

FHIR to HL7 v2 Conversion Library for Incremental Modernization

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Who are we?



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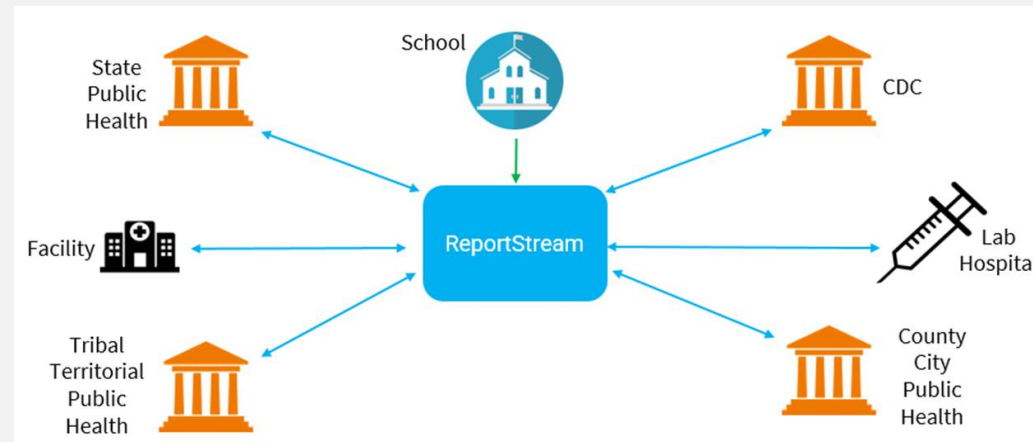
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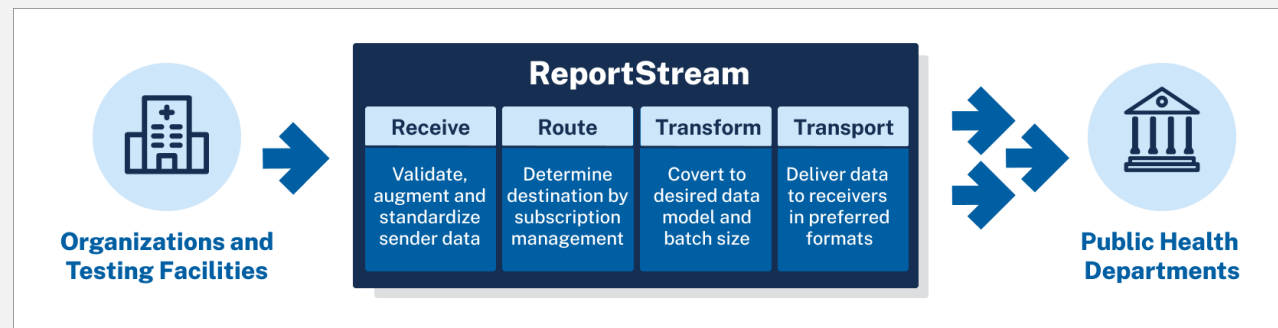
CDC ReportStream

- Part of the Centers for Disease Control and Prevention (CDC) Pandemic Ready Interoperable Modernization Effort (PRIME)
- Free, open source reporting platform that aggregates and delivers reportable disease test results to health departments
- Supports
 - testing facilities, data aggregators, community organizations, and manufacturers that want to meet reportable disease data requirements
 - public health departments that want access to high quality reporting data for their jurisdictions



Meet Public Health Where They Are

- Entities have different levels of maturity for reporting
- Goal: to speed up the process of onboarding new data models and customers
 - Supports various data formats (CSV, HL7 v2, and now FHIR)
 - Support different levels of data quality (we validates and enrich received data)
 - Routes data to public health agencies based on jurisdictional rules and quality gates
 - Supports various data transports: REST, SOAP, SFTP, Azure BlobStore, AS2, GAEN
- Support incremental modernization of health care



ReportStream v1 – The COVID Pandemic

- Goal: reduce burdensome manual and fax based reporting
- Conversion from HL7 v2 or CSV to custom internal CSV data format to normalize data
 - Worked as designed for the COVID pandemic, but only supported one reportable condition
 - One internal format simplifies enriching and routing
- Different reporting requirements meant hard coded or special configuration per reporting entity
- Router required hard coded filters to determine destination
- Conversion from CSV to HL7 v2 required lots of hard coding

