



# FHIR<sup>®</sup> Webinar

FHIR Search

November 03, 2021

# Agenda & Structure

- **House rules, intro, agenda**
- **1. FHIR resources, Search basics**
  - GET vs Search
  - GET vs POST
  - Search response – content and status
    - Pagination, \_elements, \_summary,...
- **2. Search parameters**
  - Search parameters basics
  - Special: \_text, \_list,...

- **3. Advanced search**
  - Chaining, composite
  - GraphQL
- **4. Using and specifying Search**
  - Design considerations
  - Adding SearchParameters
- **5. Practical usage**

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# Goals

1. Understand/recall the basics of FHIR® search: How / When to use it, what to expect and require as a response. Pagination, response formats...
2. Understand FHIR® Search parameters – how to find which ones are accepted, special search parameters, how to use them, how to add new search parameters
3. Understand advanced searches – chained, composite...
4. Be able to issue these searches against your own server
5. Understand some of the design and implementation aspects of Search



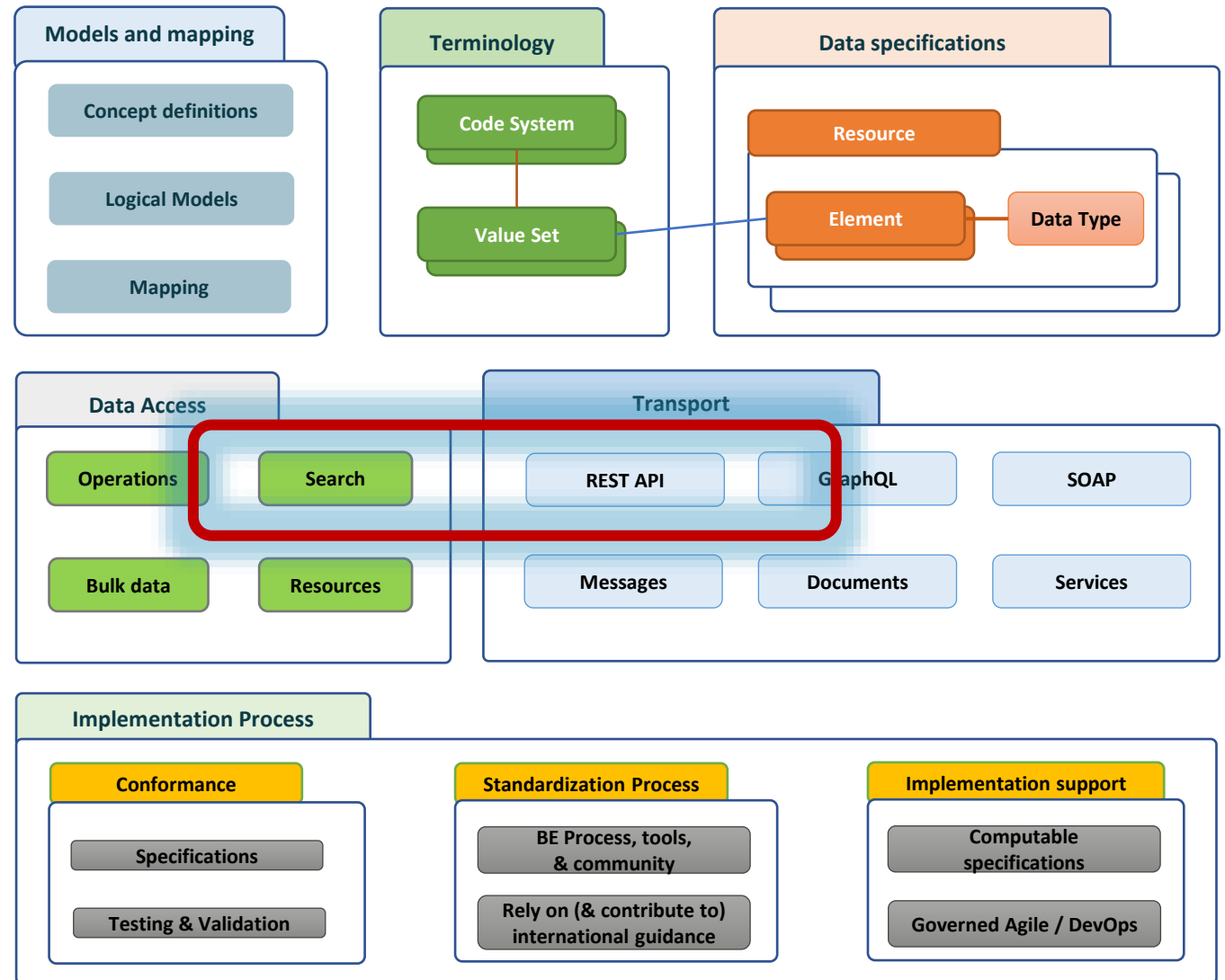
# Practicing

- If you want to practice these examples, use
  - Any of the reference servers: [hapi.fhir.org/r4](http://hapi.fhir.org/r4), [test.fhir.org/r4](http://test.fhir.org/r4)
  - Our collection with these examples:  
<https://github.com/openhie/FHIRexamples/blob/main/search/search.http>
    - Requires VSCode

# FHIR Resources, REST

# Search in FHIR

- FHIR<sup>®</sup> resources and profiles
- REST API
- Search API



Profiling, Searching are done technically – and FHIR has a language for that



# FHIR Search



# FHIR Search

- Search works as a filter – what data to retrieve
- RESTful search can be done with GET or POST
- Each system can configure its search behaviour
- Individual search operations can be parametrized – e.g. to include additional resources or limit the data

# Anatomy – search request

```
GET [base]/[type]?parametername=value&...}
```

```
POST [base]/[type]/_search  
{ [parameters] }
```

# Anatomy - Search response

```
{
  "resourceType": "Bundle",
  "id": "90df8d32-a4b4-4569-ae61-8a612955357c",
  "meta": {
    "lastUpdated": "2021-11-02T11:33:24.269+00:00"
  },
  "type": "searchset",
  "link": [ {
    "relation": "self",
    "url": "http://hapi.fhir.org/baseR4/Patient"
