Using FHIR in an Immunization Information System

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Abstract/Summary

- In collaboration with the Helios, Rhode Island Immunization Registry (RICAIR) implemented a **bulk data interface for immunization data using FHIR**.
- The interface allows authorized providers to **efficiently access up-to-date immunization data for large groups of patients** using modern tools and protocols.
- With FHIR bulk query, a provider can request immunizations for **only the patients whose immunization status has changed** recently, which is much more efficient than querying every patient.
- The bulk data work also led to the development of a **FHIR-based IIS web application in RICAIR**, demonstrating that FHIR® can double as an application modernization strategy for public health.

Agenda

- Background:
  - IIS
  - FHIR
- FHIR and IIS – Bulk FHIR
- Rhode Island IIS Implementation
- Helios FHIR Accelerator for Public Health
  - Authentication
  - Matching and Group Management
- Leveraging FHIR Bulk Data for Modernization

Background: Immunization Information Systems (IIS)

- Confidential, population-based systems
- Collect and consolidate immunization data in a given jurisdiction
- Provide actionable information for clinical and public health decision making. (Source: CDC)

IIS Background (continued)

- Inbound data exchange:
  - HL7 version 2 Unsolicited Vaccination Update (VXU)
  - Flat file
  - Interactive web applications
- Outbound data exchange:
  - HL7 version 2 Query/Response (QBP/RSP)
  - Flat file (CDC Data Clearinghouse, HEDIS data, etc.)
  - Interactive web applications

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 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

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

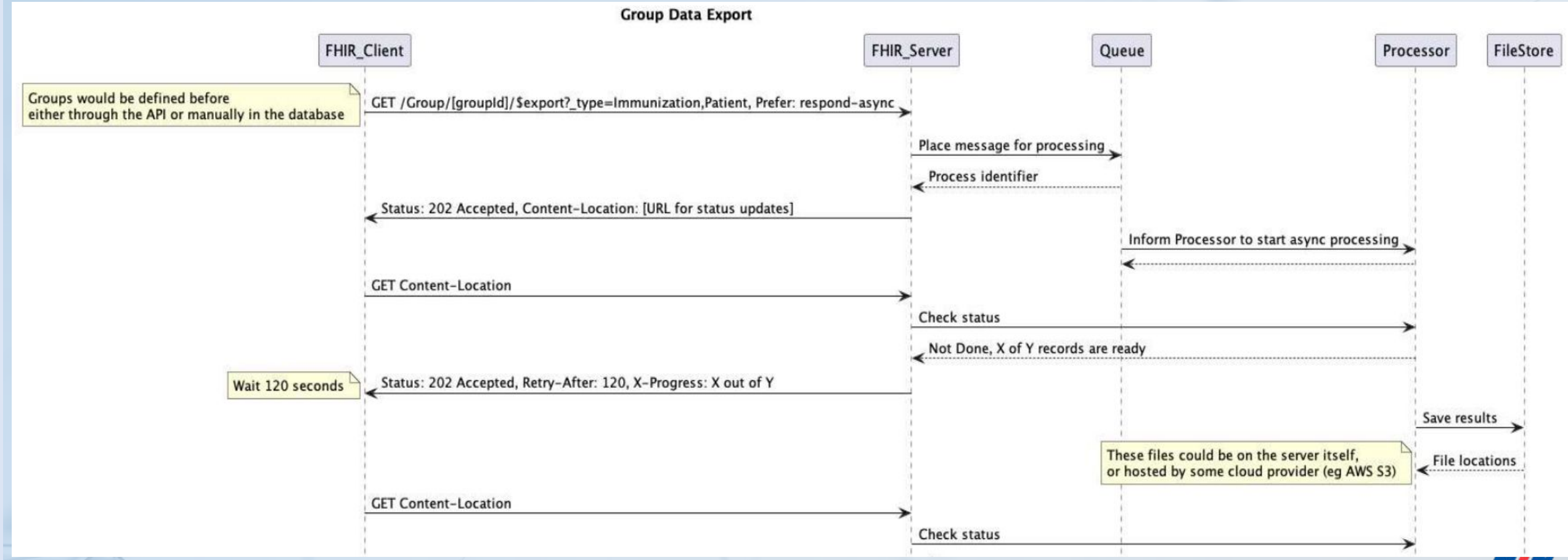
First Name: **TEST** Middle: **A** Last: **HIMSS-PATIENT**

