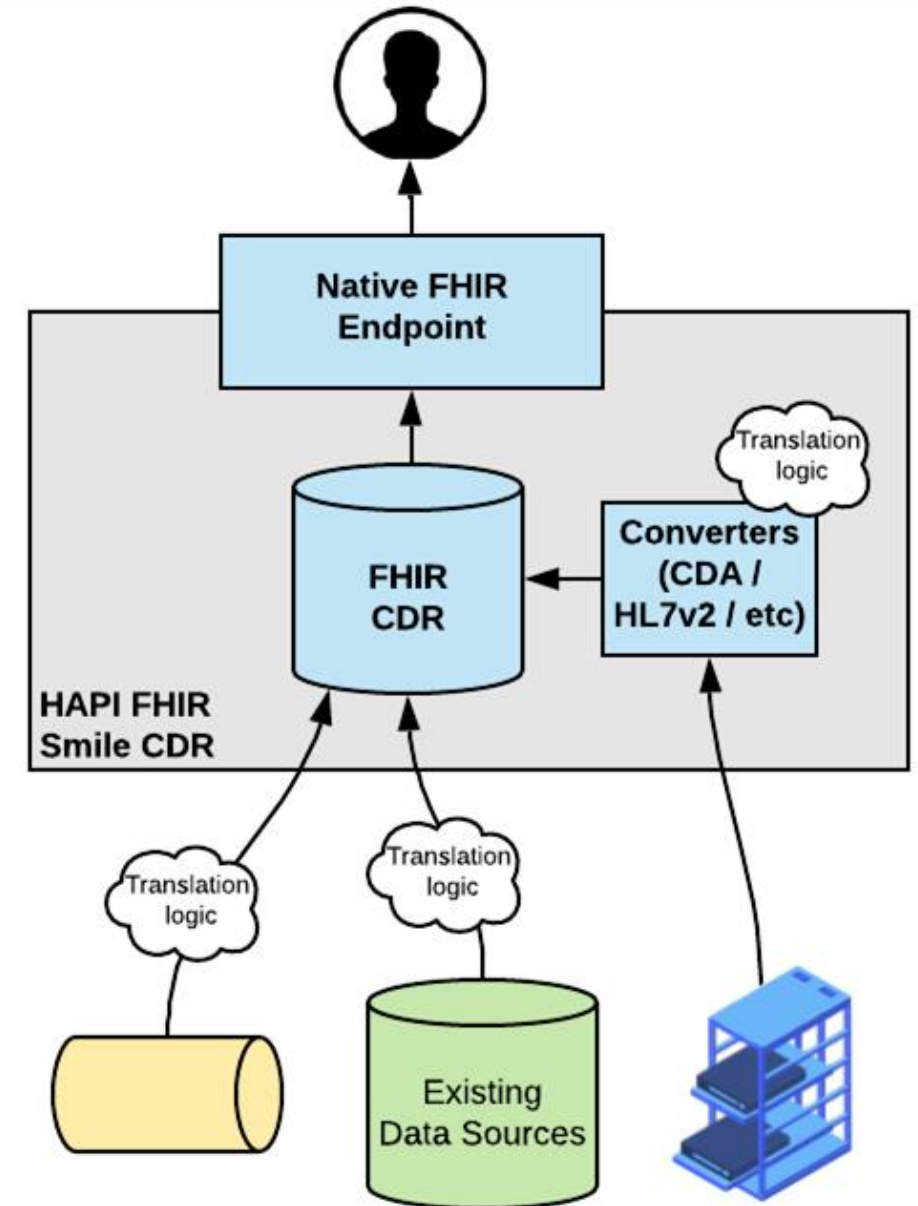


The Design

- Existing data is copied into a CDR ahead of time and queried on demand

HHS Rules Examples:

