

UW Medicine

Enterprising FHIR

UW FHIR Workshop
September 23 – 24, 2018

Kevin L. Swank
klswank@uw.edu

UW Medicine Lead Enterprise Interfaces and Data Integration Architect

AGENDA

Introduction and UW Medicine

Service Oriented Architecture – putting FHIR in the bigger picture

Mayo Clinic Clinical Innovation Accelerator Pilot

Lessons learned applied to UW Medicine

Mayo Clinic Clinical Innovation Informatics Environment

OneOme, LLC MDS Use Case Example

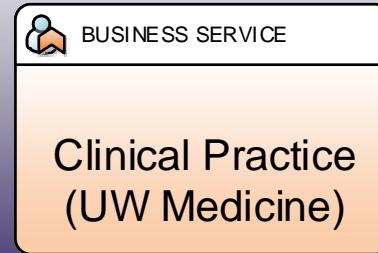
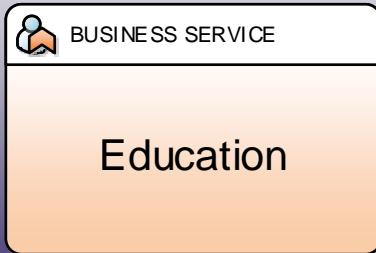
Questions/Discussion

UNIVERSITY OF WASHINGTON

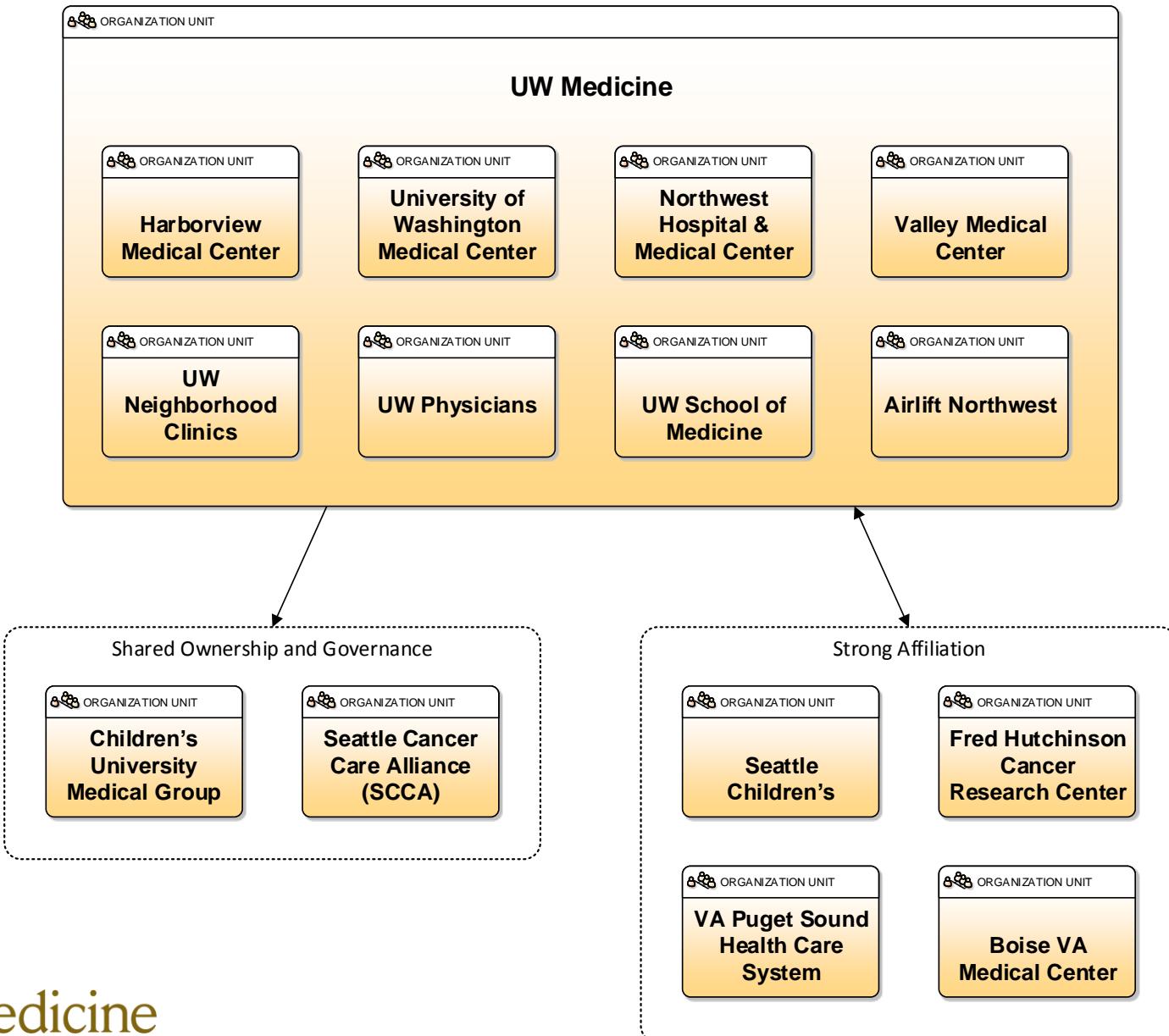


ORGANIZATION UNIT

University of Washington



UW MEDICINE



UW Medicine

UW MEDICINE

- Seattle, Washington area – Olympia to Bellingham
- 65,000 admissions annually
- 4 hospitals, 188 clinics, 1,544 beds, 86 operating rooms
- 1.6 million outpatient and 205,000 ED visits
- 2,483 employed faculty and 4,649 clinical faculty across the WWAMI (Washington, Wyoming, Alaska, Montana & Idaho) medical education program
- 26,000+ employees
- EpicCare for Ambulatory
Cerner Millennium for Inpatient
Valley instance of Epic
NWH instance of Soarian
- New CIO – Joy Grosser
- New CHSO – Lisa Brandenburg



UW MEDICINE

	NWH	HMC	UWMC	Neighborhood Clinics	SCCA	Valley
LOGICAL APPLICATION CODE	Organization Unit	Organization Unit	Organization Unit	Organization Unit	Organization Unit	Organization Unit
EMR	Soarian	●	Epic Ambulatory Cerner (ORCA) – In-patient		Epic	
Integration	OpenLink	●	Infor Cloverleaf, Go Anywhere MFT, Epic Bridges & Interconnect, Cerner OpenLink, Cerner iBus		Bridges, other	
Lab		●	Sunquest LIS, Sunquest Instrument Manager, Iguana			
Path		●	Sunquest PowerPath, Tissue Tracking, Mirth			
Rad		●	GE PACS*, GE RIS, Powerscribe*, TeleRad,			
Pharm		●	Cerner PharmNet (in), Eterby (ambul.), Pyxis, PIMS			
Enterprise		●	3M(coding), WhiteBoards, EDW, ADFS, Mindscape, PUMA			
Cardio-Vascular		●	MCG BreezeSuite, eMix, GE Mars and Muse, LifeImage, PaceArt, Qlab, Syngo Dynamics, TeraRecon, CareFusion VMax, and Xcelera			
Perip		●	AIMS 8, MAC, CPU Tray Controller, PHS/HSM, Spacelabs, Tissue TrackCore and Ultrasound			
Auxiliary Systems		●	Alaris Pumps, Allscripts, Audbase, CADD-Solis Infusion pumps, Endoworks, Forum PACS, Heidelberg Eye Explorer PACS, Merge Eye Care PACS, HOPS, Maestro, Noah, N-Centaurus, OPIE, TheraDoc			

- Support Group**
- ITS
 - Laboratory
 - Pathology
 - Radiology
 - Pharmacy

UW MEDICINE – CT

- Journey of Clinical Transformation supports and enables our UW mission to Improve the Health of the Public
- One Patient, One View, One Story across the health system
- Not an IT project
- The journey will be led by our clinical and business leaders and enabled by technology

CT – PROJECT OBJECTIVES (EXTRACT)

Business and Operating Efficiencies:

- Revenue Cycle Management Improvements.
- **Simplification and standardization across operations and IT.**
- Optimized resource utilization.
- **Platform development for future opportunities for centralized clinical and administrative services.**

THE FUTURE OF THE EHR

“The future of the EHR is going to look a lot like your [cell] phone,” predicts Stanley Crane, Chief Information Officer at Allscripts.¹



“We’re really looking at this as Cerner is a platform versus a product solution,” says Zane Burke, president of Cerner. “We’ll know we’re there when you see a lot of apps on our platform.”²



Geisinger's Journey to Inter-APP-ability
<https://www.youtube.com/watch?v=Z87iAYVQ2gA&feature=youtu.be&t=1414>



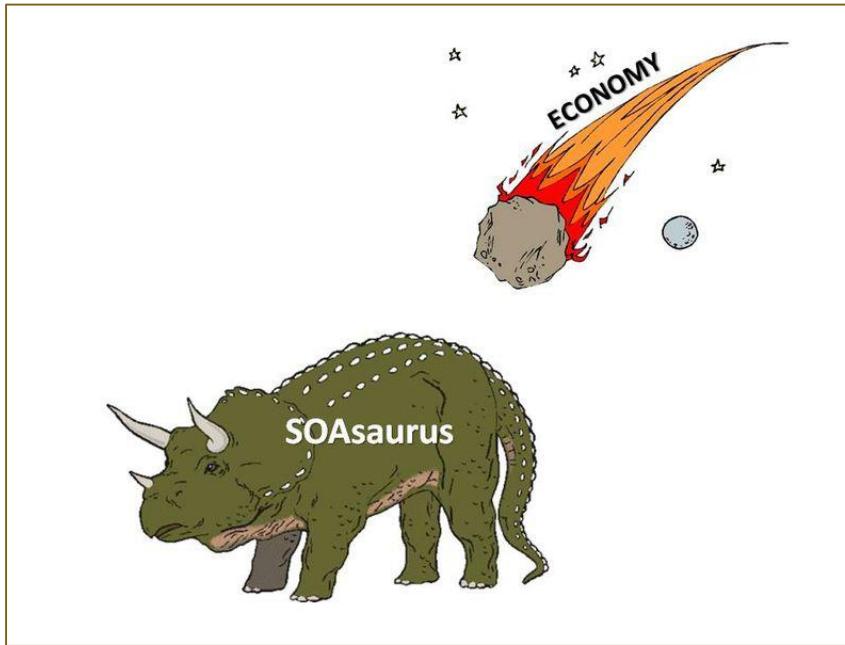
¹ Bresnick, Jennifer (2016, March 22). 4 Basics to Know about the Role of FHIR in Interoperability. HealthIT Analytics. Downloaded from <https://healthitanalytics.com/news/4-basics-to-know-about-the-role-of-fhir-in-interoperability>

² Slabodkin, Greg (2018, March 26). Cerner envisions HER as platform for FHIR apps. HealthData Management. Downloaded from <https://www.healthdatamanagement.com/news/cerner-envisioned-ehr-as-platform-for-fhir-apps>

SERVICE ORIENTATION

A service-oriented architecture (SOA) is a style of **software design** where **services are provided** to the other components by application components, **through a communication protocol** over a network. The basic principles of service-oriented architecture are independent of vendors, products and technologies.

ISN'T SOA DEAD?



¹Myth: APIs Are New; Service-Oriented Architectures Are Old

REMOVING THE CONFUSION

SOA has become confused with heavy-weight (some would say over-engineered) interfaces using SOAP/WS*.

API has become confused with lightweight, mobile-focused ReSTful interfaces.