Date of Birth: **04/20/2022** Age: **10m 16d**

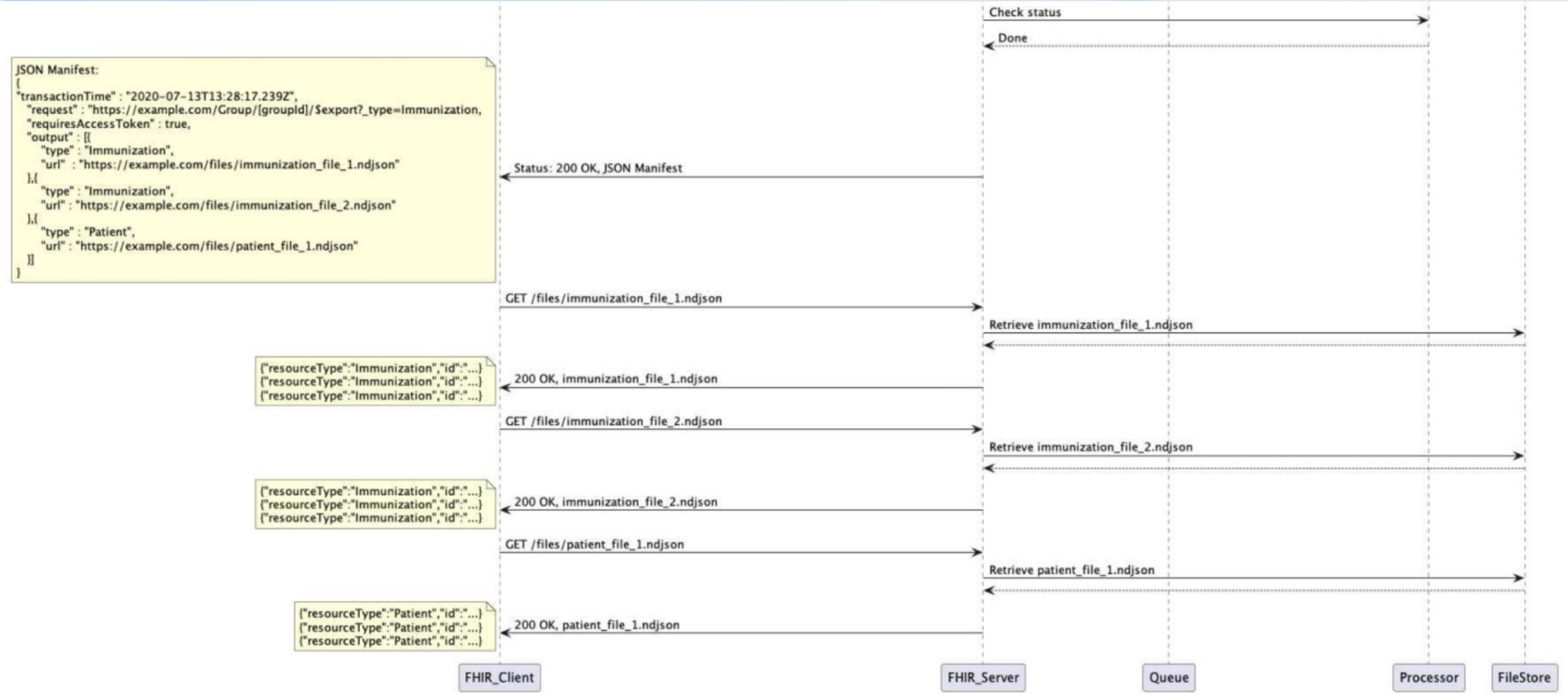
VALID DOSES					NEXT DUE
COVID-19 2 valid doses	10/20/2022 COV19 PF PFR 6m-5 6m 0d	11/20/2022 COV19 PF PFR 6m-5 7m 0d			**Due Now** (On or after 01/15/2023) Dose 3 Covid Record
Influenza					**Due Now** (On or after 10/20/2022) Dose 1
Hepatitis B 3 valid doses	04/20/2022 HepB ped/adol 0m 0d	06/20/2022 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