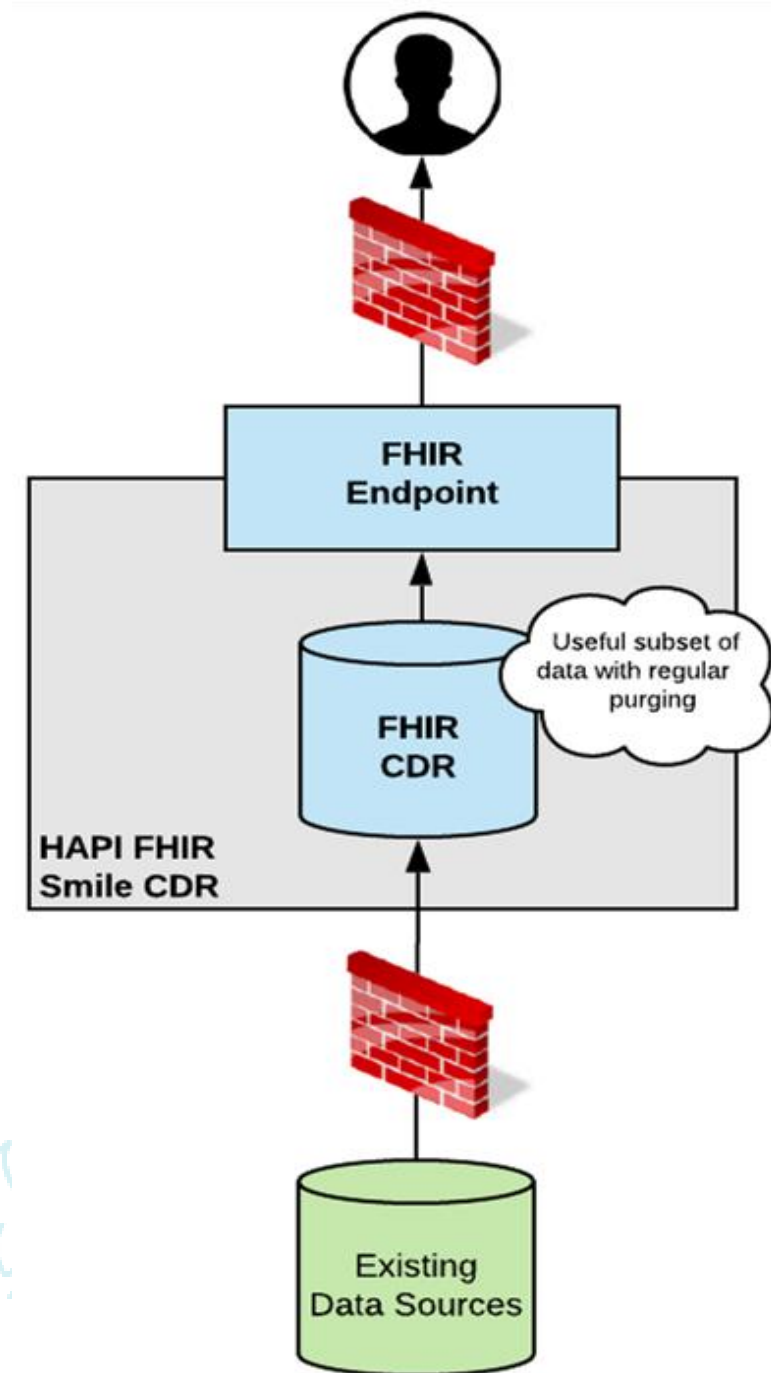
- To **deliver secure filtered data to outside world** (Blue Button and US Core)
- To **receive data from outside world** (Payer to Payer) and eventual provider transfers using US Core
- To **stage data for EMPI matching US Core to Blue Button resources** before sending to FHIR repository for delivery.