SOA is an architectural approach

- ²defines, at its core, architectural best practices for building de-coupled applications and fostering service reuse

API's are programming interfaces using SOAP/WS*, ReST, and other technical approaches

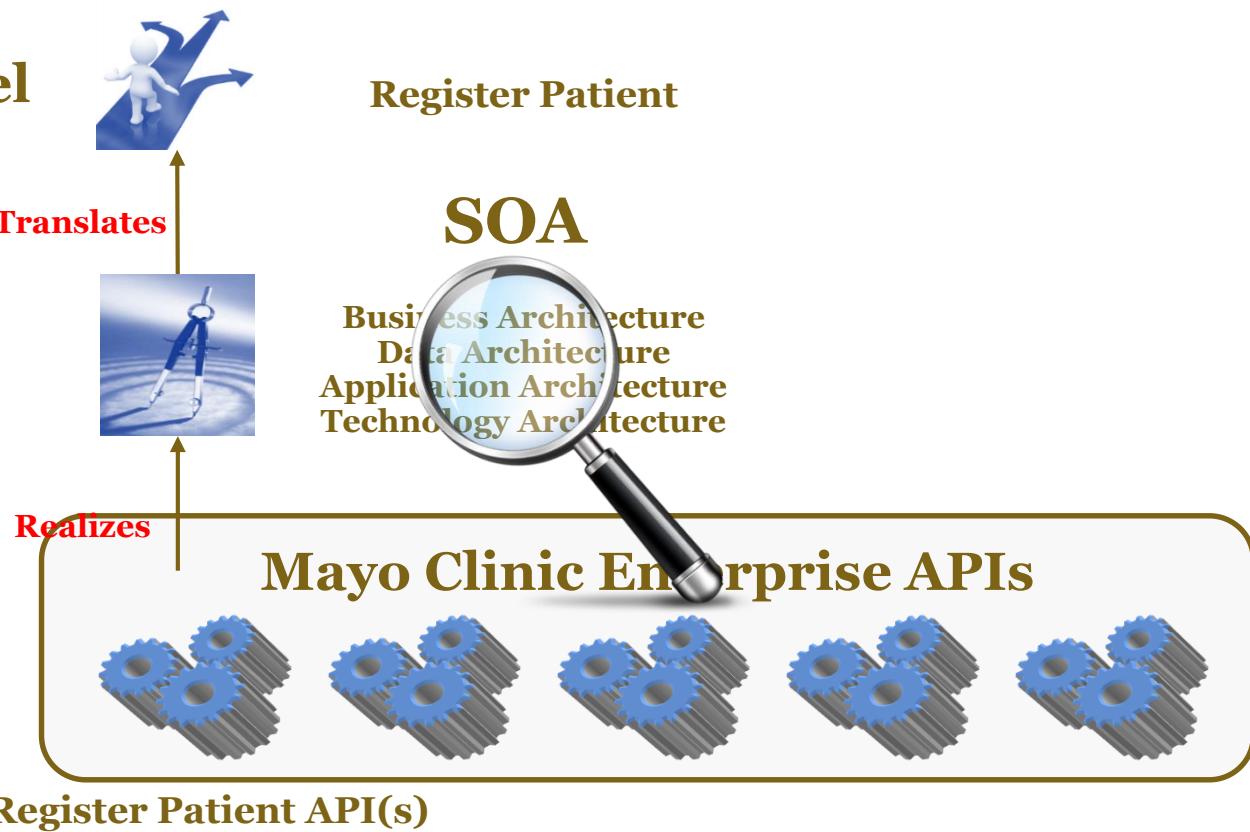
SOA AT MAYO CLINIC

- Architectural Pattern they are using to create the Mayo Clinic Enterprise API

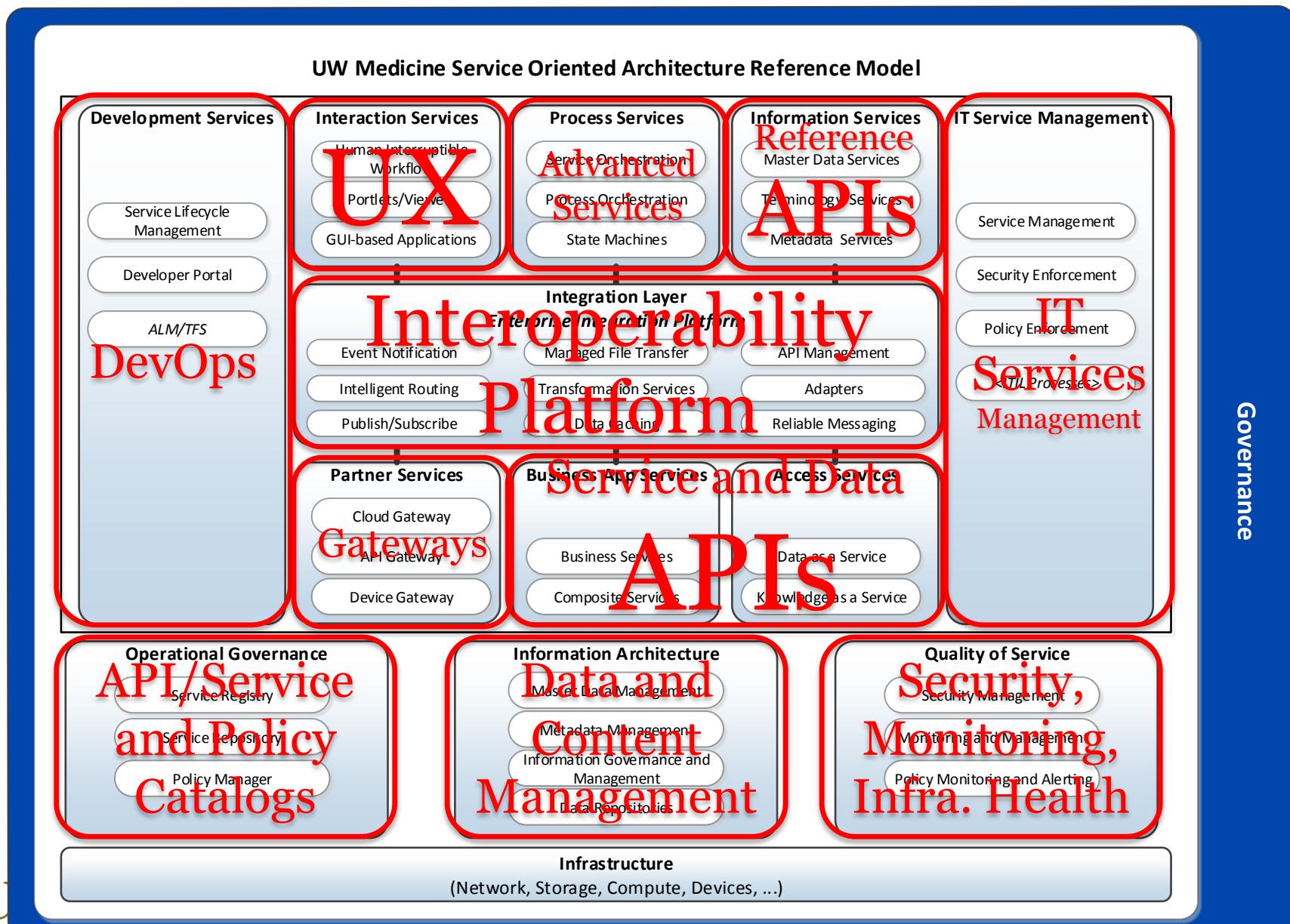
**Business Strategy
and Operating Model**

Architecture

Solutions



UW MEDICINE SOA REFERENCE MODEL



MAYO CLINIC CLINICAL INNOVATION ACCELERATOR (MCCIA) PROJECT

2016 project at Mayo Clinic to deploy a SMART on FHIR “platform” using out-of-box Epic FHIR and project developed FHIR services. Deploy a SMART on FHIR application from Smart Health IT’s App Store and build one as part of project.

Initiated on 18MAR2016 and completed NOV2016

MCCIA ELEVATOR SPEECH

Focus on innovation by leveraging
standardized data on best software
engineering standards and not on where
does data exist, what format, how do I get
access, what libraries to use to deliver it
to my customers

MCCIA KEY DELIVERABLES

Shared Services Components

- ALM Tools (Build, Package, Deploy of Visualizations, Templates, Libraries)
- Open Developer Network (TFSVC / GIT Repository)
- IT Education – Best Practices, API 101, HTML5
- Developers Guide and IT Hub for documentation, Standards etc.,

Platform components

- Configuration of API Platform
- Refactor CDANS to FHIR Resources
- Catalog for Internal Store
- SMART Environment (Dev, Int)

LESSONS LEARNED: SOLID FOUNDATIONS

Key takeaways:

Need enterprise management of the FHIR spec

- It is very unwieldy and is still emerging
- Can quickly become a non-standard standard
- Need to identify reference and code set data that will be used in the UW Medicine implementation of FHIR
- Recommend a FHIR Steering group

Need Data Governance

- terminology, data standards, cross-references
- What are the rules of the road for data access

Identity Management and Access

- needs to be federated and support OpenID Connect (our ADFS instance does)
- how else can different systems seamlessly access each others data and functions unless they share a common source for authentication – whether internal or federated

LESSONS LEARNED: SOLID FOUNDATIONS

Implement an API Management Platform

- Enables interoperability across differently sourced services by standardizing and providing API discovery, security, and other non-functional requirements
- Single “place to go” for all the UW Medicine APIs whether from an internal or external source
- Allows management and visibility into the UW Medicine services environment
- Abstracts backend complexity from consumers
- API flexibility through policies and configuration rather than coding
- Keeps API proliferation from spiraling out of control and becoming unusable

Enterprise API Team

- Direct evolution of APIs and API Platform (Incl. DevOps)
- Build Enterprise APIs as Directed
- Consult with other teams

MANAGE FHIR SPEC PATIENT RESOURCE

```
<entry>
<resource>
<Patient>
<id value="555-44-4444"/>
<extension url="http://ihe.net/ITI-78/Profile/pdqm#mothersMaidenName">
<valueHumanName>
<family value="Jones"/>
</valueHumanName>
</extension>
<identifier>
<use value="official"/>
<system value="http://ghh.org/patient"/>
<value value="555-44-4444"/>
</identifier>
<identifier>
<use value="official"/>
<system value="http://www.ohio.gov/dmv/driverslicence"/>
<value value="67-A4335"/>
<period>
<end value="2003-05-20"/>
</period>
</identifier>
<name>
<use value="official"/>
<family value="Everywoman"/>
<given value="Eve E."/>
</name>
<telecom>
<system value="phone"/>
<value value="(206)3345232"/>
<use value="home"/>
</telecom>
<telecom>
<system value="phone"/>
<value value="(206)752-121"/>
<use value="work"/>
</telecom>
<gender value="female"/>
<birthDate value="1962-03-20"/>
```

MANAGE FHIR SPEC

DIAGNOSTIC REPORT WITH OBSERVATION

```
<entry>
  <resource>
    <DiagnosticReport>
      <id value="1045813"/> <!-- Filler Order Number -->
      <contained>

        <Observation>
          <id value="observation-1"/>
          <code>
            <coding>
              <system value="http://loinc.org"/>
              <code value="1554-5"/>
              <display value="GLUCOSE^POST 12H CFST:MCNC:PT:SER/PLAS:QN"/>
            </coding>
          </code>
          <valueQuantity>
            <value value="182"/>
            <units value="mg/dL"/>
            <system value="http://unitsofmeasure.org"/>
            <code value="mg/dL"/>
          </valueQuantity>
          <interpretation>
            <coding>
              <system value="http://hl7.org/fhir/v2/0078"/>
              <code value="N"/>
              <display value="normal"/>
            </coding>
          </interpretation>
          <issued value="2002-02-15T07:30:00-04:00"/>
          <status value="final"/>
          <reliability value="ok"/>
          <subject>
            <reference value="Patient/555-44-4444"/>
            <display value="Eve E. Everywoman"/>
          </subject>
          <performer>
            <reference value="Practitioner/444-44-4444"/>
            <display value="Harold H. Hippocrates"/>
          </performer>
          <referenceRange>
```

MANAGE FHIR SPEC PROFILES

The following snippet shows how we've restricted the datatype of 'asNeeded' in the MedicationPrescription resource to Boolean, and also made it required, by setting both min and max to 1.

```
1<structure>
2   <type value="MedicationPrescription"/>
3   <name value="asNeededConstraint"/>
4   <element>
5     <path value="MedicationPrescription.dosageInstruction.asNeeded"/>
6     <definition>
7       <short value="Only support boolean in the 'asNeeded' property"/>
8       <formal value="Only support boolean in the 'asNeeded' property"/>
9       <min value="1"/>
10      <max value="1"/>
11      <type>
12        <code value="boolean"></code>
13      </type>
14      <isModifier value="true"/>
15    </definition>
16  </element>
17</structure>
```