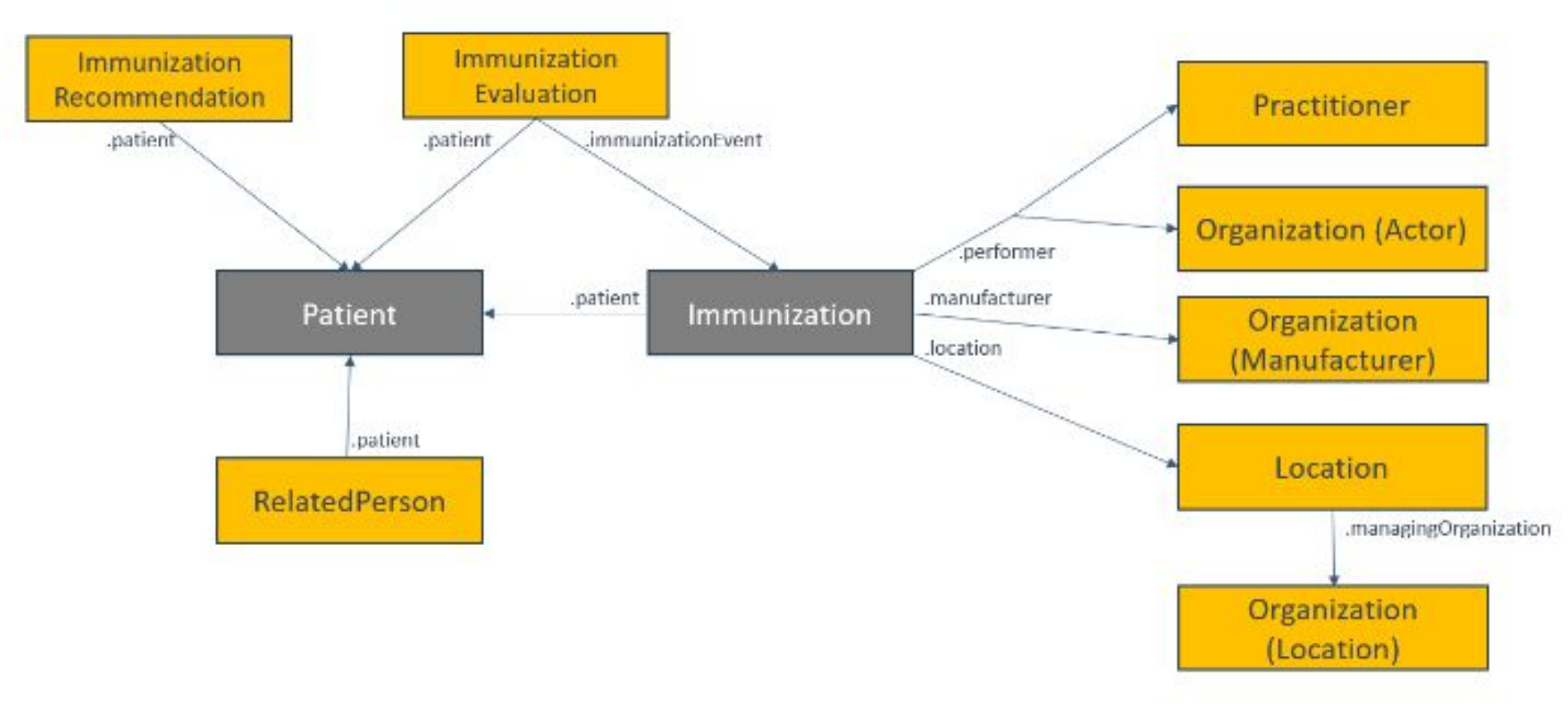
Bulk FHIR Workflow for IIS



Bulk FHIR Workflow for IIS (continued)



Helios IIS Bulk FHIR Resources



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Helios FHIR Accelerator for Public Health Home

Created by Joshua Procious, last modified by Craig Newman on Feb 06, 2024

About Helios

The Helios FHIR Accelerator is an alliance of Government, Private Sector, and Philanthropic partners that aims to ensure public health needs are at the forefront as the FHIR standard evolves and is implemented nationwide. Helios focuses on extending and adopting existing HL7 specifications in ways that are scalable, adaptable, sustainable, and suitable for public health. Participants in Helios provide the resources and technical support needed for public health practitioners and their trading partners to develop, test, and adopt more efficient, FHIR-based ways of accessing and exchanging data nationwide. Membership is open to state, tribal, local, territorial and Federal Public Health agencies, private sector partners and other groups interested in the equitable and effective use of data for the advancement of public health.

