Remote Decision Support with

Kevin Shekleton
code Learning Lab
Oct 11, 2017

ITEM
MAGIC
WEAPON
ARMOR
STATUS

KEVIN SHEKLETON

DISTINGUISHED ENGINEER

HP
13/ 37

15 YEARS

@kpshek

The problem with SMART apps

Bilirubin Chart

Newborns < 120 hours old

Bilirubin results that are either:

- Not documented
- Outside of the accepted range

The user needs to know the app is available

The user needs to know the app is relevant

The user has to find the app and launch it

CDS HOOKS

CDS Hooks

A vendor agnostic remote decision support specification

Created by the team behind SMART

Open source (Apache)

Emerging standard with active development and widespread participation from stakeholders

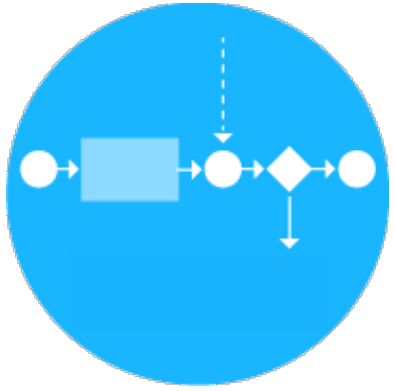
CDS Service

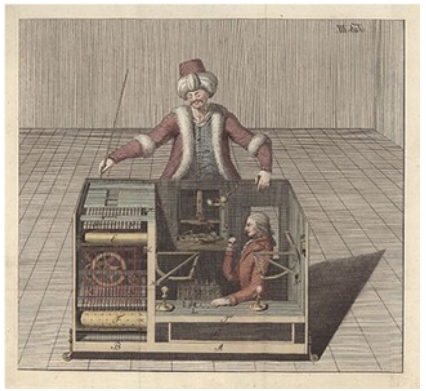
A service that is:

invoked by the EHR via a hook,

evaluates its own logic using FHIR data,

returns decision support via cards





Example Hooks

patient-view

When a patient’s chart is opened

medication-prescribe

When a medication is selected for prescription

order-review

Viewing pending orders for signing

EHR Med Order

℞ Toprol XL
50 mg daily

1

EHR triggers a **CDS hook** and invokes a remote service

CDS Services

2

CDS Service executes its own rules, leveraging FHIR data as needed

EHR FHIR Server

3

Returns **CDS cards**
(rendered and displayed by EHR)

information card

$200 per month
(patient pays $30)

suggestion card

Try HCTZ as first-line

Switch to HCTZ

smart app link card

Managing hypertension?
Launch JNC 8 Rx Pro

EHR

CDS Service

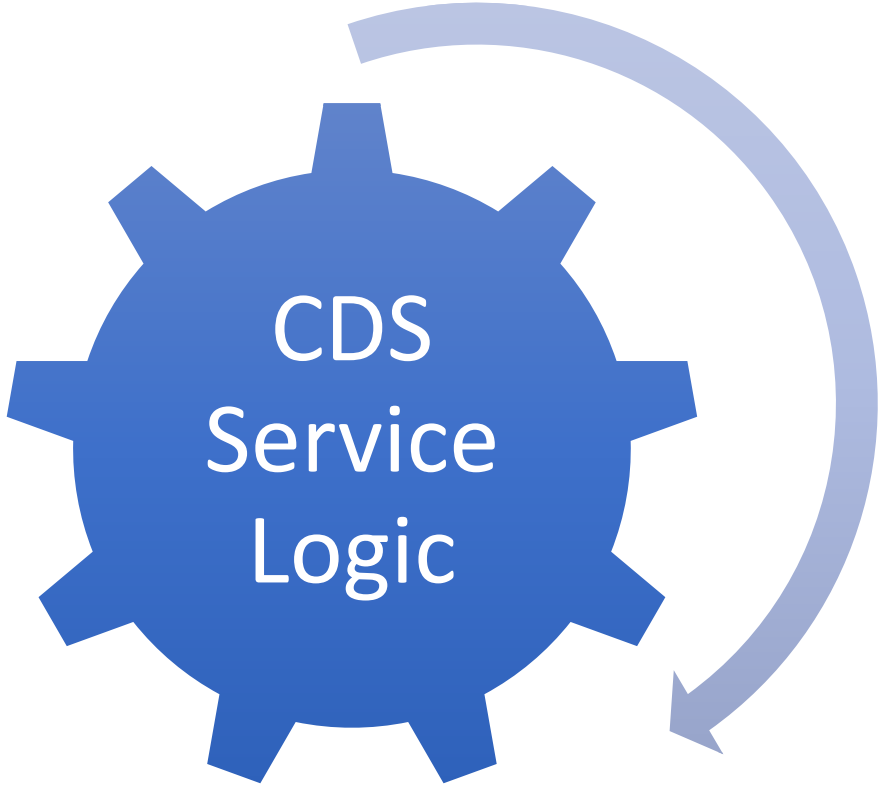
POST https://example.com/cds-services/example-service

```
{
  "hook": "patient-view”,
  "fhirServer": "https://fhir.example.com",
  "user": "Practitioner/789",
  "patient": "123",
  "encounter": "456",
  ...
}
```