Other Repository Benefits

Minimize Data & System Exposure

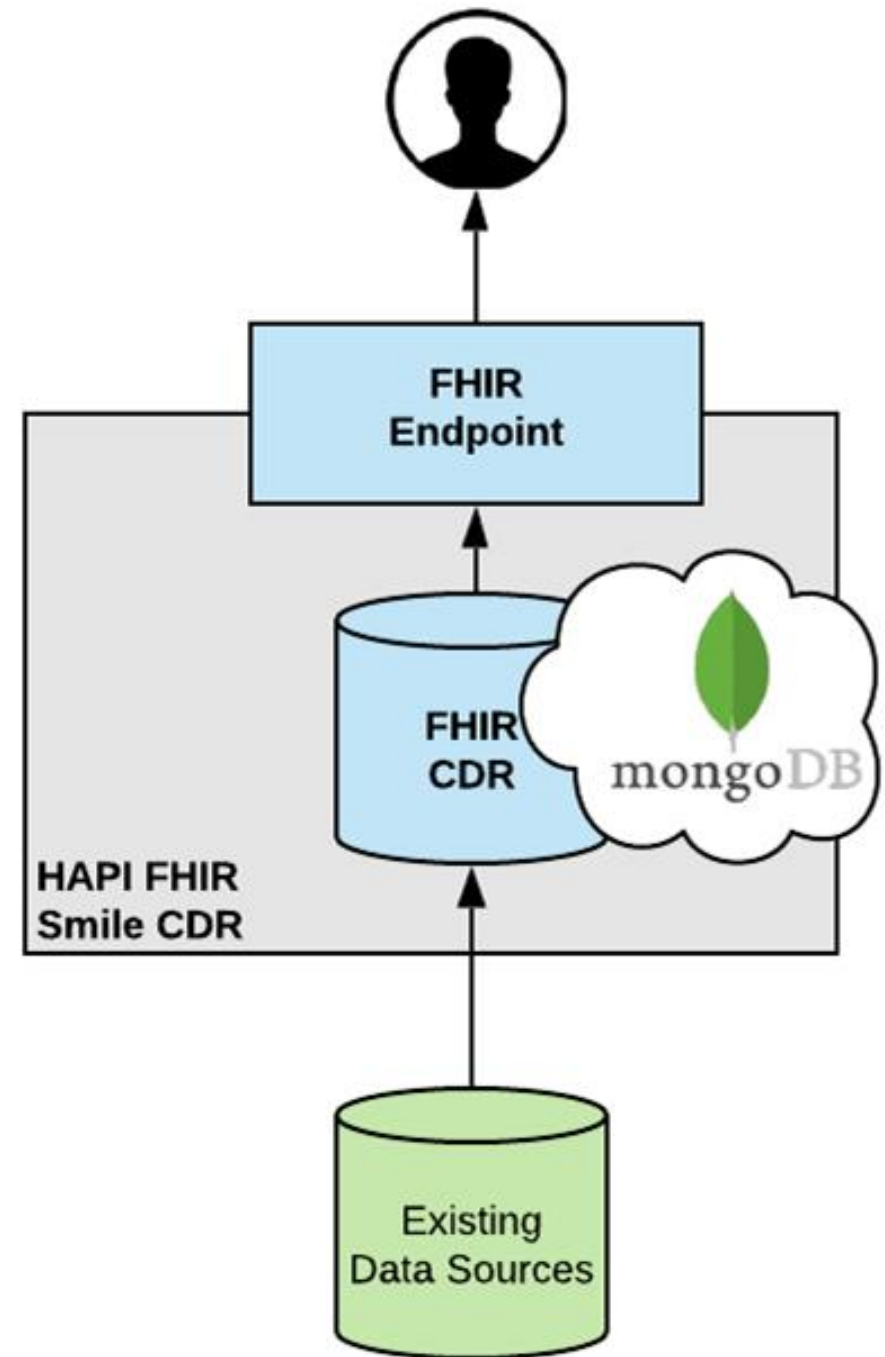
- Repository exposed to outside world can contain only a subset of data making it a less lucrative target to hackers
 - E.g. "only last 2 years", or "all data except specific sensitive data"



Other Repository Benefits

High-Performance Read-Oriented Store

- MongoDB provides a storage module that handles very high read-concurrency



Other Repository Benefits



LiveBundles

- Data grids can be challenging for traditional FHIR REST API
- Dashboards and KPIs can be automatically tracked and kept up-to-date using "Live Bundles" in Smile CDR

Modified Early Obstetric Warning Score (MEOWS)