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Helios is focused on three Priority Areas

Delivering Aggregate Information to Public Health

Making Data in Public Health Systems Accessible in Bulk

Employing Query and Response to Address Public Health Data Needs

Helios FHIR Accelerator for Public Health

- **IIS Bulk Data Query - Make Data in Public Health Systems Accessible in Bulk**
  - Leverage bulk FHIR to develop a uniform process for querying IIS data
  - Develop Implementation Guidance & vision for bulk data exchange
  - Test & pilot solutions

Rhode Island IIS Implementation

- Rhode Island Child and Adult Immunization Registry (RICAIR)
- FHIR Façade Model (with translation layer) using open source HAPI FHIR server
- Bulk Query:
  - 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
  - SMART Authentication

Helios Bulk Data Testing

- January 2023 - HL7 FHIR Connectathon - Henderson, NV
  - American Immunization Registry Association (AIRA) & National Institutes of Standards and Technology, MITRE, Envision Technology Partners, HLN & Rhode Island Department of Health, STChealth, Epic, AWS, Intersystems
  - Exchanged groups of up to 100,000 patients & immunizations
- July 2023 - Virtual Testing Event
  - Added SMART Authentication and bulk matching
- January 2024 - HL7 FHIR Connectathon – Virtual
  - More bulk matching

