



HL7[®] FHIR[®] DevDays

JUNE | 2022

FHIR Subscriptions

Gino Canessa



<http://aka.ms/devdays-gino>



About Me



- Principal Software Engineer @ Microsoft
 - MSR - Healthcare Standards and Interop
- Focused on FHIR since 2019
 - Infrastructure / Tooling
 - Code generation
 - Topic-Based Subscriptions
- DICOM-centric before
 - Apologies for the CDs!
 - They were a good idea at the time =)
- Contact
 - Gino.Canessa@microsoft.com
 - [Zulip](https://chat.fhir.org) (chat.fhir.org)
 - [YouTube](#) (FHIR Educational Content)

FHIR & REST

- Primary model for communication
- **Representational State Transfer**
 - Generally based on HTTP model
 - Client-driven interactions
 - Stateless
 - Cacheable

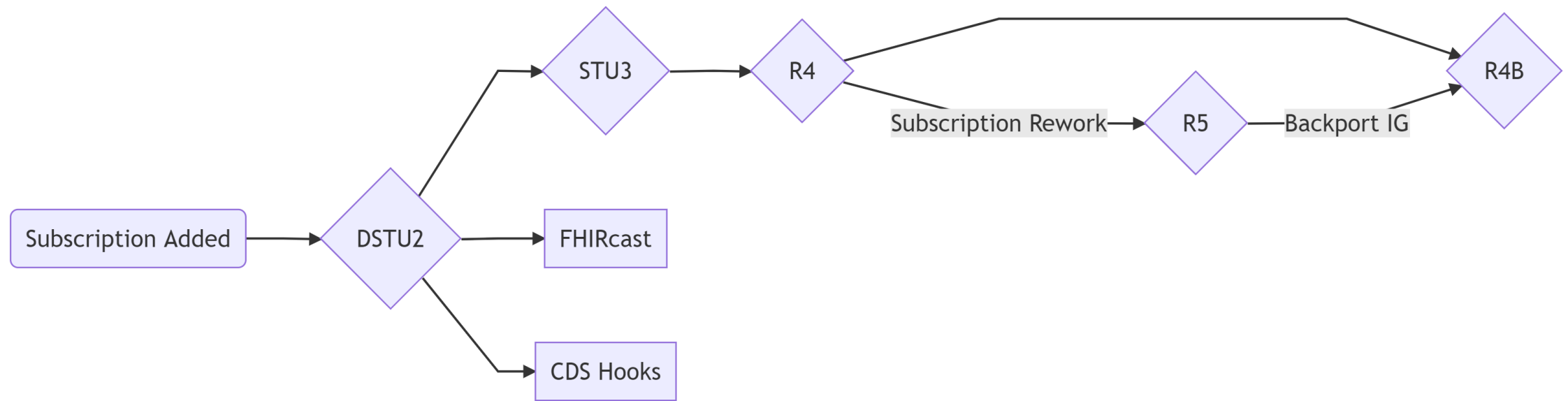
REST and the Polling Problem



"Tell me when data changes"

Problem Solved!

Should Be Easy, Right?



R2–R4: Query-Based Subscriptions



*Looked great
for clients*



*Issues with
scale*



*Hit or miss for
a use case*

Topic-Based Subscriptions

- Topics can be resource or event driven
- Servers *choose* which topics to support
- Common topics across systems
- Optimized implementations
- Server-Driven workflows

FHIR R5 Subscriptions

- Change model to Topic-Based
 - SubscriptionTopic resource
 - A conceptual event (e.g., admit)
 - Defines allowed filters
- Add Flexibility to Subscriptions
 - Filters by topic
 - Extensible channels
 - Payload options
- Update the Notification Format
 - New type of Bundle
 - SubscriptionStatus resource

R4B Backport IG

- All the functionality, half the wait!
- New resources in R4B
 - SubscriptionTopic
 - SubscriptionStatus
- Extensions for Subscription
 - Adds features from R5
- Notification Format
 - 'history' Bundle
- Requesting publication next week



Topic

SubscriptionTopic: [R4B](#), [R5](#)

Define what causes a notification

Allowed filters

Related Resources



Subscription

Subscription: [R4B](#), [R5](#)

Notification configuration

Actual filters

Endpoint information



Notification

Bundle: [R4B](#), [R5](#)

SubscriptionStatus: [R4B](#), [R5](#)

Payload contents

Parts of a Subscription

SubscriptionTopic

What is it?