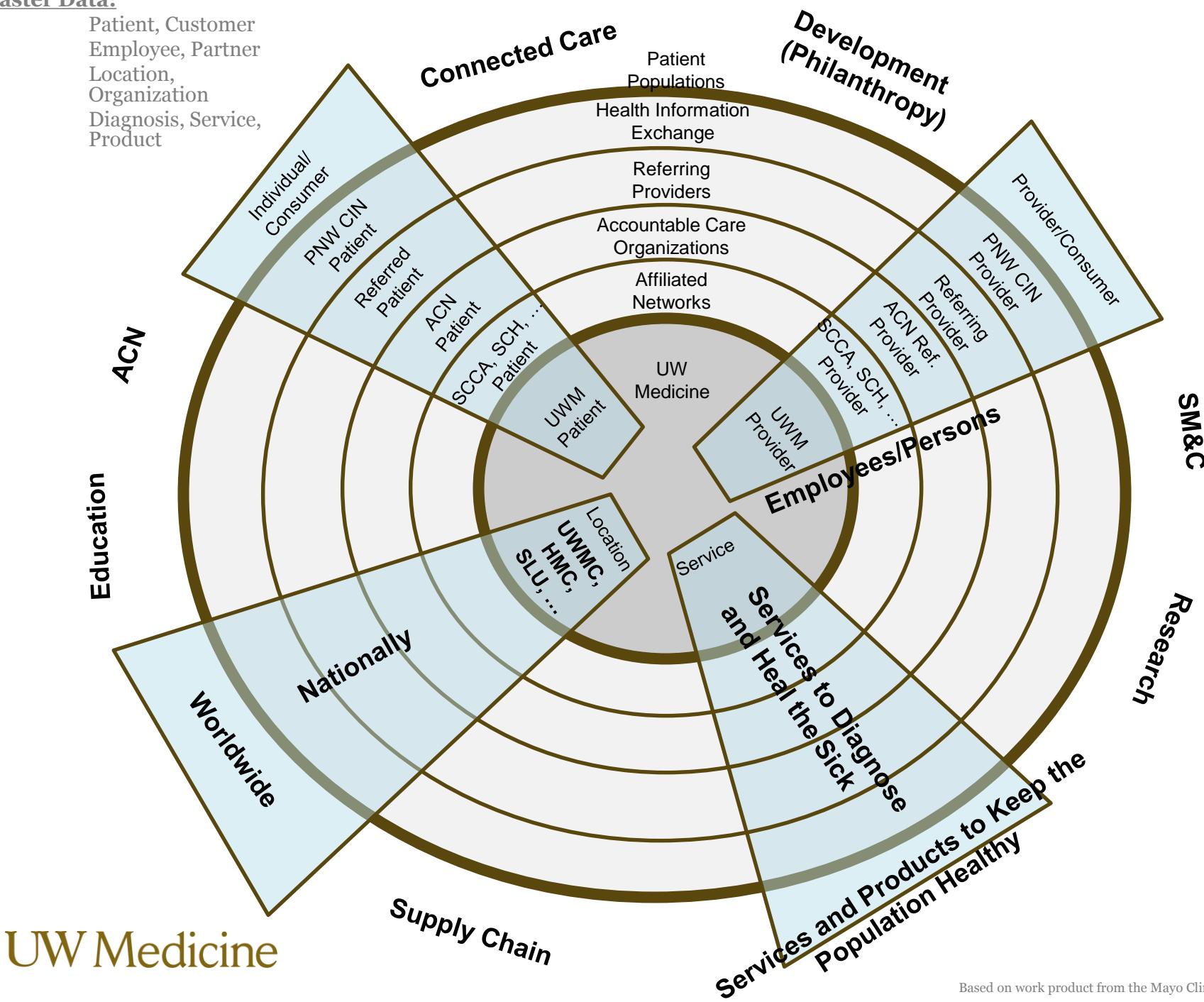
MANAGE FHIR SPEC PROFILES

The following snippet shows how we've restricted the code values that can be used for medications to those defined in a ValueSet of ULM (Universal List of Medicines) codes that a GP (Ambulatory care) clinician can prescribe. We could also have used a direct reference rather than the ValueSet, but the ValueSet allows us to filter the list.

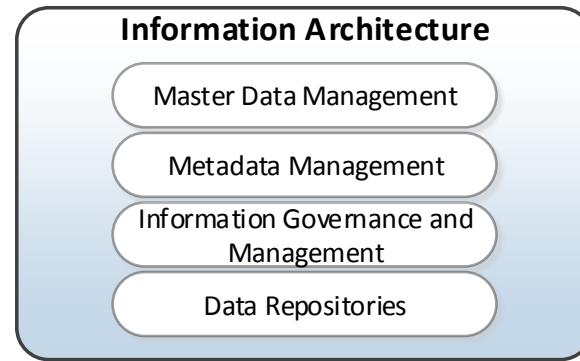
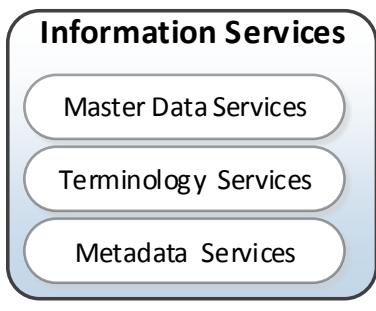
```
1<structure>
2    <type value="Medication"/>
3    <name value="medicationCodeConstraint"/>
4    <element>
5        <path value="Medication.code"/>
6        <definition>
7            <short value="GP ULM Codes only"/>
8            <formal value="Specify that the medication code must come from the NZ ULM codeset"/>
9            <min value="0"/>
10           <max value="1"/>
11           <isModifier value="false"/>
12           <binding>
13               <name value="List of medications GP's can prescribe"/>
14               <isExtensible value="false"/>
15               <referenceResource>
16                   <reference value="http://www.nzgovt/fhir/ValueSet/ulm-gp"/>
17               </referenceResource>
18           </binding>
19       </definition>
20   </element>
21</structure>
```

Master Data:

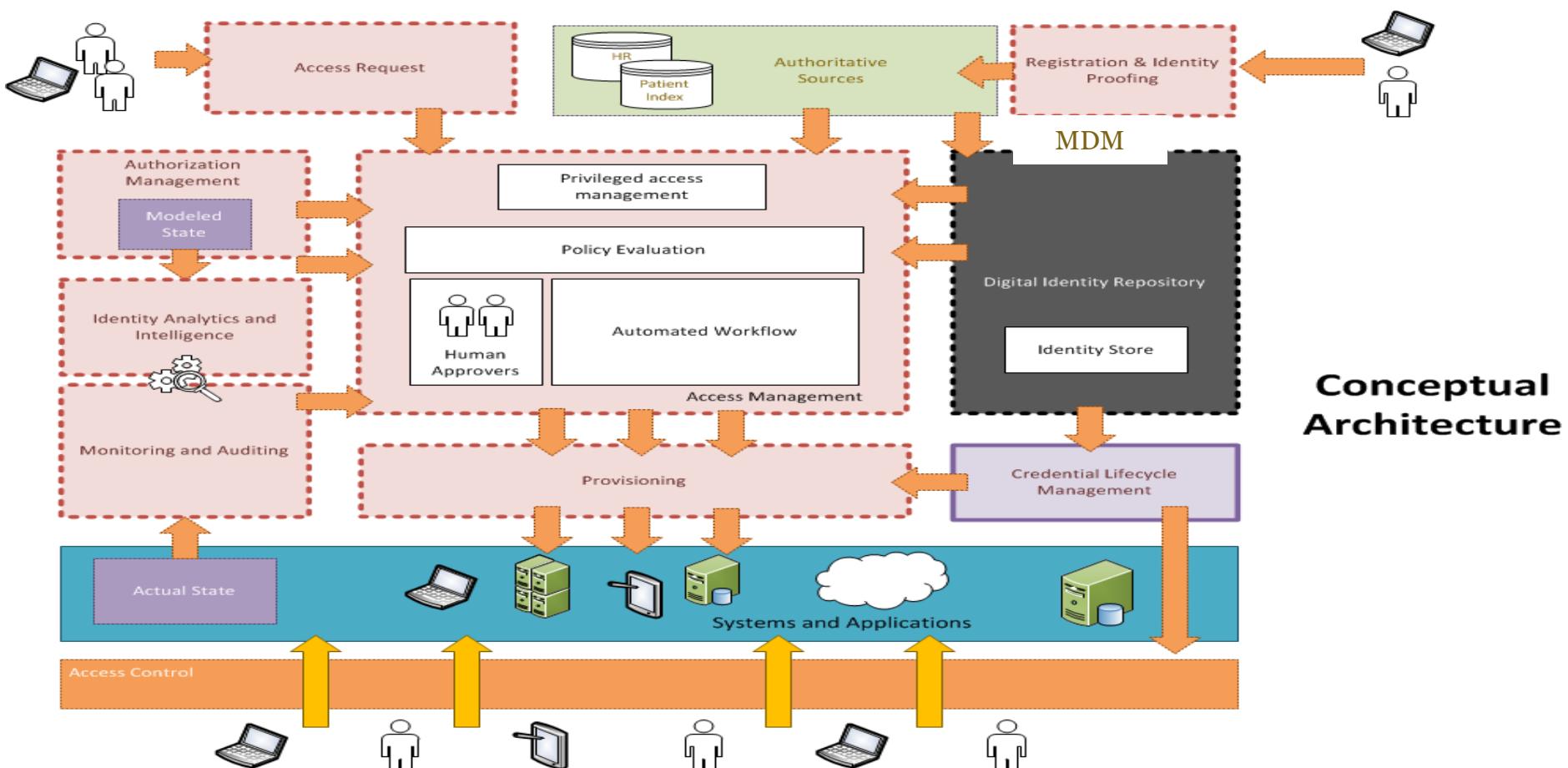
1. Patient, Customer
2. Employee, Partner
3. Location, Organization
4. Diagnosis, Service, Product



