Integrating a FHIR Server in your Architecture

Christiaan Knaap, Firely
The Question

I want to integrate some systems.

Where does this FHIR Server go?
Audience

• High level
• Architects
• Integrators
• No code involved
Speaker

• Christiaan Knaap
• Firely
• 20 yr IT dev / analist / architect
• Lead dev of Vonk FHIR Server
• christiaan@fire.ly
• Zulip
Agenda

• What is a FHIR Server?
• Use cases
• Architectures
• Use cases & architectures
• Questions (and maybe answers)
FHIR Server in the specification

The OperationOutcome may be returned with any HTTP 4xx or 5xx response, but this is not required - many of these errors may be generated by generic server frameworks underlying a FHIR server. (HTTP Status Codes)

When processing create and update interactions, a FHIR server is not obliged to accept the entire resource as it is (Transactional Integrity)

FHIR does not (yet) define a root document. When defined, it will contain information about what the FHIR server has done (as opposed to a Capability Statement, which describes what it is capable of doing) (OMG hData RESTful Transport)

FHIR Servers do not have to support versioning, though they are strongly encouraged to do so.

A FHIR REST server is any software that implements the FHIR APIs and uses FHIR resources to exchange data.
FHIR Server definition

Any software that implements all or several parts of the FHIR RESTful API

<table>
<thead>
<tr>
<th>Instance Level Interactions</th>
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<tbody>
<tr>
<td>read</td>
</tr>
<tr>
<td>vread</td>
</tr>
<tr>
<td>update</td>
</tr>
<tr>
<td>patch</td>
</tr>
<tr>
<td>delete</td>
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<tr>
<td>history</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Type Level Interactions</th>
</tr>
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<tbody>
<tr>
<td>create</td>
</tr>
<tr>
<td>search</td>
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<tr>
<td>history</td>
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<table>
<thead>
<tr>
<th>Whole System Interactions</th>
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<tbody>
<tr>
<td>capabilities</td>
</tr>
<tr>
<td>batch/transaction</td>
</tr>
<tr>
<td>history</td>
</tr>
<tr>
<td>search</td>
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FHIR Server purpose

- FHIR Servers should handle the hard parts of FHIR so that
- FHIR Clients are easy to create and use.
Functions in the API

- Capabilities
- Store resources (crud)
- Search
- History / versioning
- Validation
- Format support (xml, json, turtle)
- Transactions / batches
- Custom operations
- Across FHIR versions
Generic FHIR Servers

- Support most of the RESTful API
- For all types of resources
- With storage of their own
Specific FHIR Servers

- Implement some parts of the API
- Often bound to a backend system
  - e.g. an EHR
- Can often be seen as a ‘FHIR Facade’ to a system
- Domain specific operations
  - e.g. ‘get appointment slots’
Some examples

• External data reporting
• Portal support
• App platform
• Clinical Data Repository
• Systems integration
External data reporting
Portal support
App platform
Clinical Data Repository
Systems integration
Architecture

**source**
source of data other systems are interested in

**consumer/target of data from 1 or more sources**

**thin arrow: data request**

**query transform**

**data response / data push**

**data transform**

FHIR Facade

FHIR Server
Integration patterns

- Canonical Data Model
- Scatter-gather, Aggregator
- Event Driven Consumer
- Polling consumer
- Channel Adapter
- Message Translator
- Messaging Mapper
- Messaging Gateway
Start simple

• Single consumer, needs that data
  • Channel Adapter
  • Polling consumer
  • Message Mapper
• Single source of data
  • Message Endpoint
• You can do without FHIR
• But it works as the simplest example...
Where to put the FHIR Server?

Facade on source

Generic FHIR Server

Facade on consumer
Facade on source

- put the API directly on the source
- read natively from the source
- map read / search inbound (!)
- map data outbound
- source becomes a FHIR Server
  - supporting read / search
Generic FHIR Server

- pre-aggregate in a FHIR Server
  - results in a copy of data
- map data outbound
- scheduled or event driven (delay)
- defer load
- FHIR Server can be COTS
  - with all associated features
- FHIR Client on both sides
Facade on consumer

• Event-Driven Consumer
  • no longer Polling Consumer
• map create / update inbound
• map data inbound
• consumer becomes a FHIR Server
  • supporting create/update
• source becomes a FHIR Client
Multiple sources

- Consumer is the integration point
- Has the initiative
  - Polling Consumer
- Has a mapping for each source
  - Message Mapper
- May need to ask all sources
  - Scatter-Gather
- Has to combine all responses
  - Aggregator
Facade on source

- Consumer
  - is the integration point
  - Polling Consumer
  - Has only one mapper
  - Scatter-Gather
  - Aggregator

- Source
  - become FHIR Servers
  - mapping of REST and data
Use a Generic FHIR Server

- **Consumer**
  - is a FHIR Client
  - Message Mapper (FHIR – native)

- **Sources**
  - are FHIR Clients
  - Message Mapper (native – FHIR)

- **FHIR Server**
  - Aggregator
  - Copy of data (with delay)
Facade on consumer

• Event-Driven Consumer
  • Message Mapper (FHIR – native)
  • consumer becomes a FHIR Server
  • supporting create/update
  • Aggregator

• Source
  • becomes FHIR Client
  • Message Mapper (native – FHIR)
Facades + Generic Server

- Sources
  - Become FHIR Servers
  - Message Mapper
- FHIR Server
  - Message Router or
  - Scatter-Gather
  - Aggregator
  - No storage
- Consumer
  - FHIR Client
More sources and consumers

• From 2x2 up: mapping explodes
  • FHIR Resources as CDM useful
  • Encapsulate mappings
• Scatter-gather becomes hard
  • Put an Aggregator in the middle
• Not all systems can run a Facade
  • make them polling consumers
  • or event-driven providers
Revisit examples

• External data reporting
• Portal support
• App platform
• Clinical Data Repository
• Systems integration
External data reporting
External data reporting

source

consumer
External data reporting
Portal support
Portal support

consumer

source

source

source
Portal support

consumer

source

source

source
App platform
Clinical Data Repository
Clinical Data Repository
Clinical Data Repository
Systems integration
Systems integration
Systems integration
Common Integration Engine?

- Can provide scheduling
- Can do mapping, to/from FHIR or otherwise
- May be a router
- Probably better fit for a message broker solution
  - with or without FHIR Resources as CDM
Messaging?

• Consumer must always be online
  • not to miss messages
• Source determines contents and granularity
  • regardless of (different) consumers
• Allows for a real workflow
  • messages and acknowledgements back and forth
More on messaging?

- Thursday
- 09:00
- City Side 2
- Rene Spronk

FHIR messaging, the unloved paradigm

- 09:00 - 09:40
- Track: Building Bridges
- Type: Tutorial
- Target audience: implementers; those that believe there's more than just REST

This session covers the highlights of the FHIR Messaging Paradigm - what is it, why would you use it? Within the FHIR community messaging is usually seen as an old fashioned way of data interchange, yet at the same time: messaging is probably the most widely used paradigm for data exchange in healthcare, and a large number of FHIR projects are based on FHIR messaging. So: what's the power of messaging?

MORE ABOUT RENE SPRONK
Considerations

• Do you allow incoming requests?
• Do you allow (delayed) copies?
• Do you control all participants?
• Who has the initiative?
• Who is the primary source of truth?
• What are the development capabilities of your team?
The answer

It depends 😊