- Canonical (definitional) resource
 - FHIR Registry (after R4B release)
 - Define, Derive, Reference
- Describe what causes a notification
 - Human-readable text
 - A resource state change
 - A FHIR interaction
 - An external event
- Defines **allowed** filters
 - Limits options for better scalability
 - Prevents arbitrary multi-level chaining
- Defines **shape**
 - Resources that MAY be included

SubscriptionTopic Examples

- Patient Admission
 - Encounter resource
 - Specific status ('in-progress')
 - Filter on Patient Id
 - Filter on Patient Group membership
 - Include Patient, Practitioner, Location...
- New Explanation of Benefit
 - ExplanationOfBenefit resource
 - CREATE interaction
 - Filter on Patient Id / Group membership
 - Filter on Facility / Provider / Payee
 - Include Patient, Organization, Location...

Patient Admission

resourceTrigger

resource

"Encounter"

description

"Beginning of a clinical encounter"

fhirPathCriteria

```
[ "%previous.status != 'in-progress' and  
  %current.status = 'in-progress'"]
```

queryCriteria

```
previous = "status:not=in-progress"  
current = "status=in-progress"  
requireBoth = true  
resultForCreate = 'test-passes'
```

Patient Admission

eventTrigger

resource

"Encounter"

description

"Beginning of a clinical encounter"

event

<http://terminology.hl7.org/CodeSystem/v2-0003#A01>

Patient Admission

canFilterBy

description

"Matching based on the Patient (subject) of an Encounter or based on the Patient's Group membership (in)"

filterParameter

"patient"

modifier

["="
"in"]

Patient Admission

notificationShape

resource

"Encounter"

include

"Encounter:patient"

"Encounter:practitioner"

"Encounter:service-provider"

"Encounter:account"

"Encounter:location"

Subscription

What is it?

- Domain (regular) resource
 - Link a topic to a specific request
- Endpoint Information
 - Channel Type
 - URL / Address / etc.
- Format of notifications
 - MIME Type
 - Payload Type (amount of data)
- Defines **actual** filters



Method of
communication



Pre-defined
channels

REST-Hook
Websocket
Email
FHIR Messaging



Extensible!

Create your own!
Message Queue, Zulip, etc.
Even fax!

Subscription

Channel Types



Ping Only
'empty'

Least information
Requires queries



Include Identifiers
'id-only'

Some information
Requires *fetch*
May require queries



Include Resources
'full-resource'

All information
Use a secure channel!

Subscription

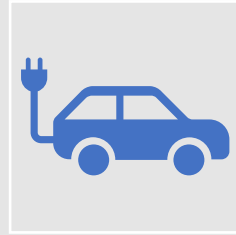
Payload Types

Comparing Payloads



Ping / empty

1. Notification has a subscription id
2. Client queries server
3. Client retrieves data



Id-only

1. Notification has a subscription id
 - 1.1. AND ids of relevant resources
2. Client retrieves data



Full Resource

1. Notification has a subscription id
 - 1.1. AND ids of relevant resources
 - 1.2. AND actual resources

Subscription Examples

- Patient Admission (consumer)
 - REST Hook
 - URL Endpoint
 - May be a relay (e.g., Push Notification)
 - Single patient filter
 - ID-only to limit PHI
 - FHIR+JSON
- Medication Dispensed (practitioner)
 - Websocket (client will connect)
 - Filter on Location
 - Full-resource since this is internal
 - FHIR+JSON

Patient Admission

consumer

topic

"http://example.org/subscriptiontopic/admission"

channelType

'rest-hook'

endpoint

"http://myserver.com/notifications/subscriptionXyz"

contentType

'application/fhir+json'

content

'id-only'

filterBy

resource = "Encounter"

filterParameter = "patient"

value = "patient/123"

Notification

What is it?