DATA ARCHITECTURE

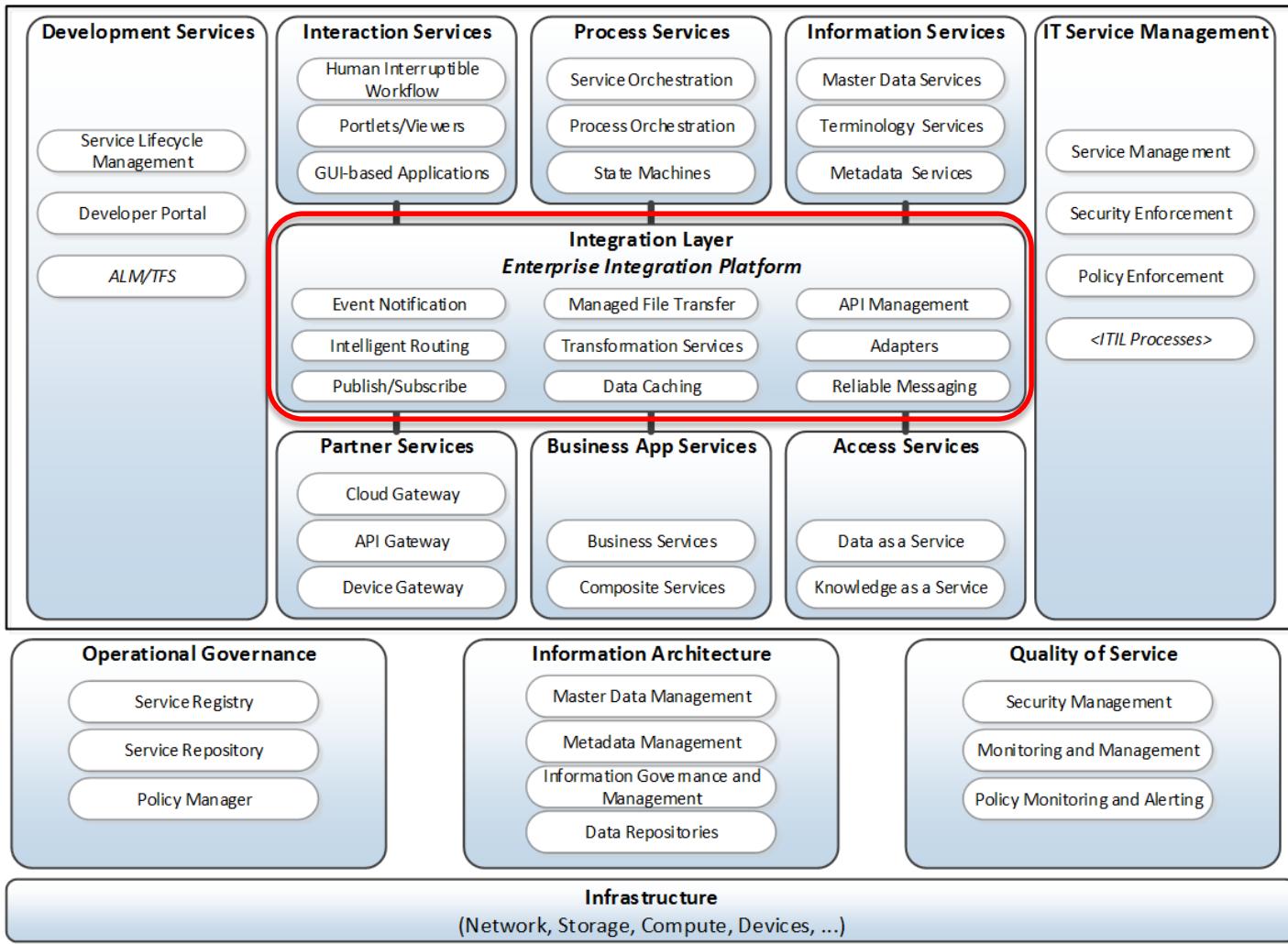


IDENTITY MANAGEMENT PLATFORM (IDMP) FRAMEWORK

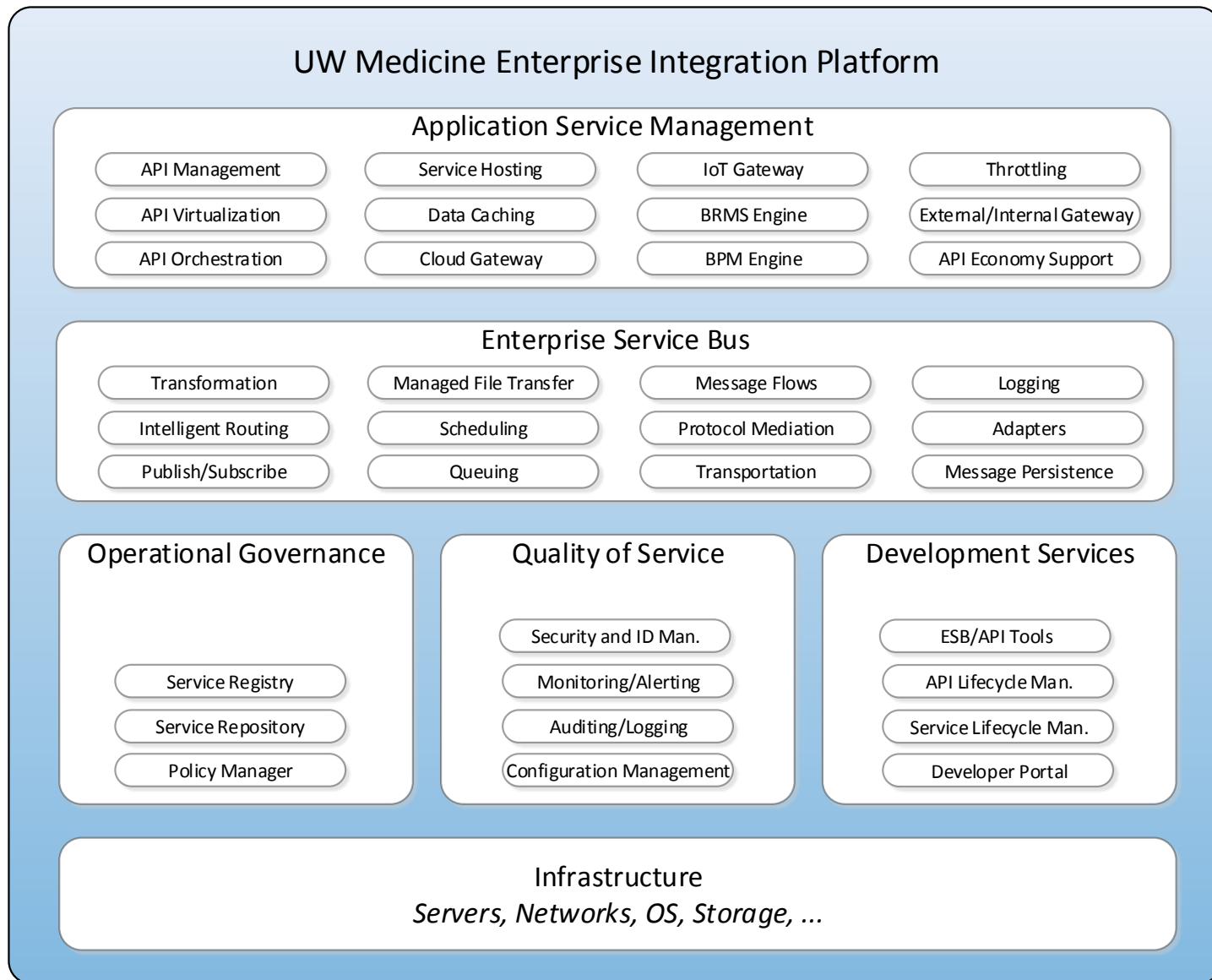


Governance

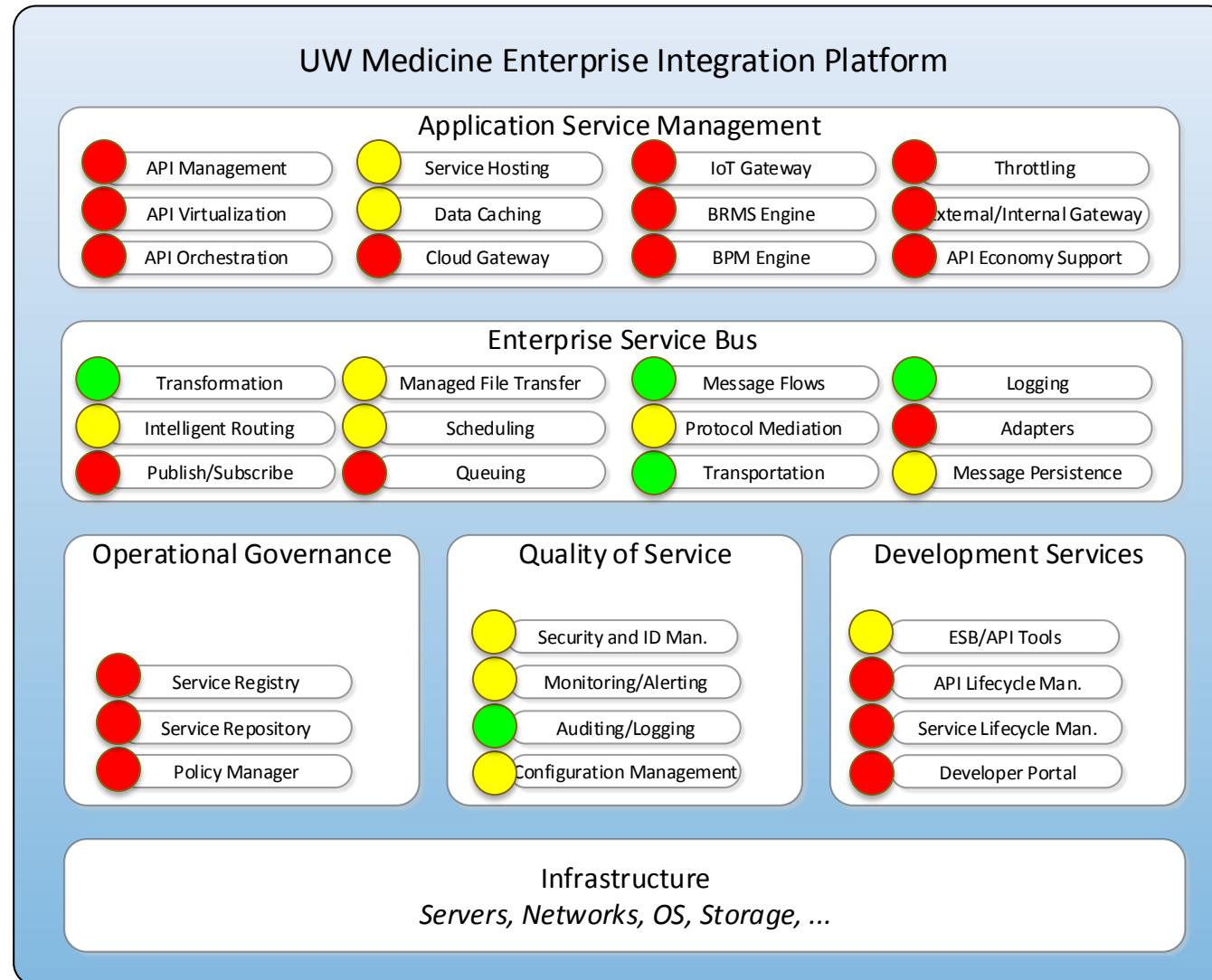
UW Medicine Service Oriented Architecture Reference Model



UW MEDICINE ELA



REQUIRED INTEGRATION CAPABILITIES



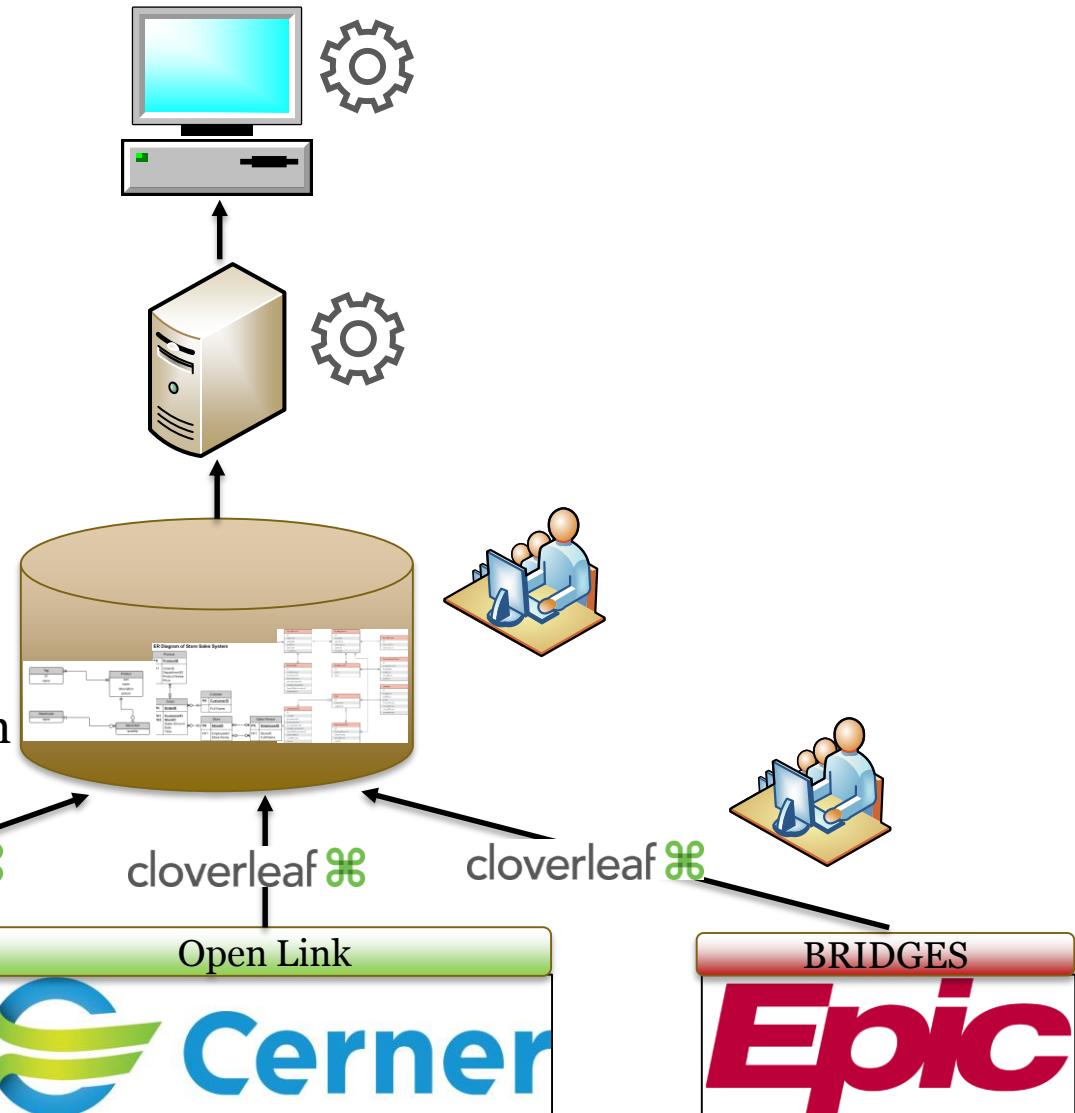
- Capability Provided
- Capability Partially Provided
- Capability Not Provided

WHAT WE DO TODAY

I have to go through multiple manual steps that must be repeated for each new application...

- Almost nothing is reusable
- Resource intensive
- No single point for security, access control, auditing, monitoring, governance, ...