EHR

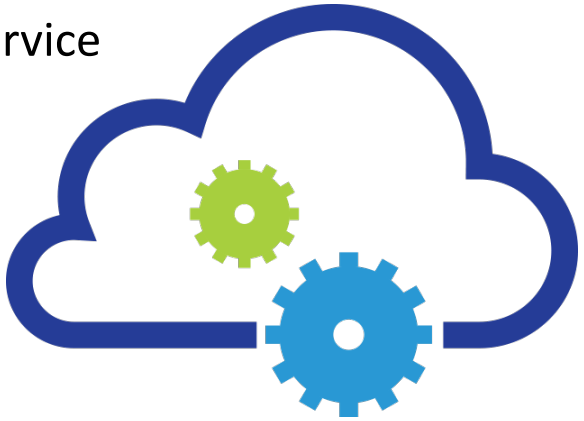
CDS Service

POST https://example.com/cds-services/example-service



EHR

CDS Service



POST https://example.com/cds-services/example-service

HTTP 1.1/ 200 OK

```
{
  "cards": [
    {
      "summary": "Example card",
      "indicator": "info",
      "source": {
        "name": "Demo CDS Service”
}}]}
```

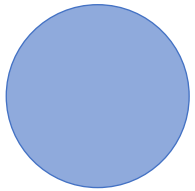
Cards

- A CDS Service can return any number of cards
- The EHR renders each card as it sees fit
- Each card must have:
  - A concise summary (140 characters)
  - An indicator noting the importance of the card
  - Information on the organization or data set that is the source of the card's data

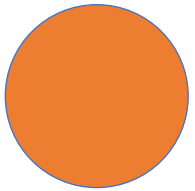
CDS Service Response JSON

```
{
  "cards": [
    {
      "summary": "Example card",
      "indicator": "info",
      "source": {
        "name": "Demo CDS Service”
      }
    }
  ]}
```

