



IIS on FHIR: A New Era of IIS Interoperability

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Agenda

- Background: FHIR and IIS
- IIS-FHIR Use Cases:
 1. Queries for **bulk data** from IIS
 2. FHIR-based IIS **web applications**
 3. IIS **reports and analytics** using FHIR
 4. IIS pulling data from an **EHR** using FHIR
 5. Immunization **clinical decision support** using FHIR

FHIR in a Nutshell

- ❑ Fast Healthcare Interoperability Resources (FHIR)
- ❑ Next generation HL7 standard
- ❑ Set of Resources and a modern RESTful API for accessing them

FHIR in a Nutshell

- ❑ **FHIR Bulk Data** – FHIR-based approach for exporting large amounts of data from a FHIR server
- ❑ **SMART on FHIR** – health app interface based on FHIR and other open standards
- ❑ **CDS Hooks** – allows CDS services to be triggered within clinician workflow
- ❑ **Subscriptions** – allows clients to request notifications on events
- ❑ **FHIR Extended Operations** – supports additional use cases
- ❑ **Implementation Guides** – standards-based ways of using FHIR in specific domains

FHIR Server Models

❑ FHIR Façade

- Data translation – translate FHIR REST calls to the underlying legacy database or service (no native FHIR storage)
- Intermediate FHIR server – synchronize native FHIR storage to underlying legacy database or service

❑ Native FHIR server

- FHIR storage is the operational data store

Why FHIR for IIS Data Access?

- ❑ Accessible to general purpose developers
- ❑ Modern APIs, software, tools, resources, and support
- ❑ FHIR Bulk Query:
 - Efficiently access up-to-date immunization data
 - Reduce redundant queries
 - Easy to parse bulk data format
 - Flexibility for different use cases: Hospitals, physicians, schools, payers, etc.
 - Modern authentication/authorization framework

Immunization FHIR Example

Patient Info

First Name: **TEST** Middle: **A** Last: **HIMSS-PATIENT**

Date of Birth: **04/20/2022**

Age: **10m 16d**

```

"name": [
  {
    "text": "TEST A HIMSS-PATIENT",
    "family": "HIMSS-PATIENT",
    "given": [
      "TEST",
      "A"
    ]
  }
],
"birthDate": "2022-04-20",

```

```

"status": "completed",
"vaccineCode": {
  "coding": [
    {
      "system": "http://hl7.org/fhir/sid/cvx",
      "code": "215",
      "display": "PCV15"
    }
  ],
  "text": "Pneumococcal conjugate PCV15, polysaccharide CRM197 conj
},
"patient": {
  "reference": "11469529",
  "type": "Patient"
},
"occurrenceDateTime": "2022-06-20",
"recorded": "2023-01-01T07:10:39-05:00",
"primarySource": true,
"manufacturer": {
  "reference": "MSD",
  "type": "Organization",
  "display": "Merck & Co., Inc."
},
"lotNumber": "FK0101",
"expirationDate": "2024-01-01",
"site": {
  "coding": [
    {
      "system": "http://terminology.hl7.org/CodeSystem/v2-0163",
      "code": "LA",
      "display": "LEFT ARM"
    }
  ]
}