Delivering new functionality can take months

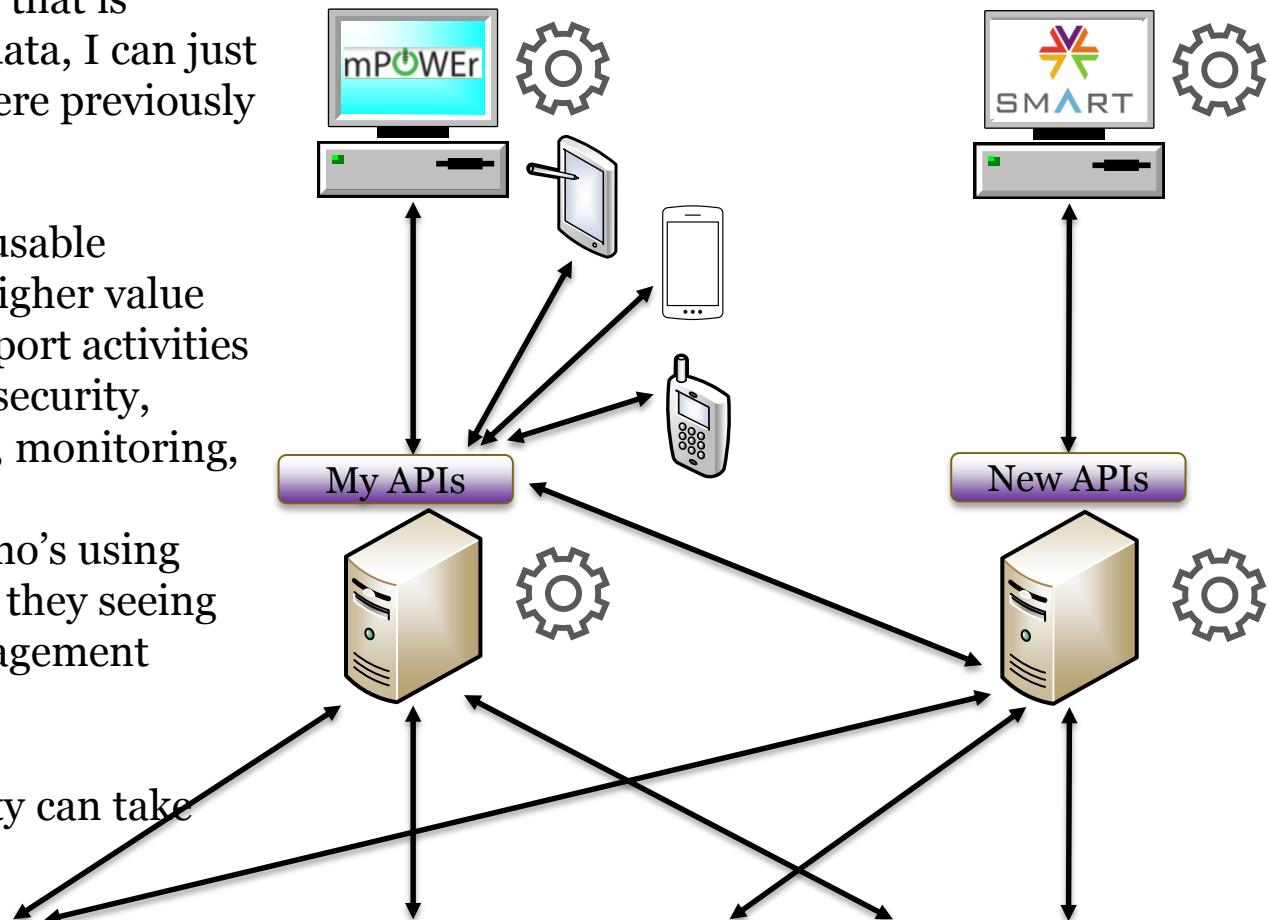


USING AN API APPROACH

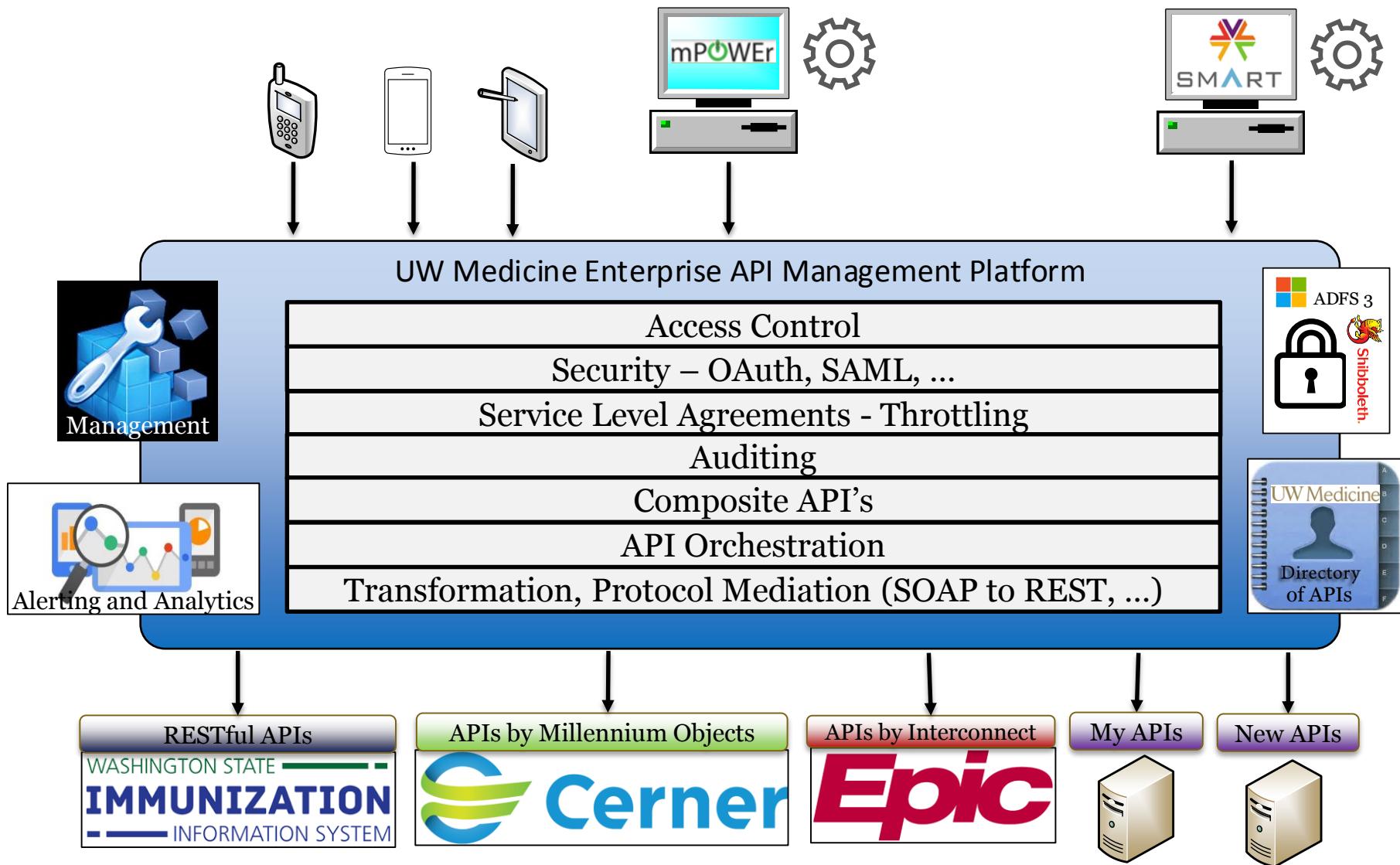
If I want to build a new app that is similar and uses the same data, I can just reuse the same APIs that were previously built.

- Almost everything is reusable
- Resource can move to higher value activities instead of support activities
- Still no single point for security, access control, auditing, monitoring, governance, ...
- Proliferation of APIs, who's using them and what data are they seeing quickly becomes a management headache

Delivering new functionality can take weeks

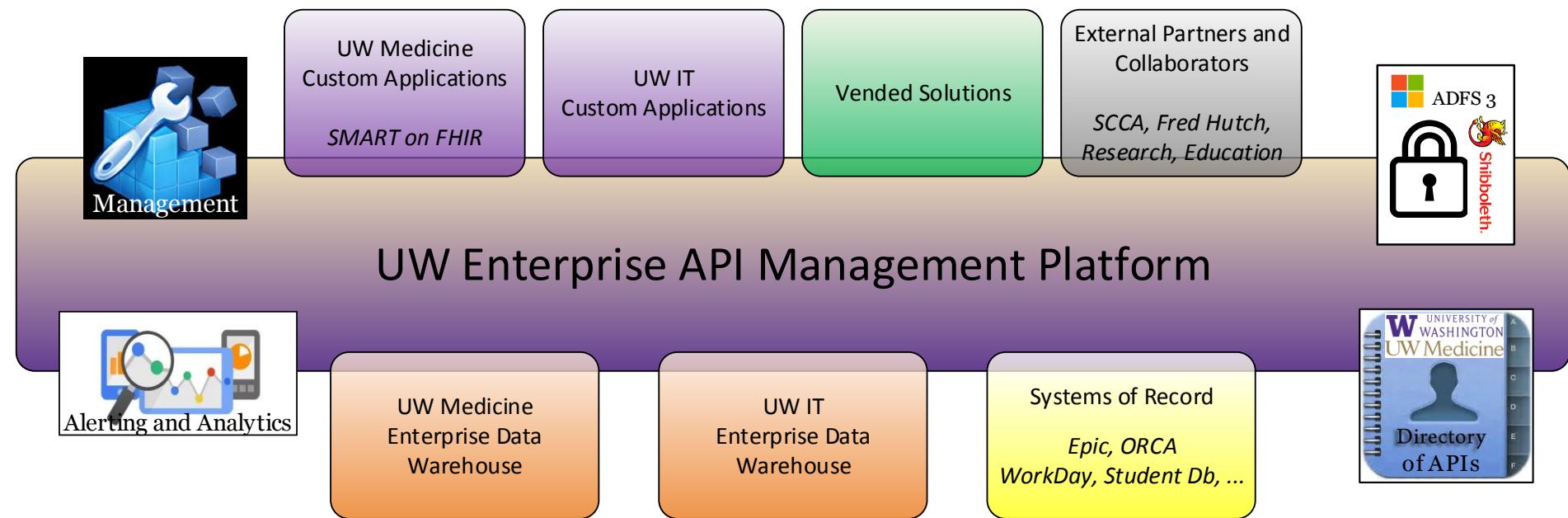


ADDING IN THE MANAGEMENT LAYER



UW Medicine

SHARED UW IT – UWM API PLATFORM



KEY TAKEAWAYS

- API and API Management are mature technologies that have been around for 10+ years
 - Supports the ability to access data across multiple systems (and organizations) to get data where it's needed, when it's needed.
 - APIs drive the internet and mobile apps today and are keys of success behind companies like Amazon and JPMorgan Chase.
 - APIs without API Management = Chaos and Missed Opportunities
- FHIR and SMART on FHIR leverage APIs – being used today by many healthcare organizations to transform healthcare delivery, support rapid innovation, and improve the experience of healthcare professionals and patients. Healthcare organizations that have led in this space have implemented API Management Platforms
- Supports dual-mode IT: Systems of Record (e.g. Epic) evolve methodically and relatively slowly, but the APIs they provide can be used to rapidly innovate and provide solutions for providers and patients
- Supports internal and external collaborations by allowing partners to share information and provide services through APIs quickly with low overhead

Consider this: with Meaningful Use 3, application vendors will be engaging our patients with innovative, sophisticated apps using the data from our (and other health system's) EHRs with little to no input from us! This is likely to change patient opinions and expectations of their healthcare providers rather quickly... Are we ready?