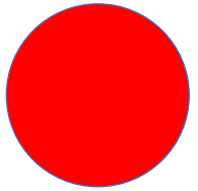
Card Indicator



Informational

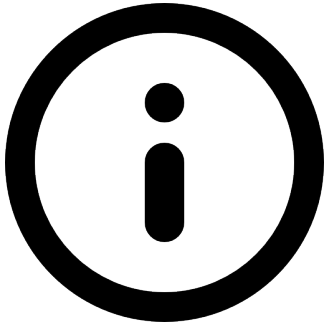


Warning



Hard Stop

Common Card Examples



Information Only

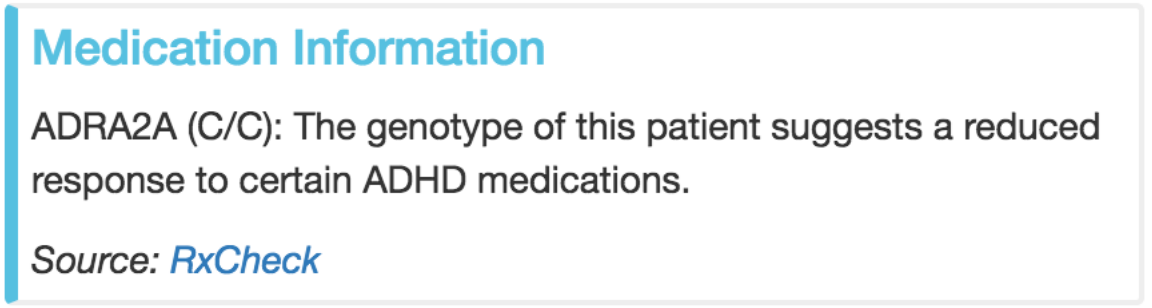
Textual information for the provider

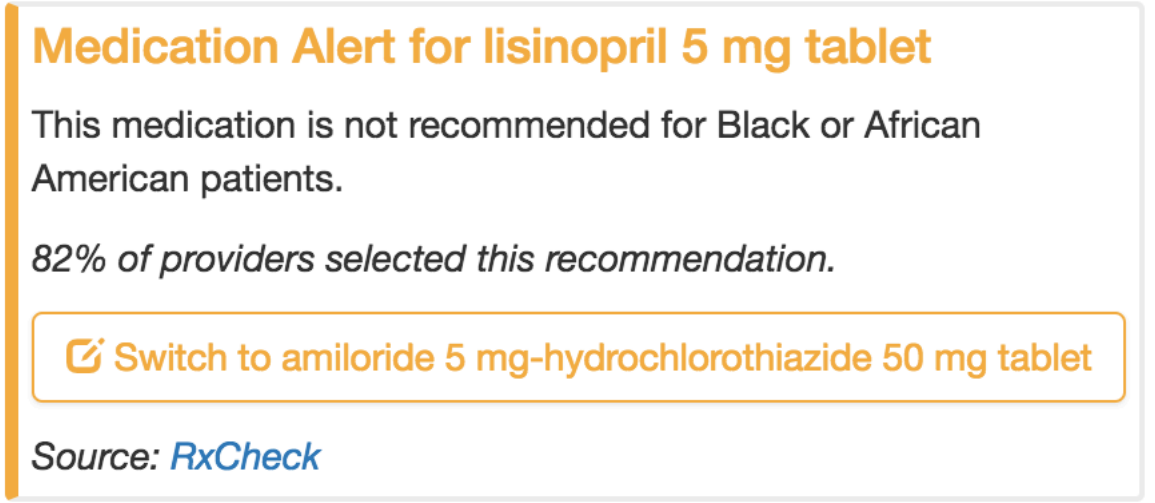
Suggestions

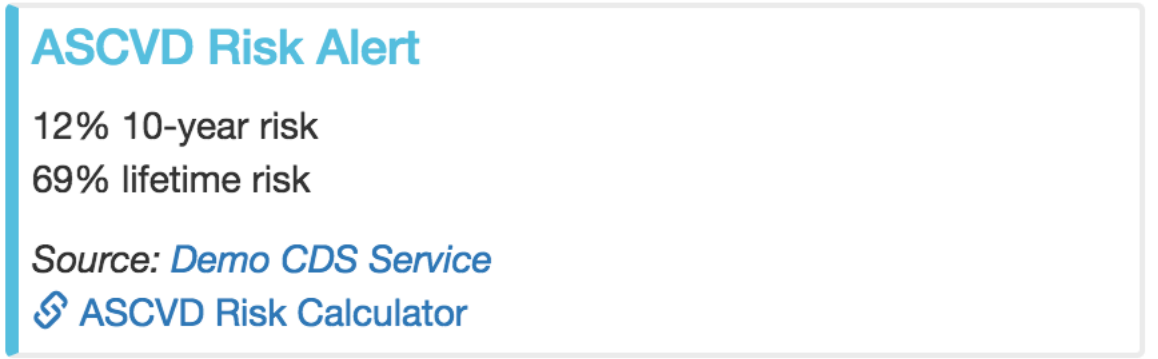
Proposed actions encoded as FHIR resources