  }, {
    "relation": "next",
    "url": "http://hapi.fhir.org/baseR4? getpages=cb8191202837& getpagesoffset=40& count=20& pretty=true"
  }, {
    "relation": "previous",
    "url": "http://hapi.fhir.org/baseR4? getpages=cb8191202837& getpagesoffset=0& count=20& pretty=true"
  } ],
  "entry": [ {
    "fullUrl": "http://hapi.fhir.org/baseR4/Patient/1231003",
    "resource": {
      "resourceType": "Patient",
      "id": "1231003",
      "meta": {
        "versionId": "1",
        "lastUpdated": "2020-06-19T16:04:28.961+00:00",
        "source": "#jkSpeJacIXqE4T87"
      }
    }
  },
```

# FHIR Search

- GET resource
- Search works as a filter:
  - `GET /Patient` – all patients ## 1
  - `GET /Patient/180252` – is NOT a search
  - `GET /Patient?_id=180252` – only the Patient resource with that ID ...
  - `GET /Patient?identifier=http://ssn.country.gov/ssn|0000-000-0000` ## 5
  - `GET /Patient?birthdate=lt2010-11-03`
- Search – always returns a Bundle
- Resources can be searched by using their search parameters
- A server can be searched across resource types ## 6

<https://www.hl7.org/fhir/search.html>

# GET and POST search

**GET** {{host}}/Patient?\_id=1545788

- Search parameters are in the URL
- May have some security implications

**POST** {{host}}/Patient/\_search HTTP/1.1

**Content-Type:** application/x-www-form-urlencoded

## 7

\_id=2081525

- Search parameters are not in the URL, but in the body
- Advantage: No URL size limitation

# Search parameters

- Resource-specific search parameters e.g. <http://hl7.org/fhir/patient.html#search>

- Common search parameters:

Search Parameter Types	Parameters for all resources	Search result parameters
Number Date/DateTime String Token Reference Composite Quantity URI Special	<code>_id</code> <code>_lastUpdated</code> <code>_tag</code> <code>_profile</code> <code>_security</code> <code>_text</code> <code>_content</code> <code>_list</code> <code>_has</code> <code>_type</code>	<code>_sort</code> <code>_count</code> <code>_include</code> <code>_revinclude</code> <code>_summary</code> <code>_total</code> <code>_elements</code> <code>_contained</code> <code>_containedType</code>

In addition, there is a special search parameters `_query` and `_filter` that allow for an alternative method of searching, and the parameters `_format` and `_pretty` defined for all interactions.