WHY USE AN API MANAGEMENT LAYER

Security

- One federated security model across all the data and business services in the enterprise – setup once and reused across all APIs; partners/collaborators use their own ID/Passwords
- Ability to audit all access to UW Medicine data and service APIs in one place
- Ability to stop a person or organization's access to all our APIs at once

Governance

- Maintain a single point of oversight and governance of the data and resources available through APIs – it's our data and services and we should know who's using it, how they are using it, and be able to give or remove access immediately
- Enforce policies and documentation requirements as part of API deployment workflow – do what's required with as little overhead to users as possible
- Enforce policies uniformly across all APIs – hide the complexities of the heterogeneous UW Medicine applications and data environment behind standardized, homogeneous access points (APIs)

Speed Delivery of Applications

- Discoverability – directory of all APIs available on platform allows for fast, easy search and discovery
- API Platforms use configuration and policies instead of coding (“flipping switches”)
- Write-once, reuse over-and-over again APIs to get to the business value quickly – 1 API can be exposed in various ways to different consumers by configuration rather than re-programming
- Simple versioning of APIs – provides flexibility/agility to users by giving them additional time to change in response to new or updated applications

WHY USE AN API MANAGEMENT LAYER

Collaboration

- Discover, request access, test, and provide communication channel between API owners and users (vendors, patients, providers, researchers) – crucial if users are external (e.g. patients)
- Creates a “sticky relationship” between owners and users – repeat business, increased interest in collaborations from potential partners

Reduce Costs

- Single point for security/governance instead of potentially thousands
- Directory of all APIs means they can be found – reduce redundant development
- Standards-based means more developers/vendors/tools to choose from – increased competition and lowered costs
- API reuse means less has to be developed by IT
- Plug-n-play applications provide agility as we can quickly swap and add/remove applications with limited negative impacts to other systems

API MANAGEMENT EXAMPLE

Transforming Healthcare with API Management Platforms
(click link)

The video link above shows how Mount Sinai Health System is leveraging an API Management Platform to transform healthcare, engage partners and patients, and reach people in need across the continuum of care. The vendor used by Mount Sinai is just one of several providing API Management Platforms. What API Management Platforms can enable in Healthcare is the important point, not the vendor used.

UW MEDICINE EPIC API ENABLEMENT

	Patient Facing APIs		Internal/Partner APIs	
	FHIR APIs	Pre-FHIR APIs	FHIR APIs	Pre-FHIR APIs
Patient Access	● Enterprise ● SMART – Stand Alone ○ SMART – Embedded ○ Basic	X	X	X
Internal Access	X	X	● Enterprise ● SMART – Stand Alone ● SMART – Embedded ● Basic	● Enterprise ● External OAuth Prov. ● EHR OAuth Provider ● Basic
Partner Access	X	X	● Enterprise ● SMART – Stand Alone ● SMART – Embedded ● Basic	● Enterprise ● External OAuth Prov. ● EHR OAuth Provider ● Basic

ENTERPRISE FHIR USE CASES

Mayo Clinic

- Clinical Innovation Informatics Environment
- Provided by Thomas Johnson, Mayo Clinic API Platform Owner

OneOme, LLC

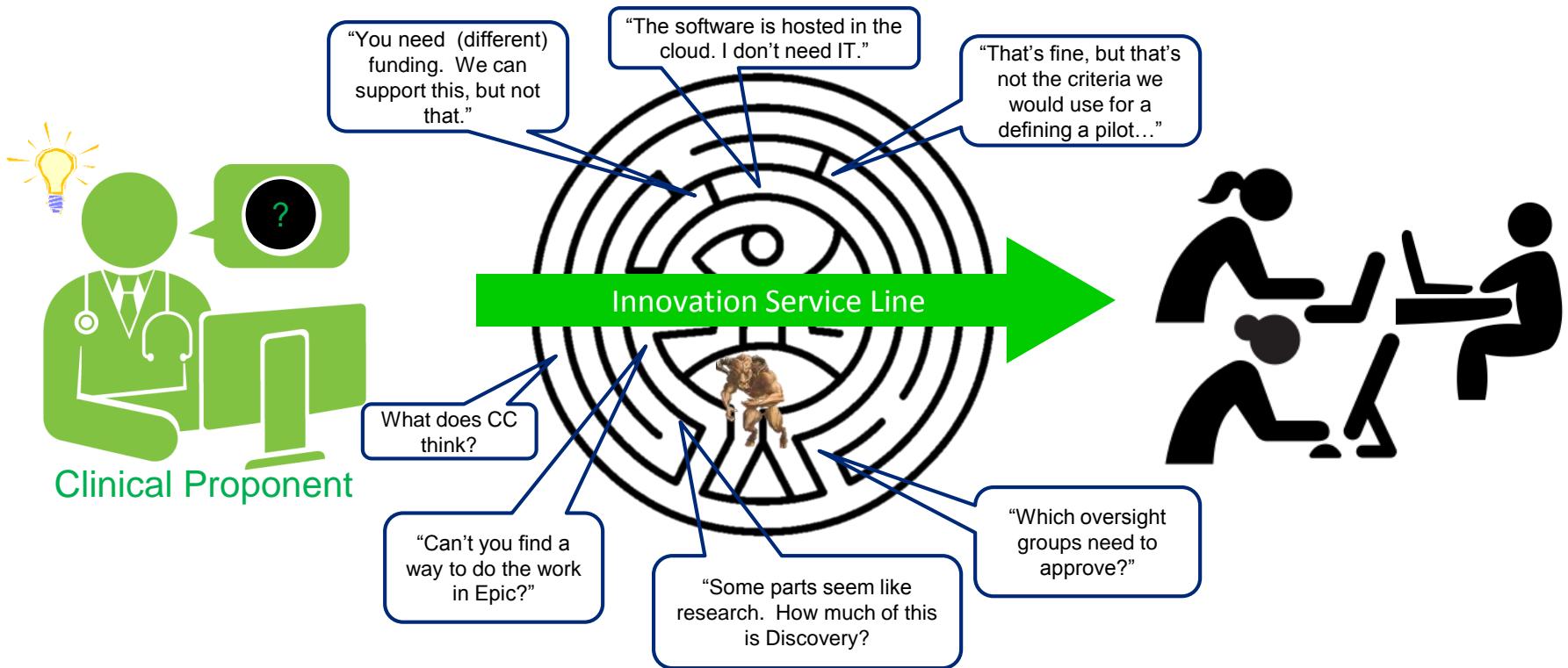
- Molecular Decision Support
- Provided by Jason Ross, OneOme Chief Technology Officer



2018 UW FHIR® WORKSHOP

Clinical Innovation Informatics Environment

The Path from “Idea” to “Get Started”



Innovation Overview

❑ What is Clinical Informatics Innovation Environment?

- An incubator for Clinical Informatics Discovery and Innovation
- Enables informaticians discover and innovate in the field of medicine and clinical practice
- Provides rapid development, testing, piloting and productization capabilities by leveraging and orchestration of services provided by the Enterprise

❑ Discover → Translate → Apply (DTA)

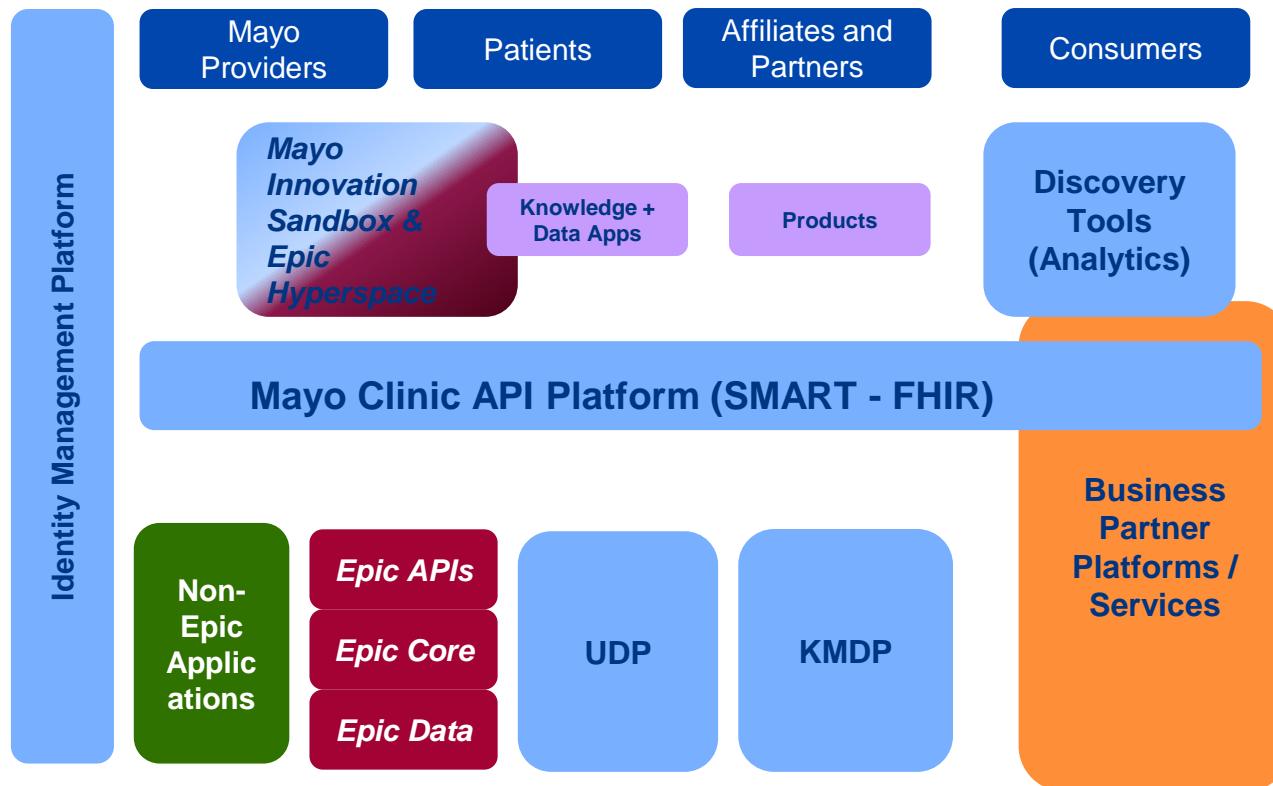
- Clinical Informatics Innovation Ecosystem supports DTA framework through tailored services, tools, and governance; collectively enabling rapid discovery and innovation

Discover: build insight, propose changes to standard of care, validate tools, and approach

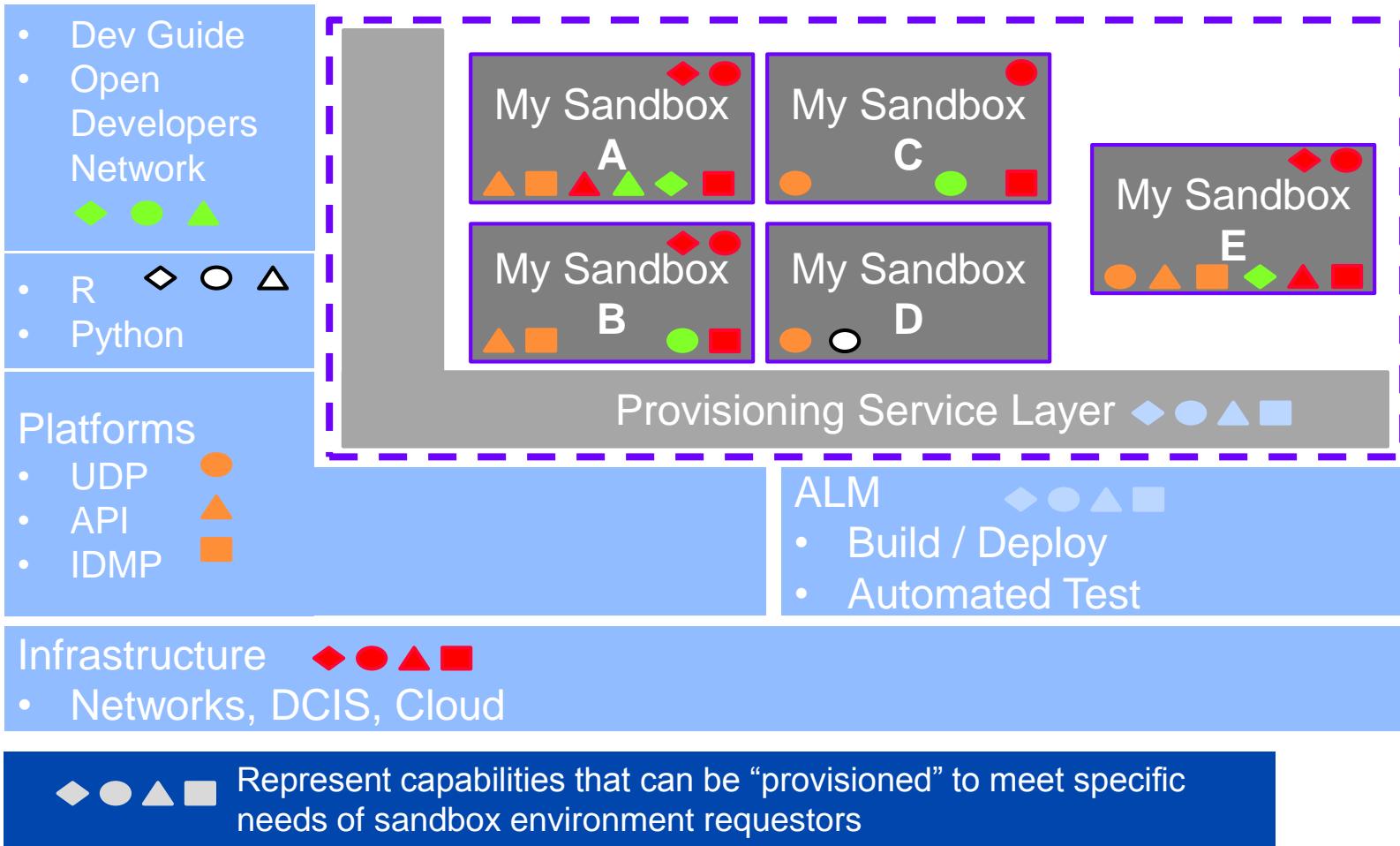
Translate: demonstrate a technical and clinical pathway to adoption of what was discovered into the standard of care