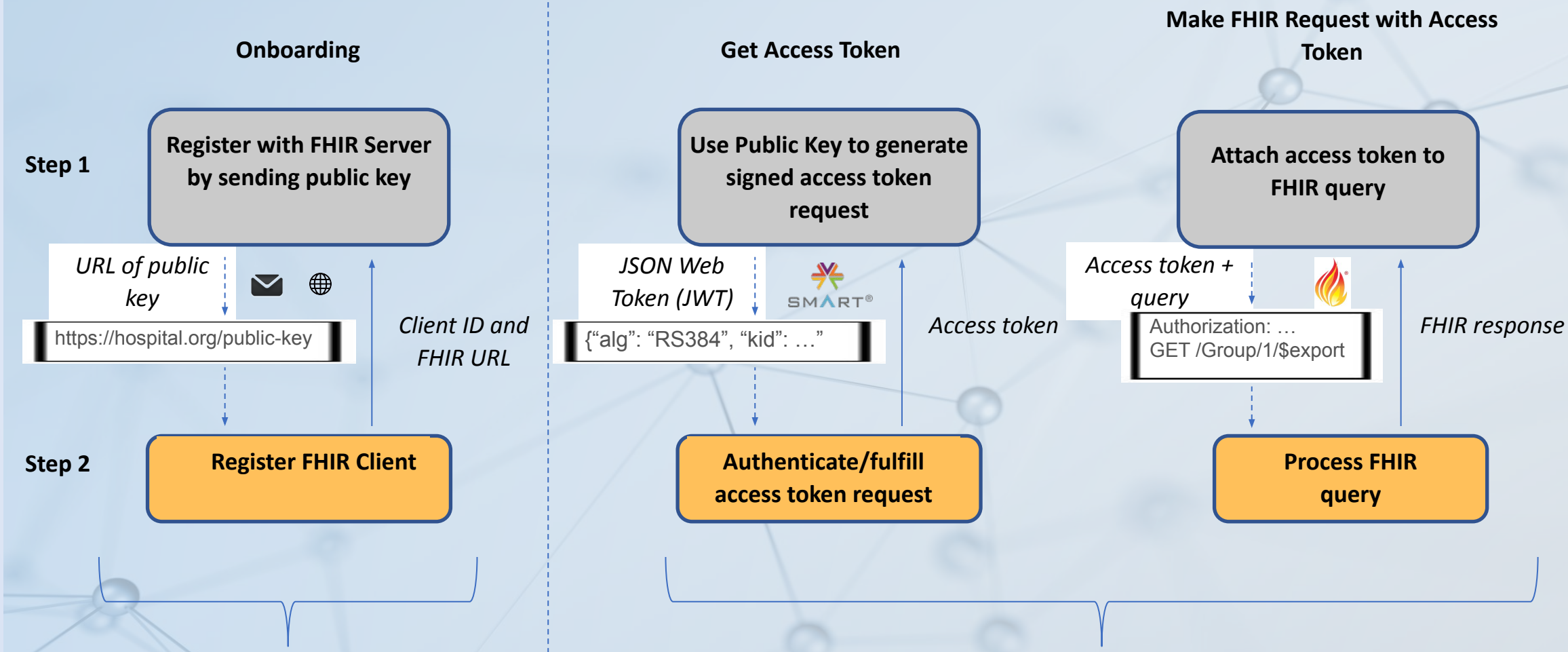
Helios Bulk Data Functionality

Functionality	FHIR functionality
Bulk Data Export	Group/[id]/$export
Patient Match	Patient/$match
Creation of Group resource	POST /Group {“member” […] }
Add Patient to Group	Group/[id]/$member-add
Remove Patient from Group	Group/[id]/$member-remove
Security/authentication – SMART Backend Services (OAuth/JWT)	/.well-known/smart-configuration POST /auth/token
Bulk Match	Patient/$match with [1..*]
HL7 v2-Mediated Matching (Automatic Group Creation)	FHIR Group/[id] maintained based on HL7v2 messages

Security/Authentication

- HL7 v2 Authentication
  - Typically involves username/password – tedious to share and can leak or be weak
  - Some use certificate authentication, but also tedious
- SMART Backend Services Authentication
  - Makes it possible to ***not*** have to share passwords with senders during onboarding
  - Partners provide IIS a URL containing their public key
  - FHIR client leverages standards to securely provide FHIR access tokens

Security/Authentication



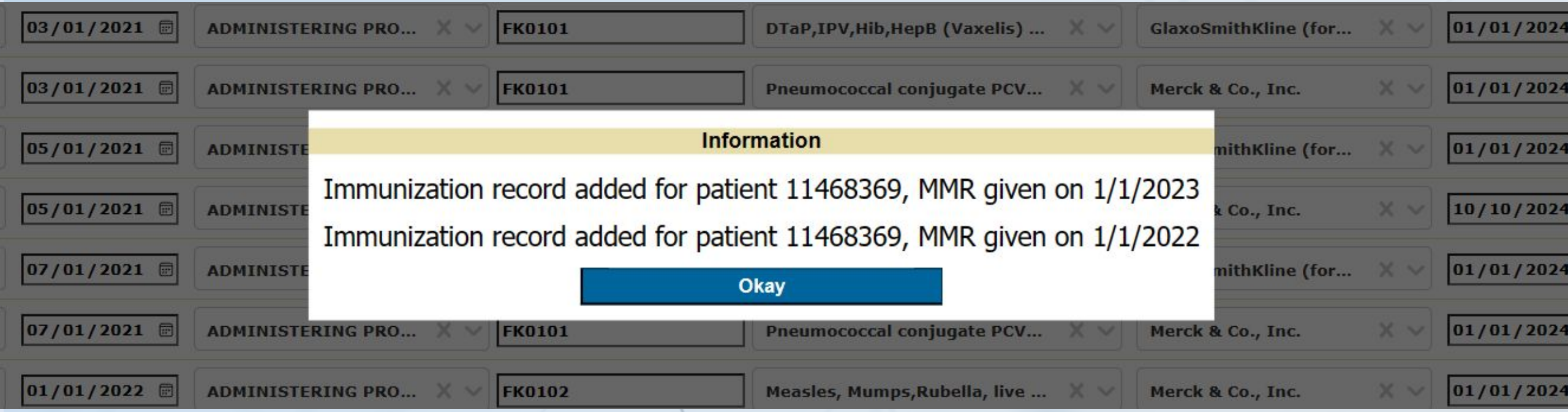
Onboarding happens once for a FHIR Client