# All searches use the predefined parameters

- Any resource can be searched by ‘\_id’, ‘\_type’,... ## 6
- Patient – searchable on ‘status’, ‘name’...
- Patient – NOT searchable on maritalStatus ## 8

# Response parameters

- Format

## 8

- XML / json
  - `_format=`

- Content

- Only Summary elements (show in FHIR spec)
- Specific elements using `_elements`

## 10

## 11



# Result parameters

- Sort: add one or more parameters for sorting
  - prefixed by a – for descending order
- Search pagination: ‘\_count’ defines how many results to obtain
  - May be overridden by server limits

## 12

## 13

# Text search

- Some servers support free text search
- Search for “John Mark” near “Gliclazide”

## 14

# Search resources in a List

- Get all medication statements from the list that has been curated ## 15

# References, chaining and reverse chaining

- References – Search for resources that reference a given resource
  - E.g. all Observations for a given patient ## 16
  - Logical References – using identifiers instead of id ## 17
- Reverse Chaining – Get all patients that have a MedRequest of a given type ## 18
- Include:
  - Get all MedRequests, include reference Patients ## 19
  - Get a given Patient, include also the Observations that reference the Patient ## 20

# Search parameters

# Search parameters

Search Parameter Types	Parameters for all resources	Search result parameters
Number	<code>_id</code>	<code>_sort</code>
Date/DateTime	<code>_lastUpdated</code>	<code>_count</code>
String	<code>_tag</code>	<code>_include</code>
Token	<code>_profile</code>	<code>_reinclude</code>
Reference	<code>_security</code>	<code>_summary</code>
Composite	<code>_text</code>	<code>_total</code>
Quantity	<code>_content</code>	<code>_elements</code>
URI	<code>_list</code>	<code>_contained</code>
Special	<code>_has</code>	<code>_containedType</code>
	<code>_type</code>	

In addition, there is a special search parameters `_query` and `_filter` that allow for an alternative method of searching, and the parameters `_format` and `_pretty` defined for all interactions.

Structure

Name	Flags	Card.	Type	Description & Constraints
Practitioner	TU		DomainResource	A person with a formal responsibility in the provisioning of healthcare or related services. Elements defined in Ancestors: id, meta, implicitRules, language, text, contained, extension, modifierExtension. An identifier for the person as this agent.
identifier		0..*	Identifier	
active		0..1	boolean	Whether this practitioner's record is in active use.
name		0..*	HumanName	The name(s) associated with the practitioner.
telecom		0..*	ContactPoint	A contact detail for the practitioner (that apply to all roles).
address		0..*	Address	Address(es) of the practitioner that are not role specific (typically home address).
gender		0..1	code	male   female   other   unknown AdministrativeGender (Required)
birthDate		0..1	date	The date on which the practitioner was born.
photo		0..*	Attachment	Image of the person.
qualification		0..*	BackboneElement	Certification, licenses, or training pertaining to the provision of care.
identifier		0..*	Identifier	An identifier for this qualification for the practitioner.
code		1..1	CodeableConcept	Coded representation of the qualification v2 table 0360, Version 2.7 (Example)
period		0..1	Period	Period during which the qualification is valid.
issuer		0..1	Reference(Organization)	Organization that regulates and issues the qualification.
communication		0..*	CodeableConcept	A language the practitioner can use in patient communication. Common Languages (Preferred but limited to AllLanguages)

Documentation for this format

See the Profiles & Extensions and the alternate definitions: Master Definition XML + JSON, XML Schema/Schematron + JSON Schema, ShEx (for Turtle) + see the extensions & the dependency analysis.

## 8.4.4.1 Terminology Bindings

Path	Definition	Type	Reference
Practitioner.gender	The gender of a person used for administrative purposes.	Required	AdministrativeGender
Practitioner.qualification.code	Specific qualification the practitioner has to provide a service.	Example	v2.0360.2.7
Practitioner.communication	A human language.	Preferred, but limited to AllLanguages	CommonLanguages

## 8.4.5 Notes:

- The practitioner's Qualifications are acquired by the practitioner independent of any organization or role, and do not imply that they are allowed/authorized to perform roles relevant to the qualification at any specific Organization/Location.

## 8.4.6 Search Parameters

Search parameters for this resource. The common parameters also apply. See Searching for more information about searching in REST, messaging, and services.