```

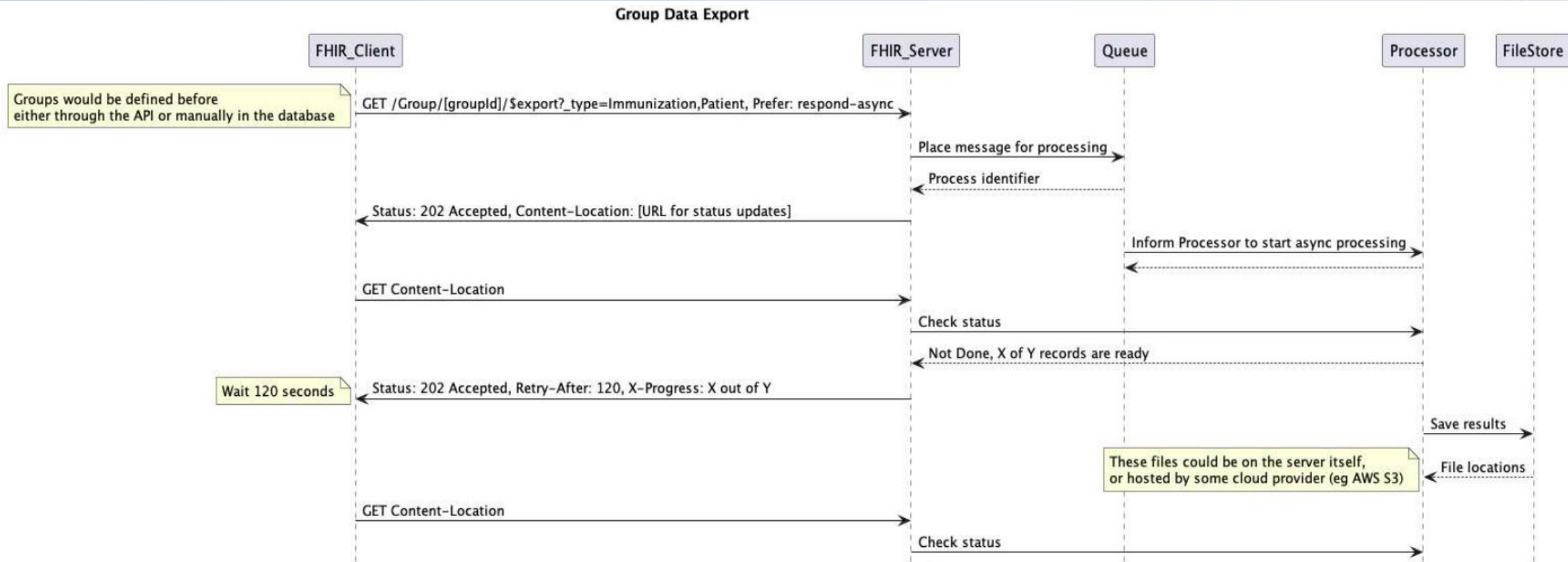
VALID DOSES					NEXT DUE
COVID-19 2 valid doses	10/20/2022 COV19 PF PFR 6m-5 6m 0d	11/20/2022 COV19 PF PFR 6m-5 7m 0d			Due Now (On or after 01/15/2023) Dose 3 Covid Record
Influenza					Due Now (On or after 10/20/2022) Dose 1
Hepatitis B 3 valid doses	04/20/2022 HepB ped/adol 0m 0d	06/20/2022 VAXELIS 2m 0d	08/20/2022 VAXELIS 4m 0d [1]	10/20/2022 VAXELIS 6m 0d	End of Series
DTaP/DT/Tdap/Td 3 valid doses	06/20/2022 VAXELIS 2m 0d	08/20/2022 VAXELIS 4m 0d	10/20/2022 VAXELIS 6m 0d		Due in the Future (07/20/2023 - 12/17/2023) Dose 4
Pneumo 1 valid doses	06/20/2022 PCV15 2m 0d				Past Due
Polio 3 valid doses	06/20/2022 VAXELIS 2m 0d	08/20/2022 VAXELIS 4m 0d	10/20/2022 VAXELIS 6m 0d		Due in the Future (04/20/2026 - 05/17/2029) Dose 4
Hib 3 valid doses	06/20/2022 VAXELIS 2m 0d	08/20/2022 VAXELIS 4m 0d	10/20/2022 VAXELIS 6m 0d		Due in the Future (04/20/2023 - 09/16/2023) Dose 4
Rotavirus 0 valid doses					Maximum Age Reached