FHIR Client obtains short-lived access token whenever needed to perform FHIR query

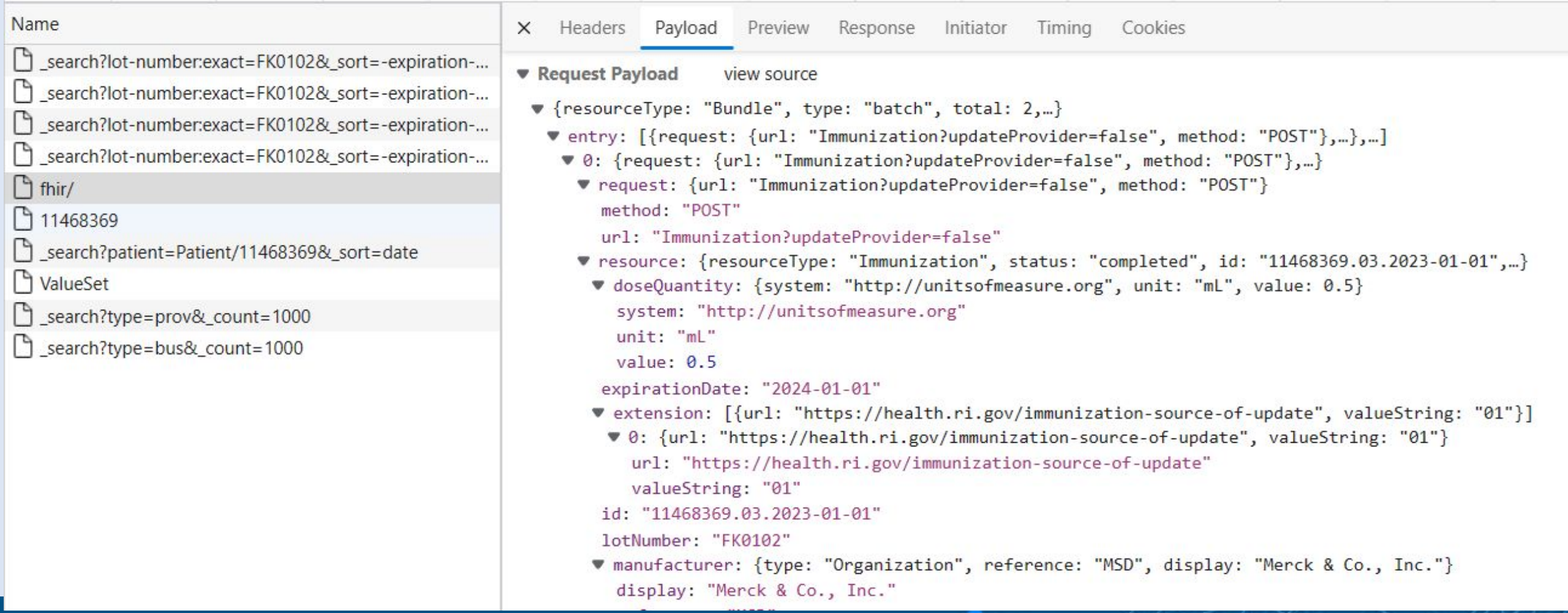
Patient Matching & Group Management

- Having the right group is critical to the use cases
- Provider can create and maintain a group
  - Patient Match and Bulk Match in combination with Group functions
- IIS can maintain a group
  - HL7 v2-Mediated Matching (Automatic Group Creation)
  - Other automatically-maintained Groups

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



IIS Web App – FHIR behind the scenes



Leveraging FHIR Bulk Data for DMI

- FHIR Server for IIS can double as an application modernization strategy
- 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
    - IIS-to-IIS - IZ Gateway

Thank you!

- Special thanks to:
  - Rhode Island Child and Adult Immunization Registry (RICAIR) and CDC
  - Helios – The HL7 FHIR Accelerator for Public Health
  - Immunization Integration Program (IIP)
  - American Immunization Registry Association (AIRA)
  - Jesse Bonzo and the HLN Rhode Island Team
  - Craig Newman and the Helios Bulk Data team
- Please contact berrym@hln.com if you have any questions.