Apply: operationalize the new insights, standard of care or tools into the enterprise-wide practice

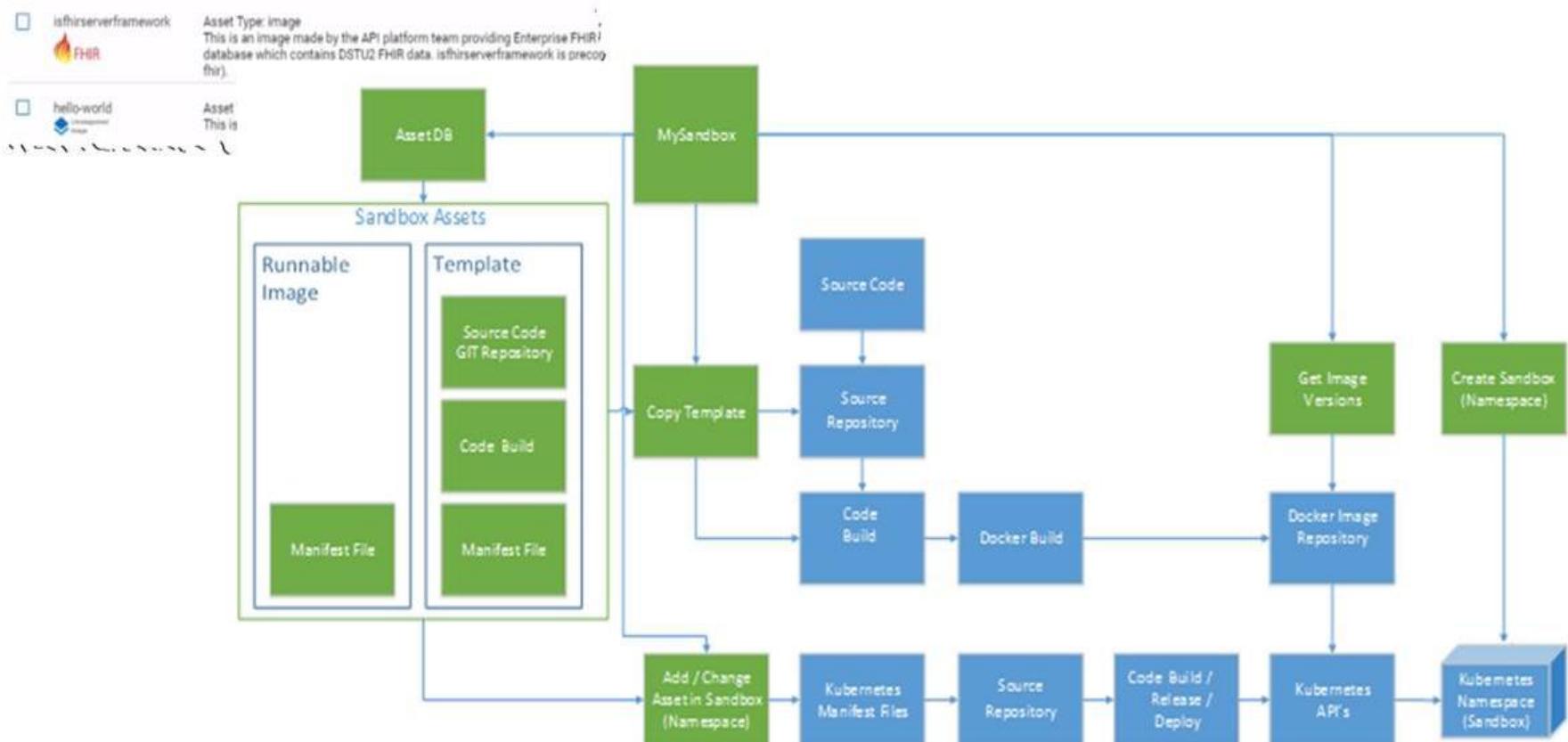
Mayo Architecture for Digital Medicine



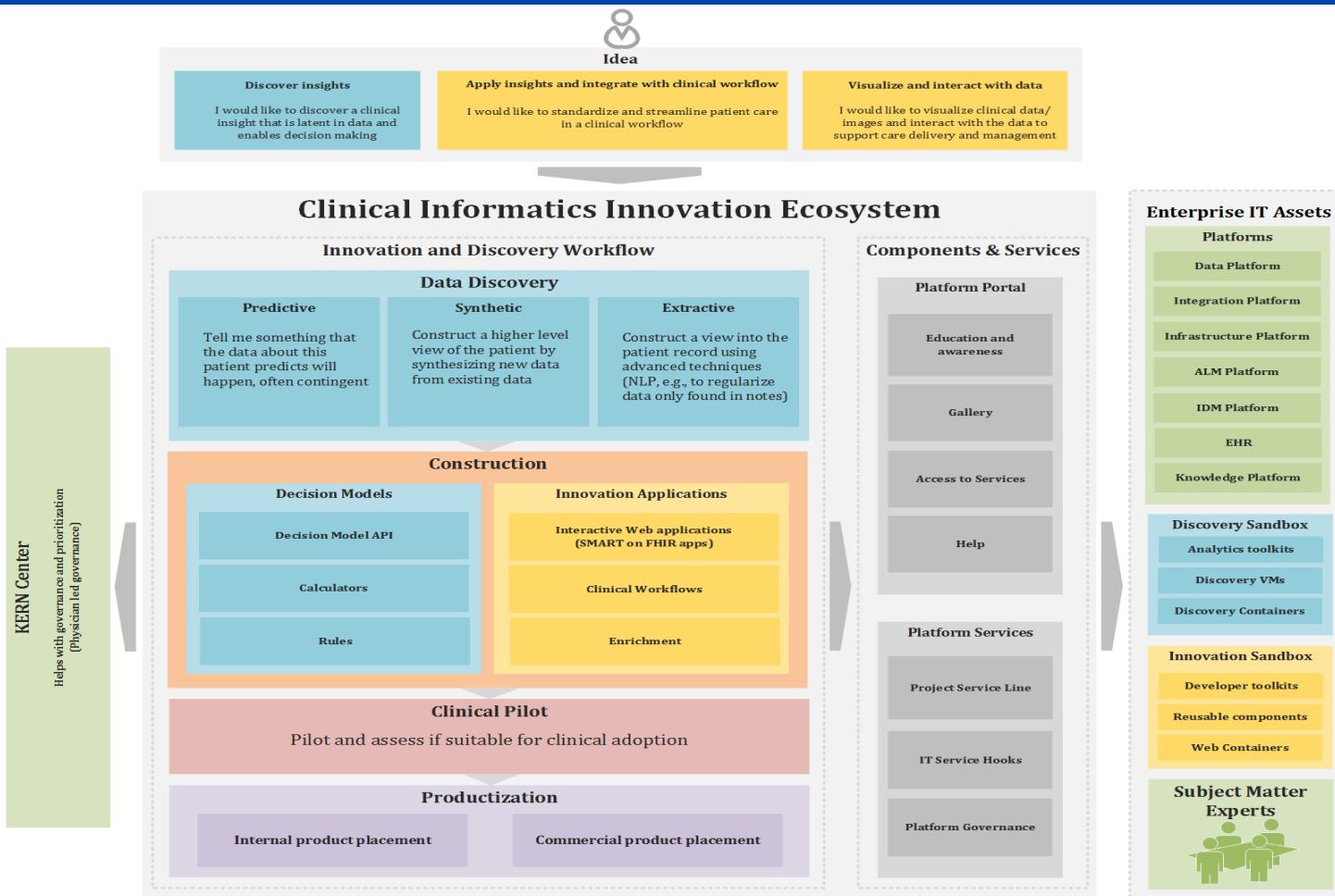
Technical Concept for Innovation Sandbox



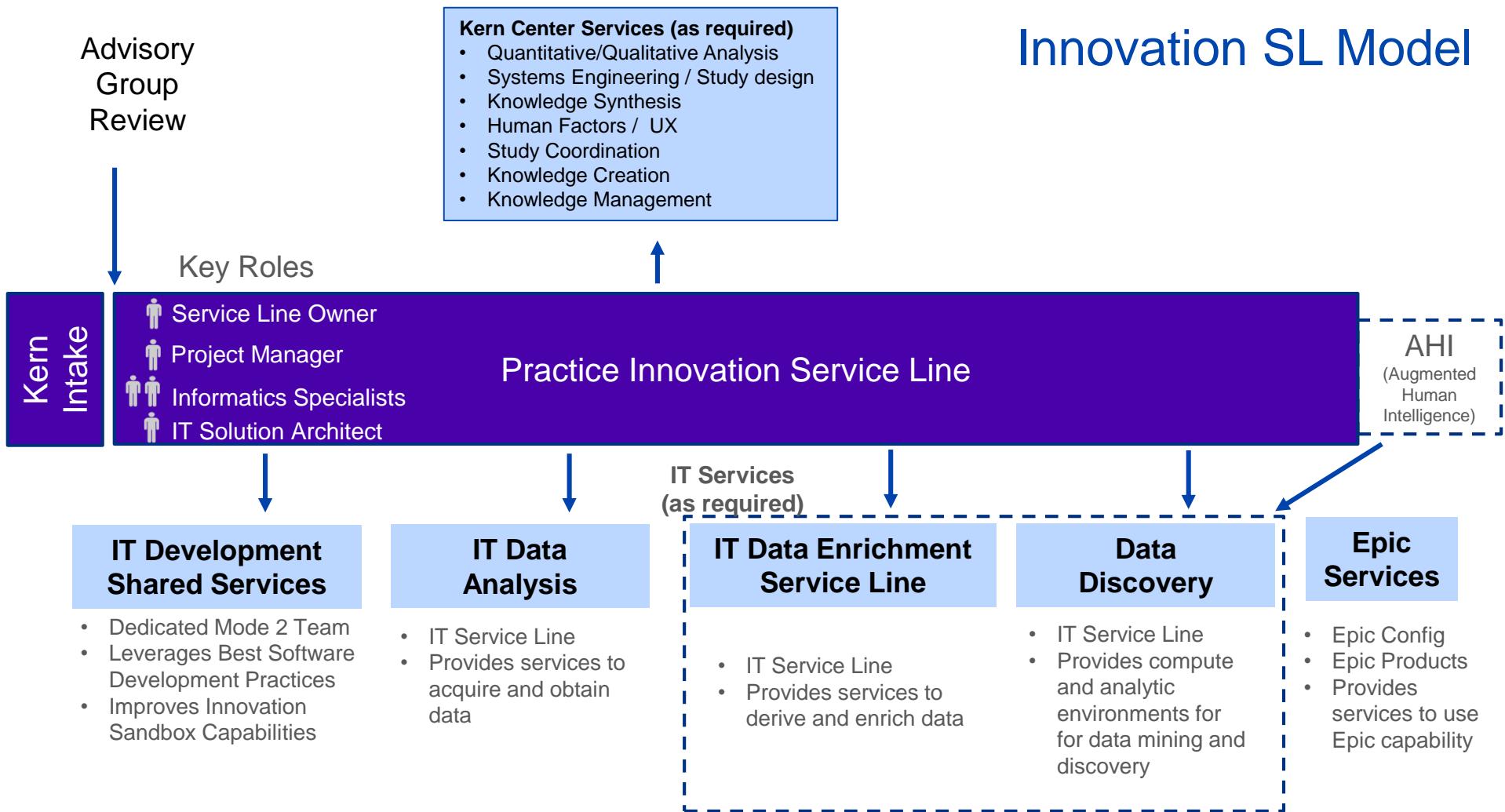
FHIR Support – Innovation Sandbox



Reference Model



Innovation SL Model



Enterprise FHIR Resources in Production

- Patient
- Encounter
- Procedure
- Practitioner
- Location
- Organization
- Diagnostic Report
- Communication
- Document Reference
- Condition
- Medication
- Medication Statement
- Medication Administration
- Observation (Labs, Vitals, Assessments, IO, Smoking status)
- Allergy Intolerance