*Courtesy of the Rhode Island IIS

Use Case #1: Queries for Bulk Data from IIS

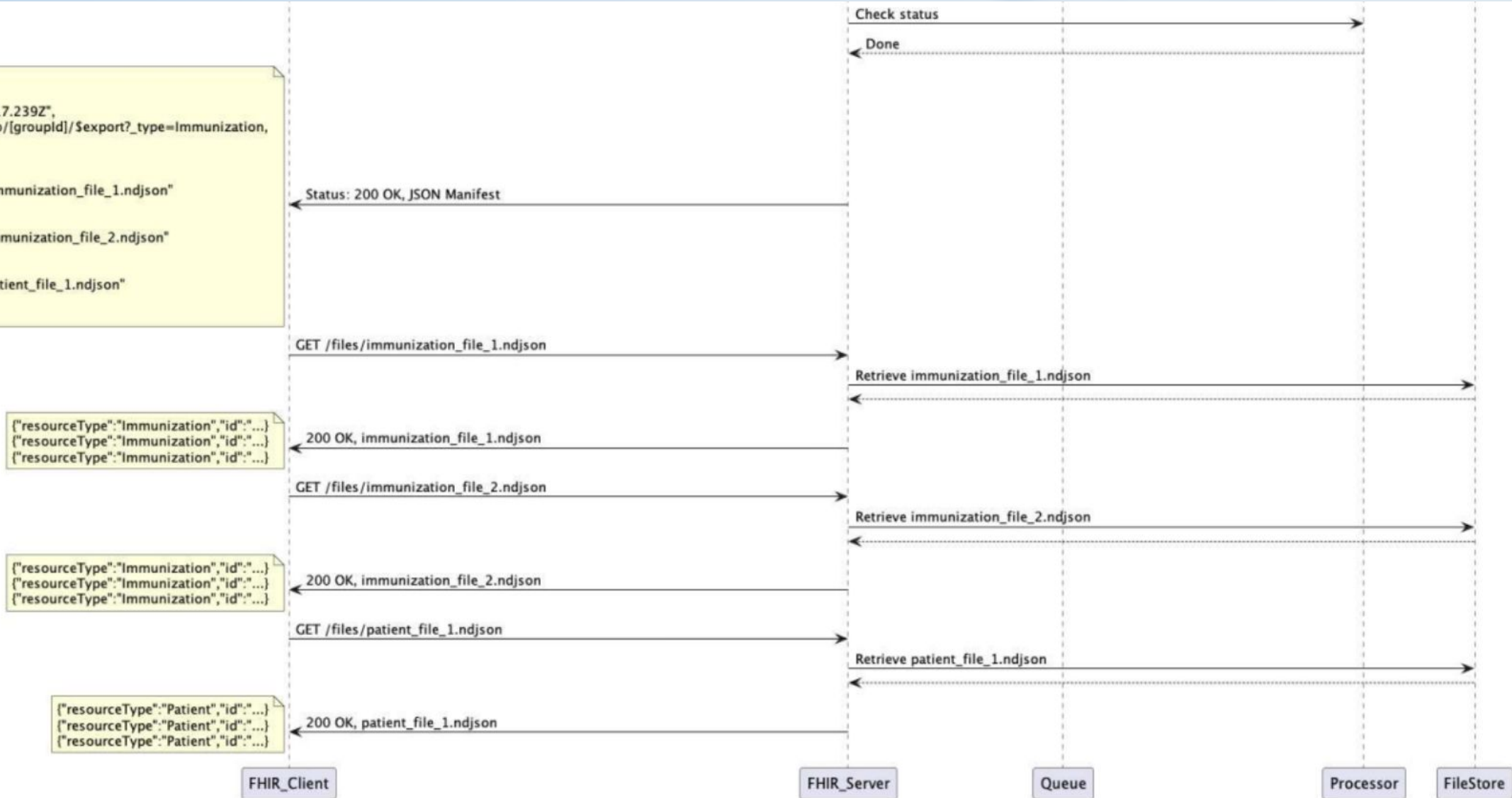
- FHIR Bulk Query:
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 - Modern authentication/authorization framework

Bulk FHIR Workflow for IIS



Bulk FHIR Workflow for IIS (continued)

```
JSON Manifest:  
{  
  "transactionTime": "2020-07-13T13:28:17.239Z",  
  "request": "https://example.com/Group/[groupId]/$export?type=Immunization",  
  "requiresAccessToken": true,  
  "output": [[  
    {"type": "Immunization",  
     "url": "https://example.com/files/immunization_file_1.ndjson"},  
    {"type": "Immunization",  
     "url": "https://example.com/files/immunization_file_2.ndjson"},  
    {"type": "Patient",  
     "url": "https://example.com/files/patient_file_1.ndjson"}  
  ]  
}
```