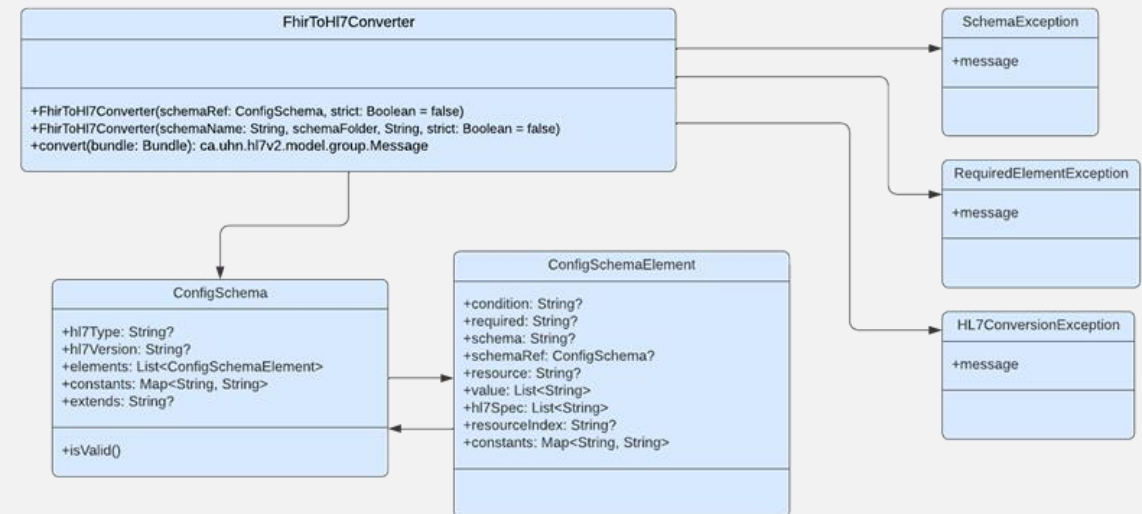


ReportStream v2 – Towards Pandemic Readiness

- Internal FHIR data format to normalize data allows for a huge amount of flexibility
 - One internal format simplifies enriching and routing
- Ingests FHIR Bundles or HL7 v2 messages
 - Performs functionally lossless conversion from HL7 v2 to FHIR Bundle
- FHIR Transformation enriches sender data to fill in gaps and fix bad data values
- Routing uses FHIR Path expressions to specify jurisdiction and quality filtering
- Delivery using various transports and data formats
- Functionally lossless conversion from FHIR Bundle to HL7 v2 if needed by receiver
 - No existing library or service could support our conversion requirements, ... so we built it

The Open-source FHIR to HL7 v2 Conversion Library

- Simple description: Extracts a value using FHIR Path and assigns it to one or more HL7 v2 fields
- Java-based written in Kotlin
- Uses the Java HAPI FHIR and HL7 v2 libraries
- Converts one HAPI FHIR bundle to HAPI HL7 v2 Message
- Configuration driven conversion uses FHIR Path to extract data
- Initial v0.1 supports FHIR R4 to HL7 ORU R01 v2.5.1
- Configuration is read from text-based YAML files or passed in as object
- Thread safe



Flexibility Through Extensibility and Reusability

- Top level schemas define
 - Output HL7 v2 message type and version
 - Set of elements that can be segments or fields
- Child level schemas define
 - Set of elements that can be segments or fields
 - Reusable (E.g. common field types, segments)
- Top level schemas can be extended to define variations of a parent
 - To overwrite any existing element configuration
 - To add new elements
 - E.g. define a base ORU R01 schema and make variations per customer requirements

```
hl7Type: ORU_R01
hl7Version: 2.5.1
extends: ../../ORU_R01/ORU_R01-base
elements:
  #####
  # ReportStream specific #
  #####
  - name: sending-application-namespace-id
    value: [ "CDC PRIME - Atlanta, Georgia (DeKalb)" ]
  - name: sending-application-universal-id
    value: [ "2.16.840.1.114222.4.1.237821" ]
```


Flexibility Through FHIR Path Expressions

- Allows the extraction and manipulation of values in the same expression
 - Very powerful and flexible
- Includes custom extension to FHIR Path with new functions
 - Manipulate and validate phone numbers
 - Manipulate and validate IDs (e.g. ISO, CLIA, etc.)
 - String split function