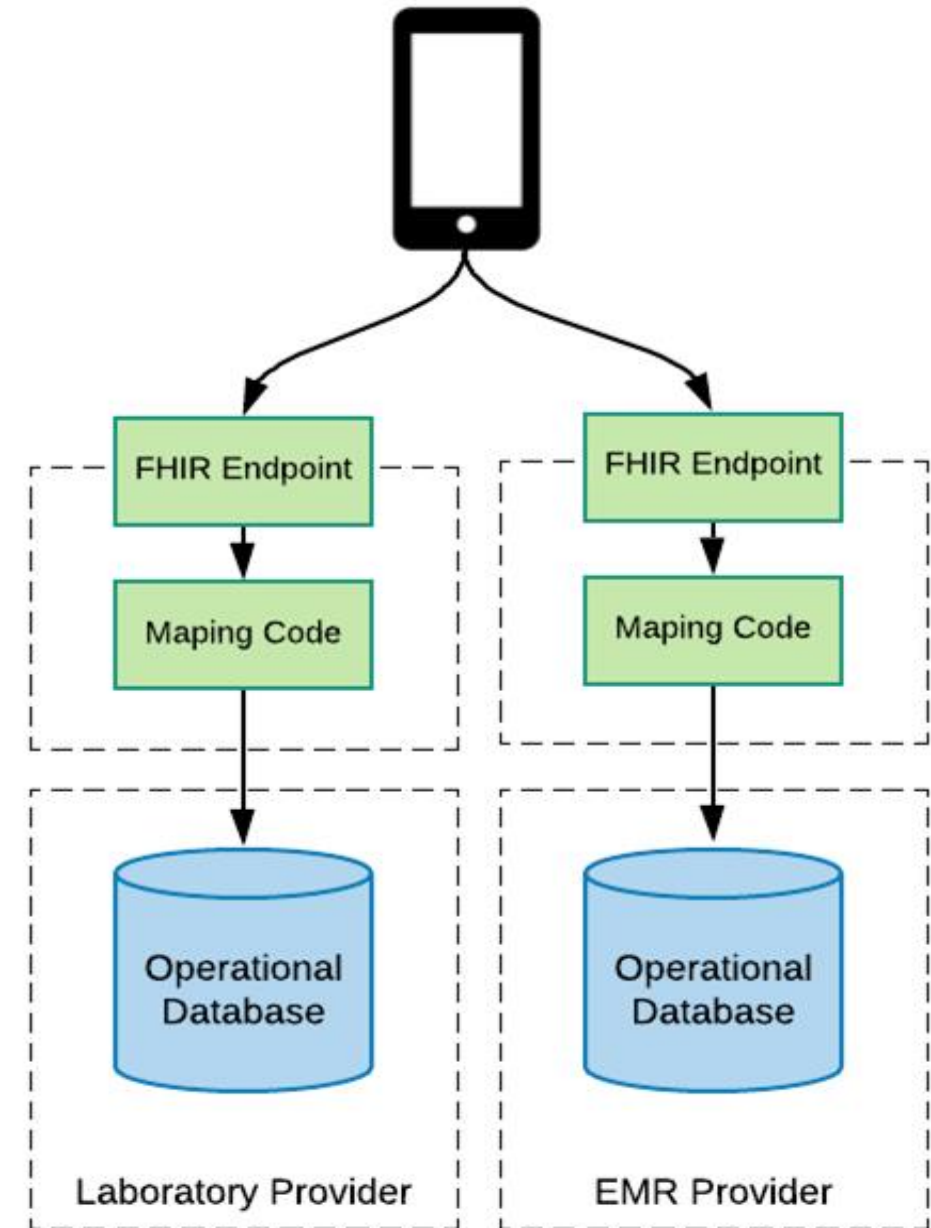
Name	Age	Score	Temp	SBP	DBP	Pulse	Resp Rate
Anne Allen	24	0	36.5	94	52	65	15
Betty Bailey	29	7	39	150	110	80	17
Candice Cook	35	2	37	110	75	90	27
Denise Davis	27	0	37.1	130	75	85	13
Edith Ellis	37	4	38.2	82	45	42	23