Rhode Island IIS Implementation

- ❑ Rhode Island Child and Adult Immunization Registry (RICAIR)
- ❑ FHIR Façade Model using open source HAPI FHIR server and SMART Backend Services Authorization
- ❑ Bulk Query - Helios FHIR Accelerator for Public Health
 - Match and Bulk Match
 - Predefined Groups, or search and define custom groups
 - Query Patient, Immunization, ImmunizationRecommendation, and ImmunizationEvaluation resources
 - Download up to 100k patients or more in a fraction of the time of HL7 v2 QBP/RSP
 - Server has flexibility in scheduling and allocating resources to query

Use Case #2: FHIR-based IIS Web Applications

“Now that we have a FHIR server, what else can we do with it?”

The screenshot shows a web application interface for managing immunization records. The background is a grid of records, each with a date, a status (e.g., 'ADMINISTERING PRO...'), a patient ID (e.g., 'FK0101'), a vaccine name (e.g., 'DTaP,IPV,Hib,HepB (Vaxelis) ...'), a manufacturer (e.g., 'GlaxoSmithKline (for...)', 'Merck & Co., Inc.'), and an expiration date (e.g., '01/01/2024').

An information dialog box is overlaid on the screen, containing the following text:

Information

Immunization record added for patient 11468369, MMR given on 1/1/2023

Immunization record added for patient 11468369, MMR given on 1/1/2022

Okay

IIS Web App – FHIR behind the scenes

Name	Headers	Payload	Preview	Response	Initiator	Timing	Cookies
_search?lot-number:exact=FK0102&_sort=-expiration-...							
_search?lot-number:exact=FK0102&_sort=-expiration-...							
_search?lot-number:exact=FK0102&_sort=-expiration-...							
_search?lot-number:exact=FK0102&_sort=-expiration-...							
fhir/							
11468369							
_search?patient=Patient/11468369&_sort=date							
ValueSet							
_search?type=prov&_count=1000							
_search?type=bus&_count=1000							

Request Payload [view source](#)

- ▼ {resourceType: "Bundle", type: "batch", total: 2,...}
- ▼ entry: [{request: {url: "Immunization?updateProvider=false", method: "POST"},...},...]
- ▼ 0: {request: {url: "Immunization?updateProvider=false", method: "POST"},...}
- ▼ request: {url: "Immunization?updateProvider=false", method: "POST"}
method: "POST"
url: "Immunization?updateProvider=false"
- ▼ resource: {resourceType: "Immunization", status: "completed", id: "11468369.03.2023-01-01",...}
- ▼ doseQuantity: {system: "http://unitsofmeasure.org", unit: "mL", value: 0.5}
system: "http://unitsofmeasure.org"
unit: "mL"
value: 0.5
expirationDate: "2024-01-01"
- ▼ extension: [{url: "https://health.ri.gov/immunization-source-of-update", valueString: "01"}]
- ▼ 0: {url: "https://health.ri.gov/immunization-source-of-update", valueString: "01"}
url: "https://health.ri.gov/immunization-source-of-update"
valueString: "01"
- id: "11468369.03.2023-01-01"
lotNumber: "FK0102"
- ▼ manufacturer: {type: "Organization", reference: "MSD", display: "Merck & Co., Inc."}
display: "Merck & Co., Inc."