ONEOME

MAKING PRESCRIPTIONS PERSONAL

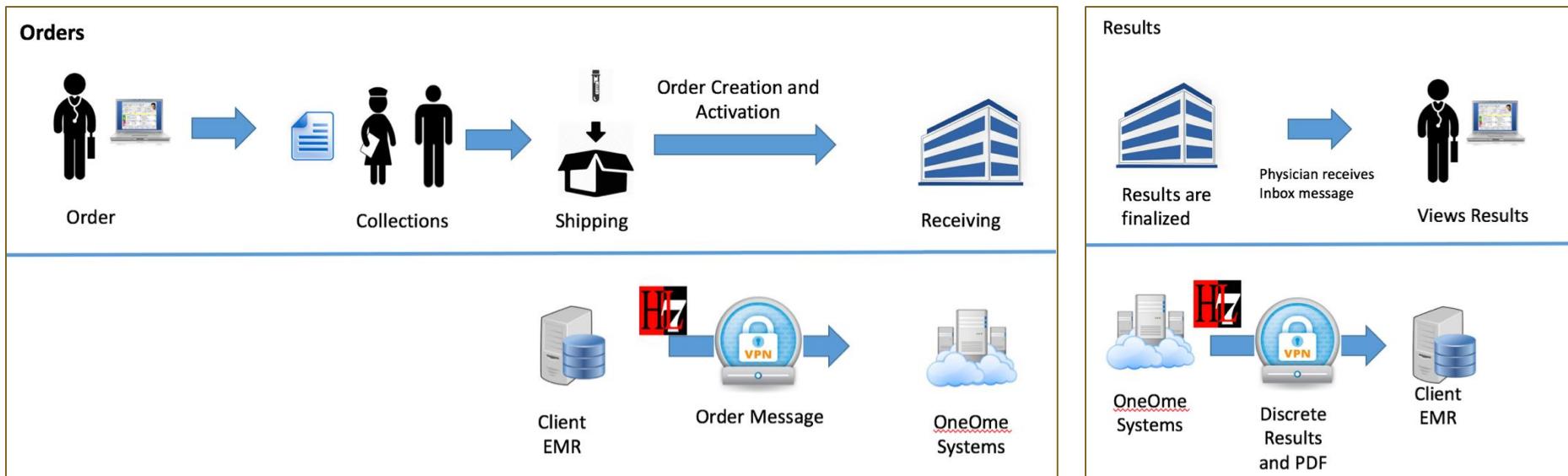
INTEGRATING PHARMACOGENOMICS INTO CLINICAL CARE

- Three main areas of focus
 - Ability to order and receive discrete results within EMR
 - Disruptive/active medication alerts
 - Passive decision support
- Which areas to implement depends on your envisioned workflow and needs
 - Each can be implemented separately
 - Each can support different requirements

EMR ORDER AND RESULTS

We provide the capability to receive orders electronically through your Epic system and return discrete results and the RightMed comprehensive test report (PDF)

- Leverages Epic's existing HL7 reference laboratory interface



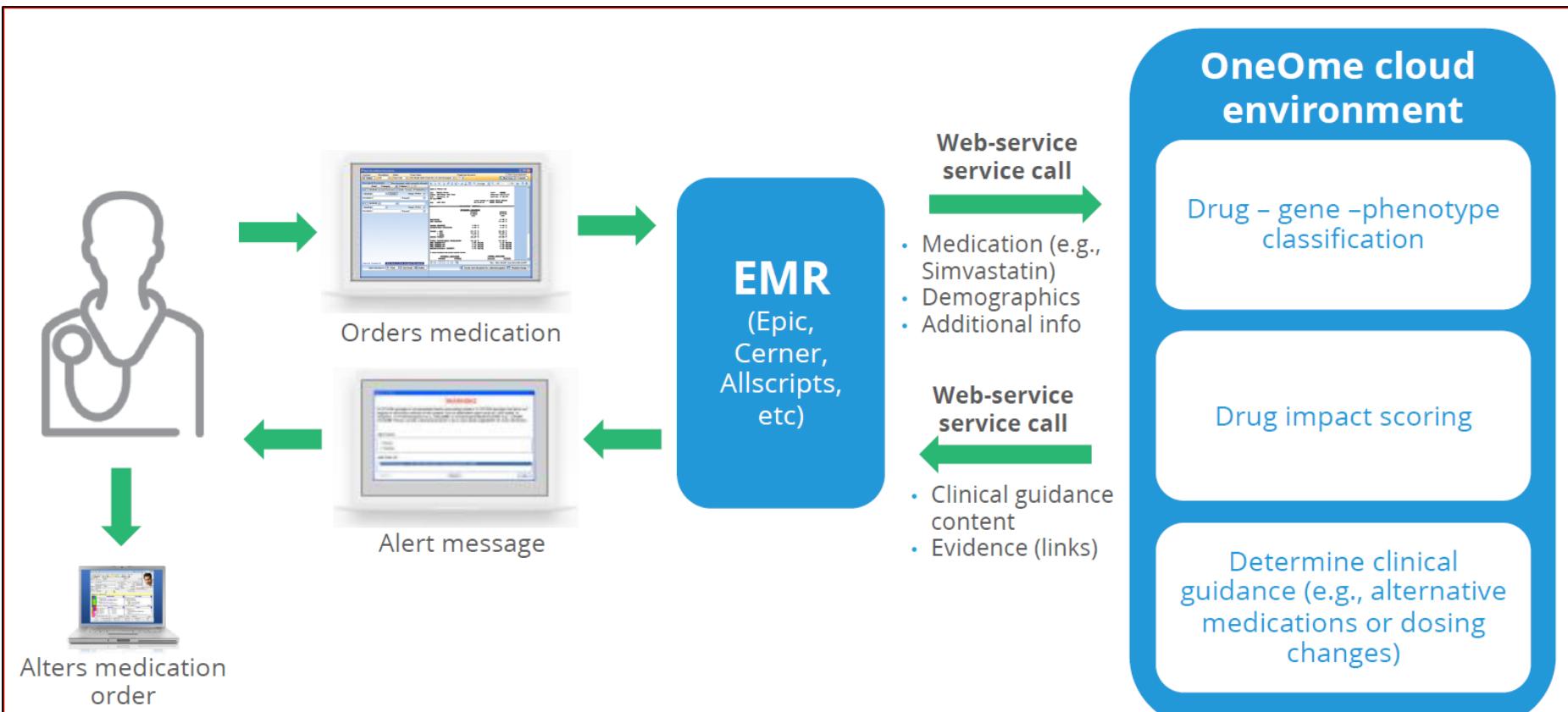
BENEFITS OF ELECTRONIC INTERFACING

- Allows all providers to find and order RightMed test within EMR
 - Defined in EMR laboratory catalog
 - Provides collection instructions
- Enables integration into providers' ordering workflows and order sets
 - Integration into downstream collection and shipping processes
- Stores RightMed results in standard laboratory EMR views
 - Instantaneous return of results
 - Accessible to all providers (enables collaboration/sharing)
- Enables use of active alerting through EMR rules engine
 - Enables the implementation and adoption of PGx CDS rules
- Reduces the risk of transcription errors

DISRUPTIVE/ACTIVE ALERTS

- Provides real-time decision support within the EMR at the time of medication ordering
 - Active alerting - stops provider
 - Based on the patient's RightMed results
 - Ability to determine when to trigger (red or yellow)
- Provides detailed information about the medication classification, genes involved, and clinical guidance
- Ability to link to RightMed Advisor
- Requires configuration/set-up on customer side
 - E.g. BPA rules that trigger when to check for OneOme results

RIGHTMED® CDS INTEGRATION



CLINICAL DECISION SUPPORT RULES

BestPractice Advisory

 Tramadol - Use with great caution

- Predicted tramadol metabolism is drastically reduced or null.
- Genotype suggests a possible decrease in exposure to the active metabolite(s) of tramadol.
- Decreased analgesic effects due to OPRM1 genotype.
- Professional guidelines exist for the use of tramadol in patients with this genotype and/or phenotype.

Provider considerations

- [FDA] The development of a potentially life-threatening serotonin syndrome may occur with the use of tramadol products, including tramadol hydrochloride tablet, particularly with concomitant use of serotonergic drugs such as SSRIs, SNRIs, TCAs, MAOIs, and triptans, with drugs which impair metabolism of serotonin (including MAOIs), and with drugs which impair metabolism of tramadol (CYP2D6 and CYP3A4 inhibitors). This may occur within the recommended dose.
- [DPWG] Select alternative drug, not oxycodone or codeine, or be alert to symptoms of insufficient pain relief.
- [Informative] Preliminary evidence suggests that variants in organic cation transporter 1 (OCT1) may influence serum concentrations of tramadol and its active metabolite, O-desmethyltramadol. These variants may cause an additive effect in the presence of additional OCT1 and CYP2D6 variants. However, insufficient evidence is available to support clinical testing. Additional in vivo studies are needed to determine the extent and clinical impact of these observations.

Genomic results related to Tramadol

- Gene: CYP2D6, Genotype: *3/*3
 - Phenotype - Poor
No to very low activity. Drugs converted to active metabolite(s) may have reduced efficacy. Active drugs converted to inactive metabolite(s) may cause side effects or toxicity.
- Gene: OPRM1, Genotype: rs1799971 AG
 - Phenotype - Asn/Asp isoform
Analgesic effects of alfentanil, codeine, and tramadol (and possibly other opioids) may be lower in patients with this genotype. Other genetic and/or clinical factors influence response.

Remove the following orders?

Tramadol
web service remove order subtitle

[OneOme RightMed™ Advisor](#)

Acknowledge Reason

Alerts provider of possible reduced metabolism

- Provides general guidance on dosing

Provides the genotype and phenotype derived recommendations

Allows for removal of drug order and links to RightMed Advisor

PASSIVE CLINICAL DECISION SUPPORT

- Providers should only be interrupted for critical issues. However, they need the ability to access additional information when needed and within different workflows (e.g. review patient history, flow sheets, lab results).
- Providers often need the ability to view aggregate, disparate information within the EMR to get a holistic view of the patient.
 - Pharmacogenomic recommendations
 - Medications
 - Diagnosis
 - Medication and treatment guidelines
- To meet this need we are actively developing an EMR-embedded application

RIGHTMED® ADVISOR EMR INTEGRATED

- Ability to implement within the EMR in certain applications/workflows
 - Application launches with a patient context
 - Ability to access patient information such as medications
- Provides quick view of patient's current PGx risks
- Allows users to dig deeper into the information
- Provides instant access to all RightMed reports
 - Specialty reports
 - RightMed Advisor custom reports

ONEOME® PATIENT OVERVIEW

Order #: FOB27
Status: Report ready (Wed, 31 Jan 2018 19:53:40 GMT)
Product: RightMed comprehensive

[VIEW ORDER](#)

Patient: Daniel X. Adams

[VIEW LATEST REPORT](#) [OPEN RIGHTMED ADVISOR](#) [VIEW PSYCHIATRY REPORT](#) [VIEW ONCOLOGY REPORT](#)

Medications

Lisinopril 20 MG Oral Tablet Lisinopril 20 MG Oral Tablet (314077)	donepezil 10 MG Oral Tablet [Aricept] donepezil 10 MG Oral Tablet [Aricept] (153367)
Memantine 10 MG Oral Tablet [Namenda] Memantine 10 MG Oral Tablet [Namenda] (404673)	Hydrochlorothiazide 50 MG Oral Tablet Hydrochlorothiazide 50 MG Oral Tablet (197770)
potassium citrate 10 MEQ Extended Release Tablet potassium citrate 10 MEQ Extended Release Tablet (199381)	

Overview

- Predicted donepezil metabolism is normal.
- Genotype suggests a normal exposure to donepezil.

Provider considerations

- Genotype-predicted cytochrome P450-related metabolism is normal. This suggests a normal exposure to donepezil when given at label-recommended doses. (Genotype predicted)

Genotype results

Gene	Genotype	Phenotype summary
CYP2D6	*1/*1	Normal level of activity. Drugs metabolized at a normal rate.
CYP3A4	*1/*1	Normal level of activity. Drugs metabolized at a normal rate.
CYP3A5	*3/*3	Normal dosing may be required because original dosing guidelines for drugs have been established on patients with poor metabolizer phenotype.

ONEOME

Contact OneOME
844-ONEOME (844-663-6363)
support@oneome.com

OneOME, LLC
807 Broadway St NE Suite 100
Minneapolis, MN 55413

QUESTIONS