Flexibility in Element Definition

- Set a root location within the FHIR bundle for an element
- Set a conditional to decide if the element is to be evaluated
- Set list of FHIR Path expressions to extract a value from the bundle
 - The first expression to result in a non-empty value wins
 - Allows for default values
- One of
 - A list of HL7 Specs to assign the value to
 - The same value is assigned to all listed HL7 specs
 - Value set to convert a FHIR value to another string
 - Useful for converting a string to a specific HL7 v2 code
 - Iterate through a FHIR collection using a specified child schema

```

- name: country-code
  value:
    - '%resource.sender.resolve().address.country'
    - '"USA"'
  hl7Spec: [ MSH-17 ]
  
```

```

- name: patient-class
  condition: '%resource.class.code.exists()'
  value: [ '%resource.class.code' ]
  hl7Spec: [ '%{hl7PV1Field}-2' ]
  valueSet:
    emer: E
    imp: I
    prenc: P
    amb: 0
  
```

Flexibility Through Iterable Resources

- HL7 v2 often has repetitions of segments, fields, etc.
- FHIR to HL7 v2 library can iterate through a FHIR resource collection
 - E.g. a collection of Diagnostic Reports
 - Assigns index number to a constant
 - Use a child schema to process the resource which can generate repeated segments, fields, etc. (E.g. Observation Request segments)

<pre> - name: order-observations resource: 'Bundle.entry.resource.ofType(DiagnosticReport)' condition: '%resource.count() > 0' required: true schema: base/order-observation resourceIndex: orderIndex </pre>		<pre> constants: hl7Order: '/PATIENT_RESULT/ORDER_OBSERVATION(%{orderIndex})' diagnostic: 'Bundle.entry.resource.ofType(DiagnosticReport)[%orderIndex]' service: 'Bundle.entry.resource.ofType(DiagnosticReport)[%orderIndex].basedOn.resolve()' hl7ObservationNotes: '/PATIENT_RESULT/ORDER_OBSERVATION(%{orderIndex})/OBSERVATION' hl7ObservationPath: '/PATIENT_RESULT/ORDER_OBSERVATION(%{orderIndex})/OBSERVATION' </pre>
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Flexibility Through User Defined Constants

- Constants can be defined at the schema or element levels
- Constants can be used in FHIR Path or HL7 v2 Specs
- Constants are inherited
 - E.g. a constant at the top level schema is available to all elements including those in child schemas
 - E.g. element constants are only available for the element or its child schema

```

constants:
  hl7SpecimenFieldPath: /PATIENT_RESULT/ORDER_OBSERVATION(%{orderIndex})/SPECIMEN/SPM
elements:
  - name: specimen-set-ID
    value: [ '1' ]
    hl7Spec: [ '%{hl7SpecimenFieldPath}-1' ]

  - name: specimen-identifier-placer
    resource: '%resource.identifier.where(type.empty())'
    condition: '%resource.exists()'
    constants:
      entityIdFieldPath: '%{hl7SpecimenFieldPath}-2-1'
    schema: entity-identifier
    resourceIndex: entityIdIndex
  
```

Base FHIR to HL7 v2 Mappings

- ReportStream uses the HL7 v2 to FHIR Mapping developed by HL7 as the base structure of its internal FHIR bundle
 - It does use extensions for data not covered by the mappings to attain functionally lossless conversion
- The library includes a base ORU R01 schema based on the HL7 v2 to FHIR mapping
 - Can be extended or reused
 - HL7 v2 segments and fields can be reused for multiple message types

More Features Coming in v1.0



- Features already developed in ReportStream that need to be migrated to the library repo
 - Support any HL7 v2 message type supported by the HAPI HL7 v2 library
 - Updated mappings that follow the latest HL7 v2 to FHIR mappings
 - FHIR Transformation – allows changing a FHIR bundle
 - FHIR Path command line tool – for testing your expressions
 - Extremely useful to find your path or test that you are on the right path

Where to Find it?

- Open-source FHIR to HL7 v2 Converter
 - <https://github.com/CDCgov/prime-fhir-converter>
 - Read more in the [README.md](#)
 - Documentation in the [docs](#) folder
 - [Base ORI R01 configuration](#)
- Open-source ReportStream Router
 - <https://github.com/CDCgov/prime-reportstream/tree/master/prime-router>

Contact

- During DevDays, you can find / reach me here:
 - Via Whova App – Speaker’s Gallery
 - Email: carlos.felix@agile6.com
- Reach out to ReportStream for more information about the library, interest and feature requests
 - Email: reportstream@cdc.gov
 - Include in your email that your request is about the FHIR to HL7 v2 Converter Library

Q&A



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