Facade

Hybrid Facade

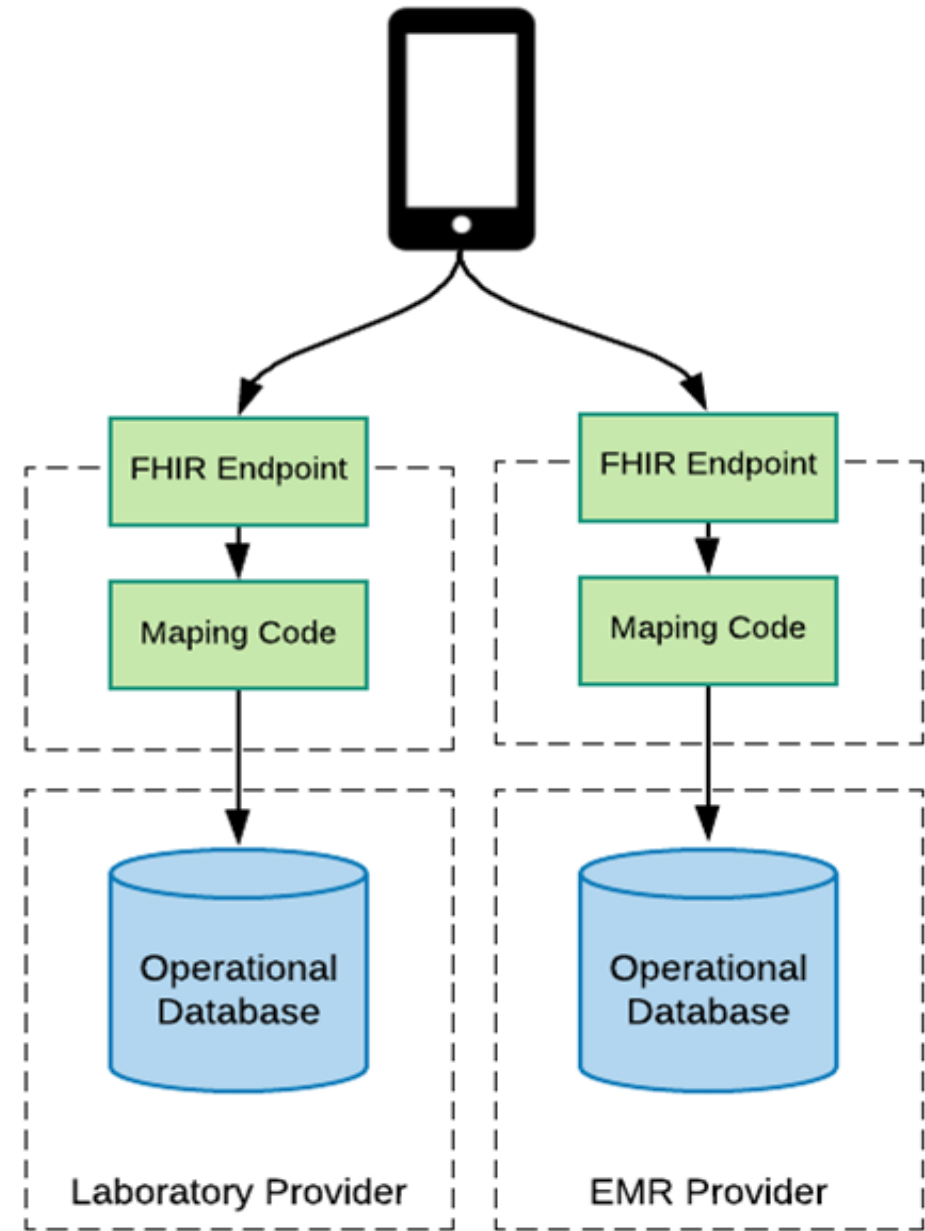
- Hybrid Facade work with data stored in external databases, services, etc., and expose this data as FHIR resources while retaining all the flexibility and support for other elements in Smile CDR.
- Hybrid Providers can be implemented both as a full or partial facade for your internal systems.



Facade

SMART on FHIR apps

- Facade on top of existing operational DB to add support for Health Records



Architectural Challenges



Identity Management is the *Hardest* Problem

- For consumer access, *Authenticating* and *Authorizing* users is almost always harder than anything else
- Existing SMART "patient" scopes don't translate well to a Payer view of the world





Accelerating Digital Transformation at Payers

New HHS rules add to business case for accelerating organizational digital transformation

Potential Areas of Impact

Administrative Cost Savings

Medical Cost Savings

Revenue Growth

Example Capabilities

- Self-service tools (member/provider)
- Paperless communications
- Sales support process automation
- Analytics-driven provider pricing
- Provider contract standardization
- Guided care/pharmacy selection
- Decision support tools for age-in conversions
- Unified CRM solutions enabling better lead management and cross sell/up-sell