Leveraging FHIR Bulk Data for App Modernization

- Replace legacy web applications with modern front-ends that communicate with the FHIR back-end:
 - Immunization Data Entry/Update
 - Other potential uses:
 - Immunization Display, Patient Demographics, SMART Health Cards, School Forms, etc.
 - SMART on FHIR apps
 - Consumer apps

Use Case #3: Reports and Analytics using FHIR

- ❑ FHIR Server + Bulk Data + FHIR Client + SQL OLAP = a workable "last-mile analytics" solution:
 - FHIR Server is queried for Resources referenced using FHIR Query.
 - Bulk Exported data stored in a DuckDB database locally and queried from there.
- ❑ CQL Front-end allows for CQL queries to be submitted and to reduce the volume of data coming back to the client
- ❑ Also: FHIR Community of Practice, Helios Aggregate Data

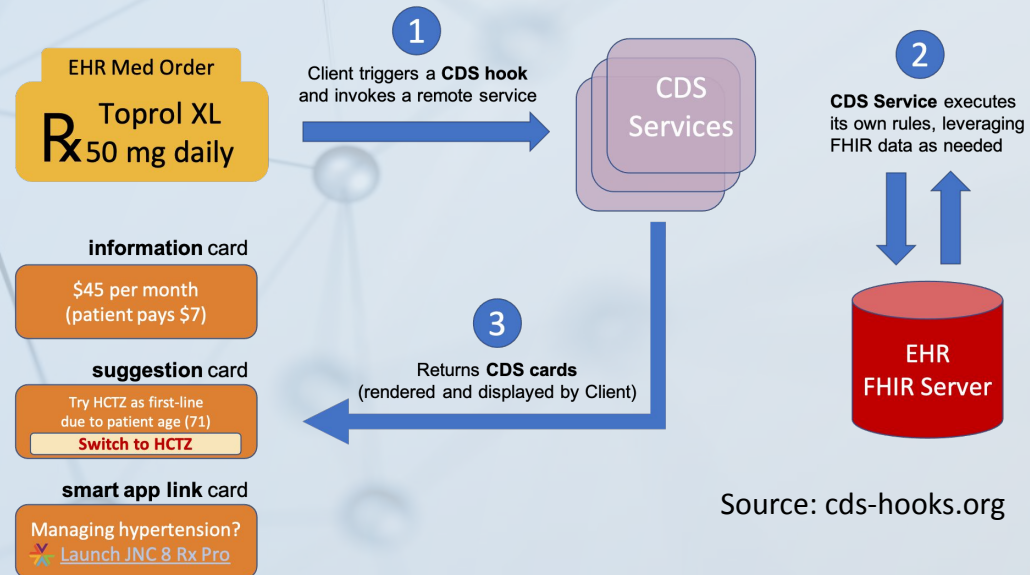
Use Case #4: IIS pulling data from an Electronic Health Record (EHR) using FHIR

- ❑ Helios Query & Response Priority Area
 - Receive Lab (ELR) or Case Report (eICR)
 - Query sending organization to obtain related/updated EHR data
- ❑ CCHD/Newborn Screening
- ❑ Obtain IIS-related data from birthing hospital:
 - HepB
 - RSV
- ❑ Also: TEFCA Public Health SOP, USCDI+, PACER

Use Case #5: Immunization Clinical Decision Support using FHIR

- Immunization Decision Support Forecast (ImmDS) FHIR IG
- Immunization Calculation Engine (ICE)
 - CDS Hooks
 - ImmDS
 - FHIR Server

```
"patient": {
  "reference": "Patient/ImmDSPatientExample"
},
"date": "2020-05-26",
"targetDisease": {
  "coding": [
    {
      "system": "http://snomed.info/sct",
      "code": "66071002",
      "display": "Hepatitis B"
    }
  ]
},
"immunizationEvent": {
  "reference": "Immunization/ImmDSImmunizationExample"
},
"doseStatus": {
  "coding": [
    {
      "system": "http://terminology.hl7.org/CodeSystem/immunization-evaluation-dose-status",
      "code": "valid",
      "display": "Valid"
    }
  ]
},
"series": "ACIP 3-dose HepB series",
"doseNumberPositiveInt": 1,
"seriesDosesPositiveInt": 3
}
```



Source: cds-hooks.org

Thank you!

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 - Jesse Bonzo – HLN FHIR Developer on the RICAIR team
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 - Craig Newman and the Helios Bulk Data team
- Please contact berrym@hln.com if you have any questions.