App Links

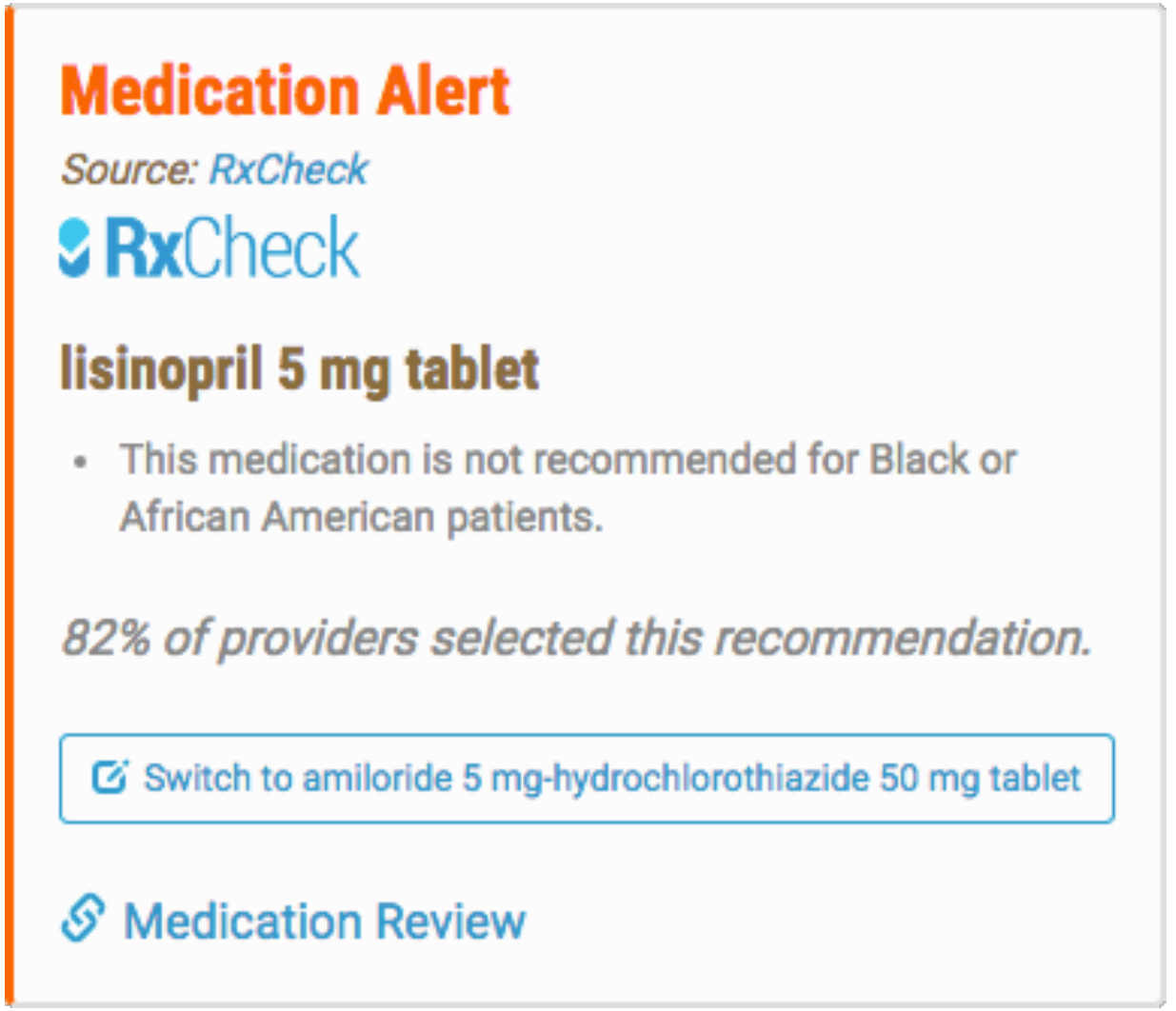
Proposed SMART app that should be used