Name	Type	Description	Expression	In Common
active	token	Whether the practitioner record is active.	Practitioner.active	
address	string	A server defined search that may match any of the string fields in the Address, including line, city, district, state, country, postalCode, and/or text.	Practitioner.address	Resources
address-city	string	A city specified in an address.	Practitioner.address.city	Resources
address-country	string	A country specified in an address.	Practitioner.address.country	Resources
address-postalCode	string	A postalCode specified in an address.	Practitioner.address.postalCode	Resources

# Search expressions

- Tokens
- Operators

# Advanced search

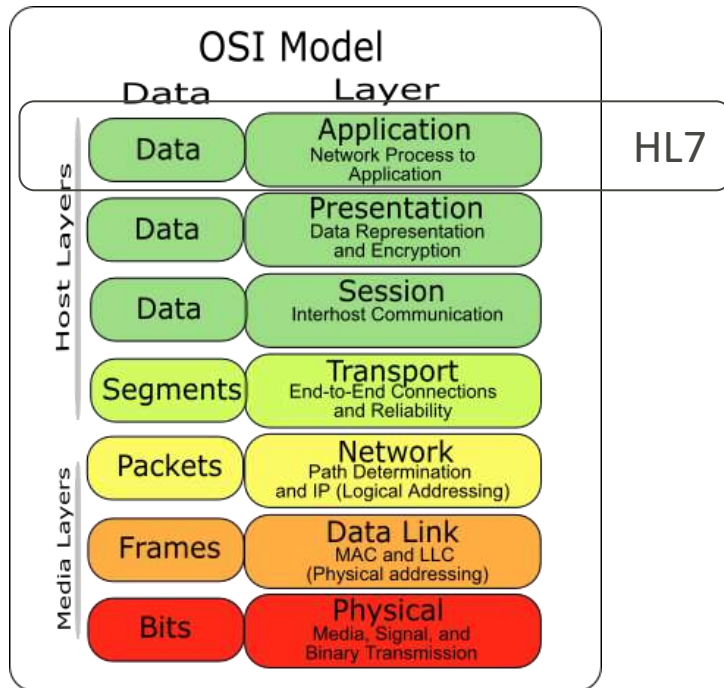


# Advanced Search

- **Composite**
- **GraphQL**

# Using and specifying FHIR search

# Situation: Levels / types of standards



<https://commons.wikimedia.org/wiki/File:Osi-model-jb.svg>

	Why	How	What	Who	Where	When
Contextual	Goal List	Process List	Material List	Organisational Unit & Role List	Geographical Locations List	Event List
Conceptual	Goal Relationship	Process Model	Entity Relationship Model	Organisational Unit & Role Relationship Model	Locations Model	Event Model
Logical	Rules Diagram	Process Diagram	Data Model Diagram	Role Relationship Diagram	Locations Diagram	Event Diagram
Physical	Rules Specification	Process Function Specification	Data Entity Specification	Role Specification	Location Specification	Event Specification
Detailed	Rules Details	Process Details	Data Details	Role Details	Location Details	Event Details

[https://commons.wikimedia.org/wiki/File:The\\_Zachman\\_Framework\\_of\\_Enterprise\\_Architecture.jpg](https://commons.wikimedia.org/wiki/File:The_Zachman_Framework_of_Enterprise_Architecture.jpg)

# Design considerations

- Privacy, behaviour
- Development:
  - Try ensure you have a server with your reference content for testing
  - Define the search possibilities. Not all servers support `_filter`, but when they do...

# Custom Search Parameters

- What if we need to add a new search parameter- e.g. patient.maritalstatus ?
- What if we make an extension and want that to be searchable?
- <http://hl7.org/fhir/searchparameter.html>



```
{
  "resourceType": "SearchParameter",
  "id": "patient-extensions-Patient-mothersMaidenName",
  "url": "http://hl7.org/fhir/SearchParameter/patient-extensions-Patient-mothersMaidenName",
  "version": "4.0.1",
  "name": "mothersMaidenName",
  "status": "draft",
  "experimental": true,
  "description": "Search based on patient's mother's maiden name",
  "code": "mothersMaidenName",
  "base": [
    "Patient"
  ],
  "type": "string",
  "expression": "Patient.extension('http://hl7.org/fhir/StructureDefinition/patient-extensions-Patient-mothersMaidenName')",
  "xpathUsage": "normal"
}
```



# Adding SearchParameters

- HAPI: <https://www.smilecdr.com/our-blog/custom-search-parameters-in-hapi-fhir>



# Additional notes, Q&A





# Final Questions and Answers

- Has this answered **your** questions?
- Any challenges you expect?
- How do **you** expect to use Search?

# Get in touch, be active

- Check with others (at [chat.fhir.org](https://chat.fhir.org) or [community.fhir.org](https://community.fhir.org))
- Create (or ask someone to create) a change request
- Join a FHIR® event like DevDays ([devdays.com](https://devdays.com)), discuss
- Join a FHIR® connectathon, test and provide feedback

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