- Bundle
 - R4B type: 'history'
 - R5 type: 'subscription-notification'
- Status Information
 - SubscriptionStatus resource
 - MUST be at entry[0]
- Payload
 - By configuration
 - May include additional resources

Want to Develop / Test / Play?

Reference Implementation



Info

Open source reference implementation, all projects on GitHub
Detailed information available [here](#)



Server Proxy

C# CLI, intercepts calls and proxies to configured FHIR server
GitHub: [argonaut-server-proxy](#)
Azure: server.subscriptions.argo.run (/r4, /r5)



Client Host

C# CLI, manages endpoints and notification forwarding for UI
GitHub: [argonaut-subscription-client](#)
Azure: client.subscriptions.argo.run (only used by the UI)



Client UI

TypeScript / React, interface for testing subscriptions (can test your own!)
GitHub: [argonaut-subscription-client-ui](#)
Azure: <https://subscriptions.argo.run>

Questions

Links!

- This deck (and others)
 - <http://aka.ms/fhirssubscriptions>
- Zulip
 - [#subscriptions](#)
- R4 Backport IG (CI Build)
 - [Subscription Backport IG](#)
- FHIR Resource Links
 - R4B: [Subscription](#), [SubscriptionTopic](#), [SubscriptionStatus](#)
 - R5: [Subscription](#), [SubscriptionTopic](#), [SubscriptionStatus](#)
- Reference Implementation
 - <http://subscriptions.argo.run>
- Connectathon 29 Subscriptions Track Videos
 - [YouTube Playlist](#)

Monday June 6	
3:00 PM - 3:45 PM - Room: 201	Introduction to FHIR search - Gino Canessa

Tuesday, June 7	
10:45 AM - 11:30 AM - Room: Ballroom A	SMART on FHIR: Introduction - Josh Mandel
1:20 PM - 1:50 PM - Room: 203	Azure Health Data Services - Doug Seven
2:55 PM - 3:40 PM - Room: 221	Topic-based subscriptions - Gino Canessa
4:10 PM - 4:55 PM - Room: 201	SMART on FHIR: hands on - Josh Mandel
6:00 PM - 8:00 PM - Room: 203	Generating actionable insights from real world clinical and genomic data in FHIR - Geralyn Miller
6:00 PM - 6:45 PM - Room: SpatialChat	Pubtalk – JavaScript is for Uis - Brian Postlethwaite - Gino Canessa
6:00 PM - 6:45 PM - Room: SpatialChat	Pubtalk – Are we making this too complicated? - Josh Mandel

Wednesday, June 8	
11:45 AM - 12:05 PM - Room: 304	SMART Health Cards - standard, testing & validation tools - Christian Paquin
1:20 PM - 1:50 PM - Room: 203	React to Events of Data Changes on FHIR Service - Teng Li
4:10 PM - 4:30 PM - Room: Ballroom A	TypeScript FHIR library - Gino Canessa
5:00 PM - 5:45 PM - Room: 201	FHIR Questionnaires and structured data capture with examples - Brian Postlethwaite

Thursday, June 9	
11:10 AM - 11:30 AM - Room: 221	FHIR Data Ingestion Tool: convert, anonymize, and publish - Mr Ibrahim Kivanc
11:45 AM - 12:30 PM - Room: ABC	Mapping FHIR data to parquet for analytics and machine learning - Quan Wan
11:45 AM - 12:30 PM - Room: 201	SMART on FHIR: what's new, what's next? - Josh Mandel
2:00 PM - 2:45 PM - Room: 201	FHIRPath by example - Brian Postlethwaite
2:55 PM - 3:40 PM - Room: ABC	SMART Health Links for verifiable clinical information - design discussion - Josh Mandel





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THANK YOU!

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