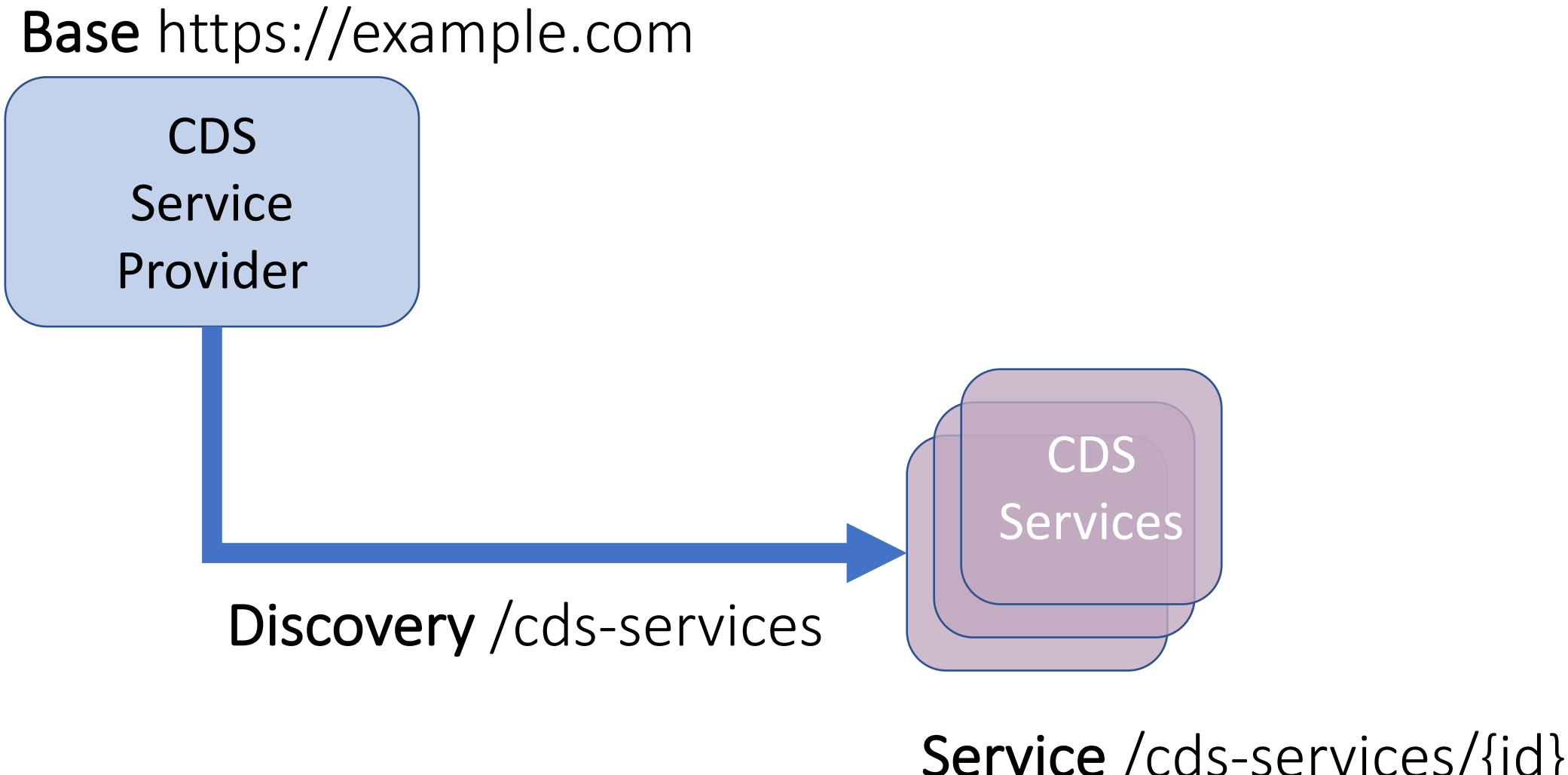
Cards can contain any combination of information, suggestions, and links



Capturing user behavior for analytics

- Since CDS Services return purely JSON, they don’t know how users interact with their suggestion
- Each suggestion *may* contain a **UUID**
- The UUID allows the EHR to notify the CDS Service that the user interacted with their suggestion

```
POST {cds-service}/analytics/{uuid}
```


Base https://example.com
CDS
Service
Provider
CDS
Services
Discovery /cds-services
Service /cds-services/{id}

Discovery

```
GET https://example.com/cds-services
{
  "services": [
    {
      "hook": "patient-view",
      "name": "CDS Service Example",
      "description": "An example CDS service",
      "id": "example-service",
      "prefetch": {
        "patientToGreet": "Patient/{{Patient.id}}"
      }
    },
    {...}
}
```

CDS Service Invocation

```
{
  "services": [
    {
      "hook": "patient-view",
      "name": "CDS Service Example",
      "description": "An example CDS service",
      "id": "example-service",
```

```
POST https://example.com/cds-services/example-service
```

```
  }
```

sandbox.cds-hooks.org

CDS Hooks Sandbox | Patient View | Rx View | Change Patient | Change FHIR Server | Card Demo | CDS Services

Patient View

Daniel X. Adams

ID: SMART-1288992 **Birthdate:** 1925-12-23

Now seeing: Daniel Adams

Source: CDS Service Tutorial

Learn more about CDS Hooks

Hello Daniel!

Source: Patient greeting service

Bilirubin Chart

Source: HSPC Bilirubin Risk Chart App

Demonstration app designed to help clinician treat newborn hyperbilirubinemia appropriately.

HSPC Bilirubin Risk Chart App

HealthyMe Patient External Clinical Records

Context Toggle

CDS Service Exchange

Select a Service:

http://hooks.fhir.me:8082/cds-services/patient-hello-world

Request

Response


```
{
  "cards": [
    {
      "summary": "Hello Daniel!",
      "source": {
        "label": "Patient greeting service"
      },
      "indicator": "info",
      "suggestions": [],
      "links": []
    }
  ],
  "decisions": []
}
```

Separation of Concerns

Concern	Owner
Workflow & hooks (triggers)	EHR
CDS logic	CDS Service Provider
Initial context data	EHR
Additional data	CDS Service Provider (via FHIR or other sources)
CDS presentation	EHR

NON SOLUS
ELSEVIER

fdb
First Databank

HSPC
the healthcare
services platform
consortium™

MAYO
CLINIC

McKESSON

NANTHEALTH

PREMIER

surescripts

visualDx

QVERA

Cerner

Epic

healthwise
for every health decision

Intermountain
Healthcare

Allscripts

athenahealth

IMO
Intelligent Medical Objects

mcg

RxREVU

Wolters Kluwer
Health

medapptech

stanson health

PHILIPS
Healthcare

MITRE

syapse

"polyglot"
Health Through Understanding™

medical-objects
CLINICAL APPLICATIONS, MESSAGING AND INTEGRATION

2017 Resolutions

Release a 1.0 specification

Launch production pilots

Argonauts ❤️ CDS Hooks

The EHR invokes a CDS service via a patient-view hook, resulting in a SMART app link card that the clinician uses to launch the SMART app.

Validate and implement the CDS Hooks security model

What’s after 1.0?

Performance: trigger guards, SLAs

Event & time based hooks

Specific use cases
(ACR ordering guidelines, CDC opioid guidelines, etc)

References

Specification & documentation
http://cds-hooks.org

Demo sandbox
http://sandbox.cds-hooks.org

Source code
https://github.com/cds-hooks

Thanks*!*